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PART 1/3

COMMISSION STAFF WORKING DOCUMENT

IMPACT ASSESSMENT REPORT

Accompanying the document

Proposal for a

REGULATION OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL on digital networks, amending Regulation (EU) 2015/2120, Directive 2002/58/EC and Decision No 676/2002/EC and repealing Regulation (EU) 2018/1971, Directive (EU) 2018/1972 and Decision No 243/2012/EU (Digital Networks Act)

{COM(2026) 16 final} - {SEC(2026) 14 final} - {SWD(2026) 14 final}

Contents

Table of Figures

Glossary

Term or acronym	Meaning or definition
Advanced high capacity 5G networks	Term which includes 5G stand-alone networks, with significant densification and using mid-band spectrum and advanced network management technologies.
Alternative operators (ANOs)	Term defining operators other than the traditional ex-monopolist operator, referred to as the incumbent operator
ACM	The Netherlands Authority for Consumers and Markets
AI	Artificial Intelligence
API	Application Program Interface is a type of software interface, offering a service to other pieces of software. The term API may refer either to the specification or to the implementation.
BEREC	Body of European Regulators for Electronic Communications
BEREC Office	Agency for Support for BEREC
Bitstream	Active access to a network, usually at a regional or national level (not at local level). Word usually used for access over a copper network, but that can also be used for fibre networks.
CAP	Content and application provider
CAMARA	Common API Marketplace And Repository Architecture is an open-source project. Its primary goal is to bridge the gap between telecom networks and application developers by creating a uniform set of APIs for the mobile ecosystem.
CEPT	European Conference of Postal and Telecommunications Administrations. 46 European countries are members of CEPT.
CGC	Complementary Ground Component: Satellite systems consist of a space segment and a ground segment, which includes the complementary ground components which are ground-based infrastructure that assist, extends, or complements satellites to improve coverage, capacity, reliability, or service quality. The proposed regulatory intervention includes measures that address both the space segment and the ground segment.
Copper network	The earliest of the three main types of telecommunications networks. Mostly built between the 1900s and the 1980s, usually as a national public monopoly, it was primarily designed and used for the provision of telephone services. It was subsequently used for provision of TV and/or internet services (xDSL). The core of the network has nowadays usually been replaced with fibre but copper remains very widespread for the terminal segment of the network. Wholesale access to the copper network can be provided in the

Term or acronym	Meaning or definition
	form of active or passive access, at local or central access. An important feature of copper is that that the speed achievable depends heavily on the length of the copper loop, decreasing with the loop's length.
CSO	Copper switch-off
DDPP	Digital Decade Policy Programme
D2D (Direct-to-Device)	Direct-to-device (D2D) refers to the ability of standard smartphones and other devices to connect directly to satellites for communication, without the need for specialized hardware like external antennas or dongles.
ECN	'Electronic Communications Network' means transmission systems, whether or not based on a permanent infrastructure or centralised administration capacity, and, where applicable, switching or routing equipment and other resources, including network elements which are not active, which permit the conveyance of signals by wire, radio, optical or other electromagnetic means, including satellite networks, fixed (circuit- and packet-switched, including internet) and mobile networks, electricity cable systems, to the extent that they are used for the purpose of transmitting signals, networks used for radio and television broadcasting, and cable television networks, irrespective of the type of information conveyed.
ECS	Electronic Communications Service
EECC	European Electronic Communications Code
Fibreco	Fibre company
FSS (Fixed Satellite Service)	Fixed Satellite Service (FSS) is a radiocommunication service that uses satellites to ensure communication between fixed earth stations.
FTE	Full Time Employee
FTTB	'Fibre to the Building' means that fibre optics are terminated in the building's basement.
FTTC	'Fibre to the Cabinet' means that the fibre optics are terminated in the distribution cabinets on the curb. The "last mile" to the individual households is still covered using existing copper pairs.
FTTH	'Fibre to the Home' means a network line serving residential end consumers, consisting wholly in fibre.
FTTP	'Fibre to the Premises" includes both FTTH and FTTB.
FWA	Fixed Wireless Access

Term or acronym	Meaning or definition
5G Fixed Wireless Access (FWA)	5G Fixed Wireless Access (FWA) is a technology that provides high-speed internet to homes and businesses using 5G's wireless network infrastructure.
5G Non-Standalone (5G NSA)	5G Non-Standalone (5G NSA) refers to a 5G network where a core network relies on 4G/LTE infrastructure but uses radio antennas that are based on 5G specifications.
5G Standalone (5G SA)	5G Standalone (5G SA) refers to a 5G network that is entirely built on the 5G specifications, including it dedicated 5G core network and radio antennas. 5G SA offers lower latency, faster speeds, and enhanced reliability compared to 5G NSA.
General authorisation	Legal framework established by a Member State ensuring rights for the provision of electronic communications networks or services and laying down sector-specific obligations that may apply to all or to specific types of electronic communications networks and services, in accordance with the EECC.
GADB	BEREC General Authorisation Database
Gbit	Gigabit
GDP	Gross Domestic Product
GIA	Gigabit Infrastructure Act
G.fast	'G.fast' is a broadband access technology that delivers ultrafast internet speeds over existing copper lines, typically in combination with fibre (FTTC) for the last segment to homes or businesses.
IMT	International Mobile Telecommunications
IoT	Internet of Things
ISP	Internet Service Provider
High quality 5G network	High quality 5G network refers to a 5G SA network that provides a high quality of service in terms of latency, data speeds and reliability, and enables the full range of 5G usage scenarios, such as enhanced mobile broadband (EBB), ultra-reliable low-latency communications (URLLC), and massive machine-type communications (mMTC), as well as network slicing.
Low Earth Orbit (LEO) satellite	A LEO satellite orbits the Earth at a relatively low altitude, typically between 500 and 2,000 kilometres. Close proximity to Earth allows for lower latency, faster internet speeds, and higher resolution imaging.

Term or acronym	Meaning or definition
Market shaping measures in spectrum assignments	Market shaping measures are measures such as one provided in art. 52(2) of EECC such as: spectrum caps, reservations, floors, conditions prohibiting transfers, or the accumulation of rights of MSS (Mobile Satellite Service).
mMTC	Massive machine-type communications
Mbps	Megabits per second
MSS (Mobile Satellite Service)	A radiocommunication service that uses satellites to connect to ground stations that move and are not fixed in place.
MNO	Mobile Network Operator
MVNO	Mobile virtual network operator
Network-as-a-Service (NaaS)	Provision of computer networking technology to an organisation as an integrated service. It underpins the optimization of resource allocations by considering network and computing resources as a unified whole.
NRAs	National Regulatory Authorities
NTN	Non-terrestrial Networks
(NI-ICS)	Number-independent Interpersonal Communication Services
OECD	Organisation for Economic Cooperation and Development
Open Gateway	A project that aims to transform communications networks into platforms. It supports application portability and seamless user experiences through standardized open APIs.
OIR	Open Internet Regulation
PIA	Passive Infrastructure Access
RSPG	Radio Spectrum Policy Group is the European Commission high level advisory group on spectrum policy
RSPP	Radio Spectrum Policy Programme
Radio Access Network (RAN)	A Radio Access Network (RAN) is the core component of a cellular network that connects user devices (like smartphones and tablets) to the core network, enabling wireless communication. It acts as the bridge between user equipment and the larger mobile network, facilitating data transmission and connectivity Market shaping measures in spectrum assignments.
RRM	Recommendation on Relevant Markets
SME	Small and Medium Enterprises

Term or acronym	Meaning or definition
SMP	Significant Market Power
Spectrum caps	Terms in spectrum auctions prohibiting participants from acquiring more than a specific amount of rights of use of Spectrum reservation
Spectrum floors	Terms in spectrum auctions setting a minimum amount of rights of use of spectrum a participant may acquire (to prevent fragmentation of spectrum)
Spectrum reservation	Term in spectrum auctions reserving part of the available spectrum for a new entrant or for a specific category of participants (e.g. verticals)
URLLC	Ultra-reliable and low-latency communications
Unbundling/unbundled access	It often: • is mandated by the NRA. • concerns the terminal part of the network (local access). When "Unbundling" is used without an adjective, it refers to a passive type of access. By contrast, "Virtual Unbundling" (usually of Local Access, or VULA) refers to a type of active access that is designed to replicate as much as possible a passive type of access (with regards to the degree of control of the access seeker). When unbundling concerns the copper network (most frequent case), it is referred to as local loop unbundling (LLU) or Sub-loop unbundling (SLU) depending on whether it concerns the entire local loop or only the sub local loop. Unbundling is also possible on a fibre P2P network. In case of a fibre GPON, only a VULA type of access can be provided.
5G-6G Verticals	5G/6G verticals are distinct industry sectors that leverage 5G's advanced features—like high speed, low latency, massive and immerse connectivity —to create new applications and improve service efficiency. Notably, verticals include, Automotive (connected and autonomous driving, enhanced navigation); Smart Farming (IoT sensors for soil and crop health, drone monitoring, automated irrigation); eHealth (remote surgery, telemedicine, wearable health devices, real-time patient monitoring); Energy (Smart grids, real-time monitoring of infrastructure, automated control systems), Industry 4.0 (automated factories, robotics, real-time monitoring, predictive maintenance); Smart Cities (intelligent traffic management, smart lighting, public safety, etc); and Entertainment and Media (augmented reality, virtual reality, cloud gaming)
VDSL	Very High Speed Digital Subscriber Line is a type of internet connection that uses copper wires to deliver high-speed

Term or acronym	Meaning or definition
	internet. It is an improved version of DSL technologies like ADSL, using the same copper wires but transmitting data at higher frequencies and faster speeds.
Virtual Unbundled Local Access (VULA)	VULA is a virtual product, however it should be functionally equivalent to physical unbundling. Key characteristics of VULA products: - occur locally (point of handover); - be generic and provide access seekers with a service-agnostic transmission capacity which is uncontended in practice; - provide access seekers with sufficient control over the transmission network to allow for product differentiation and innovation similar to local loop unbundling (LLU); - be provided with pricing that facilitates its use in a similar manner to physical unbundling; and be provided with effective migration processes towards VULA from physical unbundling to foster take-up, and ensure that competition is preserved where technological solutions force migration from unbundled access to VULA.
VHCN	Very High Capacity Networks means either an electronic communications network which consists wholly of optical fibre elements at least up to the distribution point at the serving location, or an electronic communications network which is capable of delivering, under usual peak-time conditions, similar network performance in terms of available downlink and uplink bandwidth, resilience, error-related parameters, and latency and its variation; network performance can be considered similar regardless of whether the end-user experience varies due to the inherently different characteristics of the medium by which the network ultimately connects with the network termination point;

1. INTRODUCTION: POLITICAL AND LEGAL CONTEXT

Lack of a genuine single market for electronic communications

The EU has taken a number of initiatives to ensure that Europe is the most connected continent by 2030. Adopted in 2018, the current framework for regulating electronic communications in the EU, the European Electronic Communications Code (EECC)[1] had the objective to promote connectivity and access to, and take-up of very high-capacity networks, to promote competition, drive innovation, boost consumer rights within the European single market. For Europeans, an internet connection of high quality that is fast and reliable has become a pre-condition for participation in today's economy and society. Building on the EECC, the 2022 Digital Decade Policy Programme ('DDPP')[2] prepares Europe to take full advantage of the digital transformation by, amongst others, aiming to have gigabit connectivity and 5G across Europe by 2030.

As laid out in the Letta[3] and Draghi[4] reports in 2024, a cutting-edge digital network infrastructure is critical for the future competitiveness of Europe's economy and social welfare. The availability of high-quality, reliable and secure connectivity for end-users as well as for key economic sectors is a must. Driven by the increasing importance of performance and security requirements for such services, digital networks are undergoing a technological transformation where cloud and edge computing capabilities are becoming an integral part of connectivity infrastructure. Furthermore, both reports identify the need to complete the single market for electronic communications, pointing towards fragmentation as one of the main obstacles for competitiveness. A modern and simplified legal framework that incentivises the transition from legacy networks to fibre, 5G/6G and cloud-based infrastructures as well as an increased cross-border operation and service provision is key.

The 2024 Niinistö[5] report stressed the need for the EU to ensure the continuity of its key functions, such as the Single Market, and essential services such as electronic communications, including satellite-based services, critical communication and digital services. The European Preparedness Union strategy presented in March 2025 highlighted the need to protect citizens and as well to ensure vital societal functions, while the Protect EU Internal Security Strategy further outlined measures to increase security of critical infrastructure and respond to security threats, including in the digital domain. Security, defence and economy rely on the existence of cutting-edge fixed and wireless systems, and on sufficient access to radio spectrum. However, the connectivity infrastructure of the Union is not ready to address the current and future challenges of the data-driven society and economy the growing geopolitical tensions and conflicts and the future needs of all end-users. In this situation, the June 2025

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[1] OJ L 321/36 17.12.2018.

[2] Decision (EU) 2022/2481 of the European Parliament and of the Council of 14 December 2022 establishing the Digital Decade Policy Programme 2030, OJ L 323, 19.12.2022, p. 4, ELI: http://data.europa.eu/eli/dec/2022/2481/oj.

[3] Enrico Letta - Much more than a market (April 2024), https://www.consilium.europa.eu/media/ny3j24sm/much-more-than-a-market-report-by-enrico-letta.pdf.

[4] The Draghi report on the future of European competitiveness, https://commission.europa.eu/topics/eu-competitiveness/draghi-report_en.

[5] Safer together: A path towards a fully prepared Union - European Commission, https://commission.europa.eu/topics/defence/safer-together-path-towards-fully-prepared-union_en.

Telecommunications Council called on the EU to ensure secure, reliable and resilient connectivity, including wireless (mobile, satellite)[6].

In the 2025 State of the Union Speech, President von der Leyen announced the Single Market Roadmap 2028 encompassing energy, capital market union, and telecommunications. The current initiative is intended to deliver on that promise.

The components considered for DNA

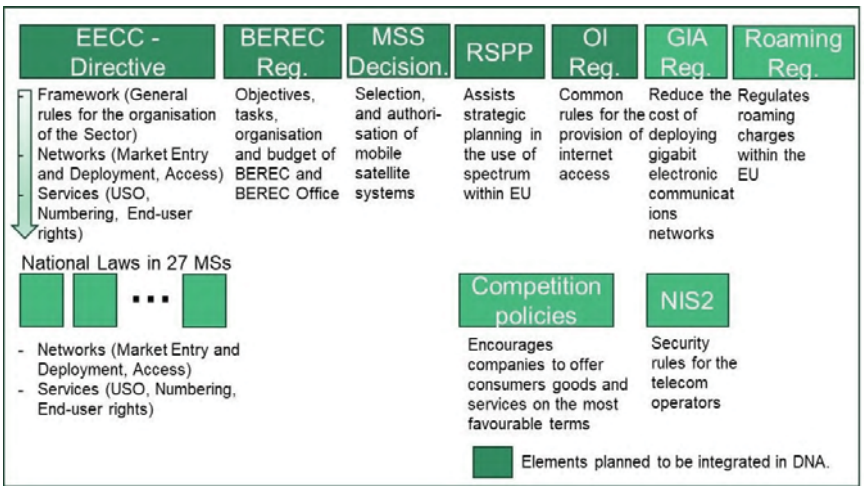
The Digital Networks Act (DNA) is planned to replace multiple existing legal acts currently in place in the EU acquis regulating the connectivity ecosystem. With a view to set the conditions for providers to operate and innovate in the Single Market, these elements need to reinforce each other. Providers need simplified and consistent authorisation rules (EECC), access to fixed networks and spectrum resources (EECC, RSPP, MSS) and a simplified and harmonised set of rules for networks and services (EECC, OIR). Finally, the governance regime needs to support and enable the Single Market. The Evaluation report (see Annex 11) reviews all these current acts to be merged in the DNA, while the Impact Assessment analyses the most important changes necessary to address the identified problems, more precisely in:

- Current Article 81 of the EECC, which deals with migration from a wholesale access perspective, but does not incentivise copper switch-off.
- Spectrum Articles 4, 28, 29, 35-37, 42, 45-55 EECC.
- Articles of the EECC dealing with authorisation, and the MSS Decision dealing with satellite services.
- Articles of EECC, RSPP and BEREC Regulation describing the objectives, the tasks and competences, and the mandate of regulatory bodies.
- Articles on access regime (Articles 76 (co-investment), 77 and 78 (mandated and voluntary separation), Article 61(3) (symmetric regulation) and Article 79 EECC (regulatory commitments)) to be eliminated, streamlined or updated/amended as needed.

The below figure summarises the various elements of the DNA, describing the main components assessed and the remaining ones not targeted.

[6] Council Conclusions on reliable and resilient connectivity (7929/25), https://data.consilium.europa.eu/doc/document/ST-9953-2025-INIT/en/pdf.

Figure 1: Current acquis on electronic communications networks and services and the DNA



It should be noted that simplification measures foreseen under the DNA are specific for the electronic communications sector. They are complementary and mutually reinforcing with the Digital Omnibus, which is a horizontal simplification tool designed to streamline reporting requirements also for ECN and ECS providers resulting from other digital acts.

The initiative on the DNA is complementary to and closely coordinated with other ongoing EU initiatives listed below. In particular, the achievement of EU technological capacities across the broader value chain is only possible if externally coherent with other major initiatives in the domain of cloud, AI, data and cybersecurity. These Acts regulate different components in the digital ecosystem of the EU.

The digital ecosystem

There is a growing interplay between telecom networks and cloud/edge computing which requires a close coordination. The planned **Cloud and AI Development Act (CADA)** aims to boost EU's cloud and edge capacity by streamlining investment rules, speeding up permits, and ensuring access to land, finance, and energy for sustainable data centres. Furthermore, several initiatives have been launched, or are planned in the area of Artificial Intelligence. Under the **AI Continent initiative**, the EU has launched an Action Plan to improve access to AI data and infrastructure, support sectoral AI applications, including a specific call to support generative AI in the sector of connectivity. The informal call for expression of interest for AI Gigafactories has seen strong response, including from telecom operators, which is another indicator of the transition of digital networks towards cloud-based and AI-powered infrastructures and services[7].

Moreover, in connection with the recently published Apply AI strategy, the **Data Union Strategy** will boost access to high-quality data, invest in infrastructure, simplify regulation, and address international data flows.

The present initiative complements these efforts by improving access to secure, fast, and reliable connectivity that is essential for the transition towards cloud-based infrastructure, data flows and AI.

[7] https://digital-strategy.ec.europa.eu/en/news/overwhelming-response-76-respondents-express-interest-european-ai-gigafactories-initiative.

Assessing the investment needs in the sections 2.1.1 and 2.1.2 is notably based on the technological situation as it is known today. The more any analysis goes into the future the more blurred the picture becomes as technological, in particular, developments create new conditions. Indicatively, the advent of AI (the importance of which for Europe's competitiveness and sovereignty is raised, among others, in the Draghi report[8]) is expected to not only enable a new generation of smart connectivity services but to also radically transform the network infrastructure and its operations compared to what is in place today. The **Apply AI strategy** of the Commission[9] of 8 October 2025 selects the area of electronic communications among the eleven key deployment/driver sectors of AI. This event is expected, in turn, to require significant investment (which given the early stages of AI cannot be reliably assessed yet) as history shows that big transformations are typically linked to high upfront costs. The Apply AI Strategy discusses such investment needs with respect to new infrastructure (e.g. data centres), skills, access to datasets, and sustainability considerations. This fast-changing digital environment reinforces the need for the new electronic communications legislation to be future proof (including removing any barriers in the creation of scale as appropriate - as per the Draghi report recommendations and further evidence[10]).

Risks to the resilience of the EU telecommunication sector

To address the resilience risks, the EU aims to restrict **high-risk suppliers** in 5G. However, despite the 2021 5G Cybersecurity Toolbox, only 13 Member States have acted in this regard. Dependencies remain across 4G/5G, fixed networks, submarine cables, cloud, and critical sectors. The planned **Cybersecurity Act revision** offers a chance to tackle ICT supply chain risks with targeted measures addressing both technical and non-technical threats linked to third countries. This initiative is closely coordinated and mutually interlinked with the present initiative which will reinforce security and resilience aspects related to networks.

The EECC does not explicitly address network resilience, with cybersecurity and resilience obligations now largely covered by the Network and Information Systems Security Directive (NIS2)[11] and under the Critical Entities Resilience (CER) Directive[12]. However, there is room for harmonisation and coordination as concerns the resilience in the electronic communications sector. Although ENISA and CERT-EU support coordination, they are not sector-specific bodies and lack operational authority. A centralised European overview of preparedness and

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[8] The Draghi report: A competitiveness strategy for Europe (Part A), AI figures among the three major transformations that Europe has to undergo, p.14, https://commission.europa.eu/document/download/97e481fd-2dc3-412d-be4c-f152a8232961_en?filename=The%20future%20of%20European%20competitiveness%20_%20A%20competitiveness%20strategy%20for%20Europe.pdf).

[9] Communication from the Commission to the European Parliament and the Council, Apply AI Strategy, COM/2025/723 final, EUR-Lex - 52025DC0723 - EN - EUR-Lex.

[10] As an example, the particular role of larger companies in the AI transition is discussed in the McKinsey study: The State of AI in 2025 (https://www.mckinsey.com/capabilities/quantumblack/our-insights/the-state-of-ai) whereby larger companies, according to the study, lead the way in scaling AI beyond pilots. Also that already one-third of high performers spend more than 20 percent of their digital budgets on AI.

[11] Directive (EU) 2022/2555 of the European Parliament and of the Council of 14 December 2022 on measures for a high common level of cybersecurity across the Union, amending Regulation (EU) No 910/2014 and Directive (EU) 2018/1972, and repealing Directive (EU) 2016/1148 (NIS 2 Directive), OJ L 333, 27.12.2022, p. 80, ELI: http://data.europa.eu/eli/dir/2022/2555/oj.

[12] Directive (EU) 2022/2557 of the European Parliament and of the Council of 14 December 2022 on the resilience of critical entities and repealing Council Directive 2008/114/EC, OJ L 333, 27.12.2022, p. 164, ELI: http://data.europa.eu/eli/dir/2022/2557/oj.

crisis management through coordination, data collection, early-warning mechanisms (e.g., IP flow disruption alerts), and resilience mapping in electronic communications is missing.

An important element of the aspects related to connectivity provided by satellites is closely coordinated with and complements measures proposed under the **EU Space Act**, which aims to create a harmonised legal framework for space activities across the European Union and with the EU support to IRIS2 constellation to increase EU satellite sovereignty. This is an important development and closely linked with the proposed initiative which responds to the ongoing integration between terrestrial and non-terrestrial connectivity.

Finally, to ensure the capacity of the EU to react to security threats and any type of crises, the European Critical Communication System (EUCCS) will be realised by 2030. It will provide broadband-based communication and services for public authorities across the EU and Schengen area, notably law enforcement, firefighters, medical emergency responders.

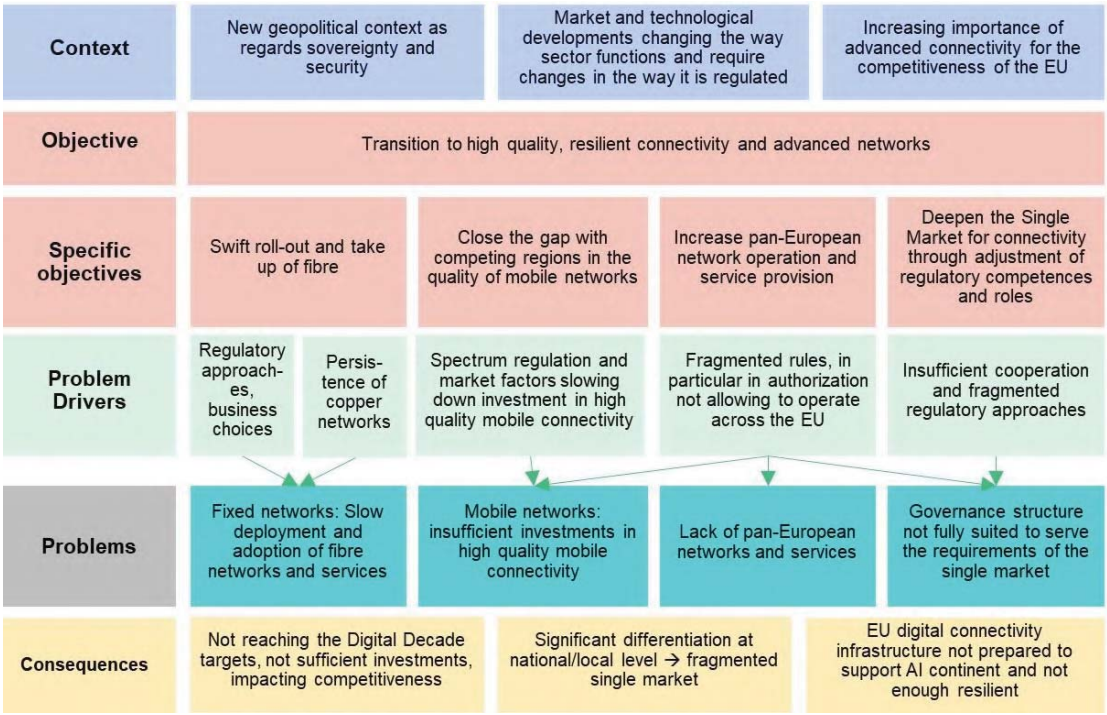
Role of Digital Decade Policy Program in promoting connectivity

The DDPP recognises the importance of fixed and mobile networks for achieving the European Union's digital targets, particularly in terms of providing gigabit connectivity and 5G coverage to all Europeans by 2030. Through the DDPP, the European Commission and Member States have expressed strong political support for the deployment of fibre and 5G networks, recognizing their crucial role in achieving the Union's digital ambitions. By prioritizing the development and deployment of fibre and mobile networks, the European Union can ensure that all citizens and businesses have access to high-quality digital infrastructure, bridging the digital divide and unlocking the full al al of the digital economy. However, the targets under the DDPP are not binding on the Member States and, although the annual reporting and recommendations issued by the Commission help to monitor progress towards the targets, they do not oblige Member States to achieve the targets at the same speed. The current initiative will provide regulatory incentives to facilitate the deployment and take up of gigabit connectivity and 5G high quality networks.

2. PROBLEM DEFINITION

Figure 2 illustrates the problems underpinning the review of the electronic communications framework and describes the problem drivers (with market and regulatory failures further elaborated in section 2.2 and in Annex 7), the problems themselves (presented below) and the consequences of those problems. Problems are interrelated and tend to have similar drivers and/or consequences.

Figure 2: Digital Networks Act Problem tree



2.1. What are the problems?

2.1.1. Fixed networks: Slow deployment and adoption of fibre networks and services

Without modern fibre optic networks, the economic and social benefits of digitalisation cannot materialise, and the EU will be at a competitive disadvantage in the digital sphere. At the same time, we observe slow deployment and adoption of fibre networks and services.

Deployment/coverage

The 2025 DDPP report shows that the Gigabit connectivity measured by Fibre-to-the-Premises (FTTP)[13], which includes Fibre-to-the-Home (FTTH) and Fibre-to-the-Building (FTTB), stands currently at 69% (2024 data). The percentage of premises reached by fibre rose by 5 p.p. from 64% in 2023 to 69% in 2024[14]. According to the same report, by 2030 around 90% of premises will be reached by FTTP, but full (100%) coverage is projected to be only achieved in 2051.

The coverage gaps are problematic as they further deepen the existing geographical digital divide between rural and urban population in Europe (only 58.8% of households living in rural areas were reached by fibre in 2024[15]). Bridging the digital divide ensures that some areas of

[13] When discussing the matter of insufficient fibre deployment and take-up, we do refer to FTTH networks. Those networks are capable of providing Gigabit speeds. However, there is no reliable and complete data of the current state or future projections of the deployment and take-up of FTTH networks per Member State. For that reason, the text in this section is discussing the figures for FTTP, instead of FTTH coverage and whenever feasible provides both.

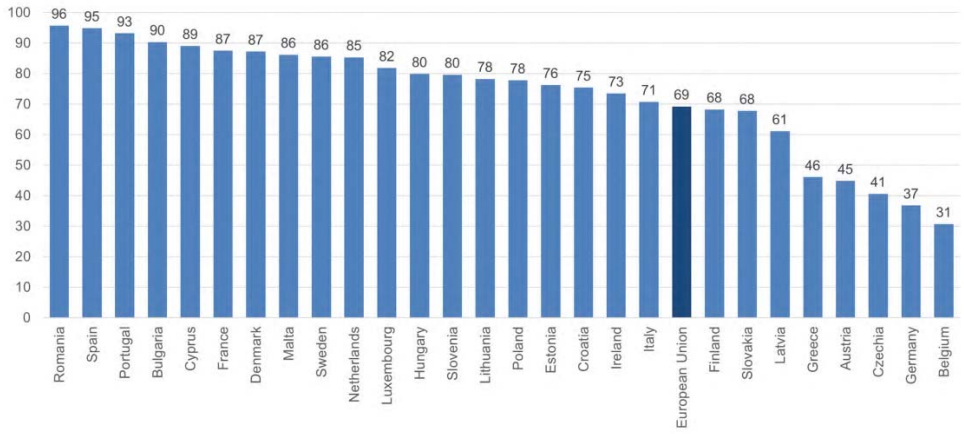
[14] Annex 1 - State of EU digital transformation in 2025: progress and horizontal recommendations, 16.6.2025, SWD(2025) 290 final, p. 5. SWD Digital Decade in 2025: progress and outlook, 16.6.2025, SWD/2025/290 final, p.16.

[15] Commission Staff Working Document: Digital Decade in 2025: progress and outlook.

the Union are not left behind and that EU citizens benefit of high quality of services and can achieve better productivity across the Union.

Furthermore, the FTTP coverage across the EU differs significantly undermining the single market dimension. There is insufficient coverage of FTTP in several Member States – in particular Austria, Greece, Czechia, Germany and Belgium - which results in a significant proportion of EU population not having access to fibre networks.

Figure 3: FTTP coverage in % of households in EU 27 (2024)



Source: European Commission (2025)[16]

In addition, it should be noted that the data refers to FTTP coverage, which includes a significant proportion of FTTB. FTTH coverage, which is fully fibre-based and is the most future-proof and high-quality fixed connectivity option, in the EU has been also expanding but not fast enough. This means that even Member States with high FTTP coverage have significant gaps in FTTH coverage.

Demand/uptake

At the same time, demand for bandwidth is increasing rapidly across the EU and fixed broadband traffic increased more than 2.5 times from 2019 to 2024[17]. The 2025 DDPP report shows[18] that the share of fixed broadband subscriptions at speeds of 1 Gbps or higher (Gigabit connection) has been increasing (20% between 2023 and 2024) but represented only 22% of total broadband subscriptions in 2024.

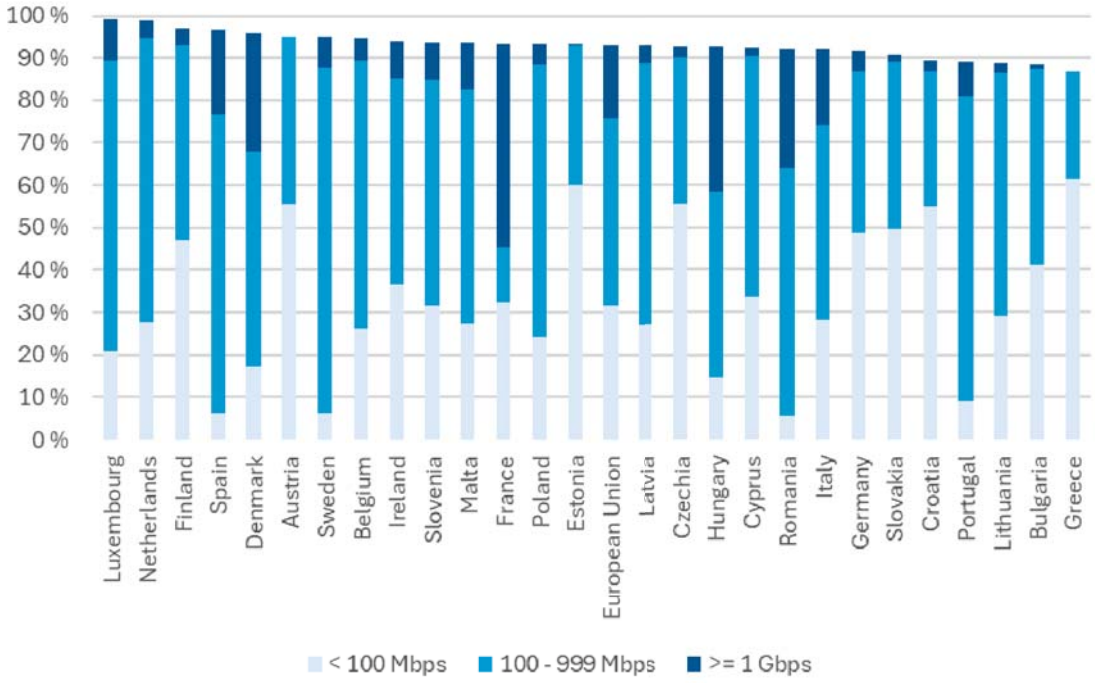
So far, there is limited take-up of Gigabit broadband with significant variations across the EU as illustrated below. Average actual broadband speeds also vary and are often lower in countries with a lower take-up of FTTH.

[16] European Commission (2025): DESI dashboard for the Digital Decade (2023 onwards), Fibre to the Premises (FTTP) coverage, Total, DESI period: 2025 (data from 2024), https://digital-decade-desi.digital-strategy.ec.europa.eu/s/2j80Egm25Oa1b/.

[17] https://www.itu.int/itu-d/reports/statistics/2024/11/10/ff24-internet-traffic/.

[18] Annex to the DDDP 2025 Report, section 1.1.3.1, p. 18.

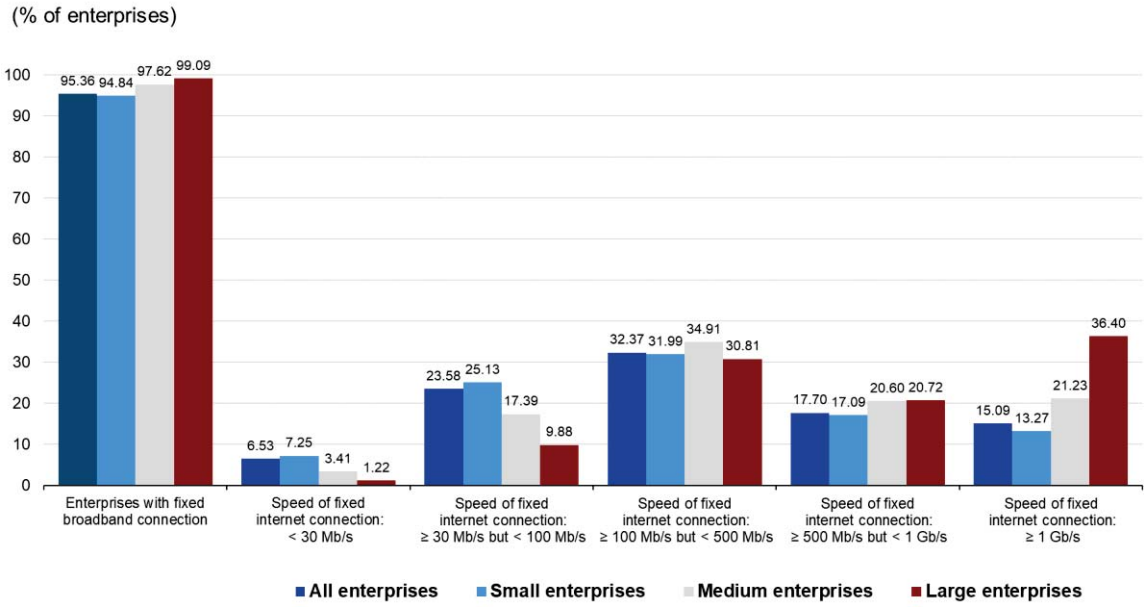
Figure 4: Broadband Penetration differentiated by bandwidth in EU 27 Countries, 2023



Source: Study on Access Regulation

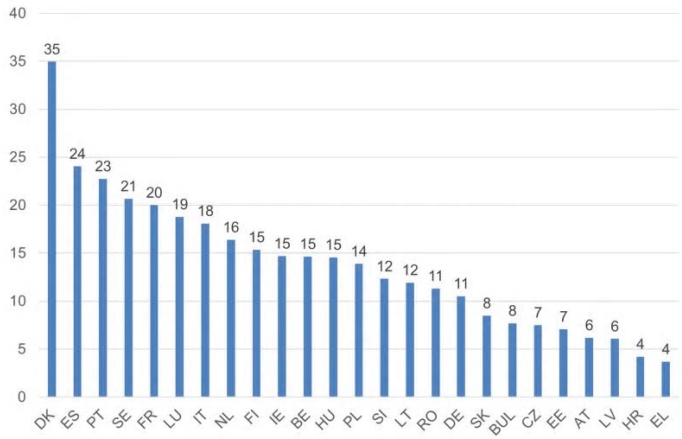
What is also worrying is that only a small proportion of SMEs (lower than for residential consumers) take up Gigabit connections, and even for large enterprises, the proportion with a Gigabit connection is less than 40%.

Figure 5: Enterprises with fixed broadband connection, by speed and size class in the EU (2024)



Data further shows that there are wide variations in the use of Gigabit connectivity amongst businesses, with take-up below 10% in a number of countries.

Figure 6: Share of businesses with Gigabit connection (download speed of at least 1 Gbit/s, 2024)



Investments/costs

To achieve (close to) full fibre coverage will ultimately require investments. According to a study by WIK-Consult[19] (based on data from 2021), the capital expenditure (Capex) required to achieve 100% Fibre-to-the-Premise (FTTP) coverage across the EU is approximately EUR 114 billion. Of that, EUR 74 billion was estimated to be economically viable without subsidies in a situation of no network duplication. The remaining 'investment gap' (i.e. total investments needed minus available private funding) is EUR 40 billion. The total investment figure would be reduced to around EUR 108 billion, of which around EUR 29 billion would be needed in subsidies, if 5G FWA is used for the most remote households.

Based on the most recent Digital Decade data, FTTP coverage has increased from 50% (in 2021) to 69% (in 2024). The remaining investment needed to achieve full FTTP coverage would therefore be significantly less than estimated by WIK. However, the shortfall cannot be calculated with precision. This is because the Capex required to deploy FTTP or FTTH varies widely depending on a variety of factors. As an example of complexity of estimating Capex requirements, in Germany, fibre deployment costs range from about EUR 1 310 per line in the densest areas to EUR 4 350 in the least dense, where subsidies are often needed[20]. A study[21] on the investment gap for the deployment of VHCN in Czechia estimates that average cost for one FTTH connection (in 2030) stand at around EUR 945 in case of 90% coverage and around EUR 1 308 in case of 100% coverage. This shows also the difficulty of covering the remaining 10% due to significant increase in costs.

The table below summarises the main findings of the evaluation on fixed networks, with references to the relevant Sections of Annex 11.

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[19] WIK- Consult. (2023). Investment and Funding Needs for the Digital Decade Connectivity Targets.

[20] Jay, Neumann, Plückebaum: The Cost of a Nationwide Fibre Access in Germany, Communications & Strategies No 85, 1 Q. 2012, pp 169-188, March 2012. Further references can be found at Jay, Neumann, Plückebaum: Comparing FTTH access networks based on P2P and PMP fibre topologies, Journal on Telecommunications Policy, 8 July 2013.

[21] Definice investiční mezery výstavby sítí VHCN ve vazbě na rozvoj sítí 5G, 2024, https://mpo.gov.cz/assets/cz/e-komunikace-a-posta/studie-k-narodnimu-planu-obnovy/2024/11/Studie-25.pdf.

Table 1: Evaluation report findings on fixed networks

EVALUATION REPORT FINDINGS:	SECTIONS IN ANNEX 11
Limitations of the current copper switch-off regulation - The process covers only SMP operators. - The process as designed in EECC was not aimed and did not contribute in any fashion to accelerate the transition from copper to fibre, as it only gave the means to regulators to govern the process for the switch off.	See Annex 11 – Section 4.3.1 Overview and evaluation of access provisions - Effectiveness
Significant differences in availability and take-up of fibre in different Member States - Whereas 11 MS exceeded 80% of coverage, 8 MS have a fibre coverage between 70 and 80% and another 4 have reached more than 50% of households. 5 MS have a fibre coverage below 50% - Whereas most European consumers have a choice of multiple providers of VHCN services, this is based on a combination of own service providers' network (often supported by regulated access to ducts and poles) and often regulated wholesale access to copper or fibre networks	See Annex 11 -Section 4.2. – Market developments.

2.1.2. Mobile networks: insufficient investments in high quality mobile connectivity

High-quality mobile connectivity in Europe remains underdeveloped, with slower deployment, low 5G SA take-up and weaker performance, all highlighting the need for additional private investment.

Basic (4G-based) **5G deployment** in Europe, currently reaching 94.3% population coverage[22], is comparable to competing economies and expected to reach the Digital Decade target of 100%[23] by 2027, i.e. ahead of the 2030 deadline.[24] However, **Europe** is still **lagging behind** in the deployment of high-quality 5G. 5G mid-band coverage in Europe (50%) is significantly lower than in China (95%), India (95%) and the US (90%).[25] As illustrated by Figure 7, 5G Standalone (SA) coverage is at around 40% in Europe, compared with 45% in Asia Pacific and 91% in North America.[26] Recent data indicate an accelerated shift to 5G SA coverage in the

[22] International comparison of Standard 5G coverage: EU 94%, US 97% , CN 95%, SK 100% and JPN 99% 5G Observatory report 2025 | Shaping Europe's digital future.

[23] According to the DDPP, by 2030, all populated areas should be covered by next-generation wireless high-speed networks with performance at least equivalent to that of 5G, in accordance with technological neutrality. To measure progress in achieving the target, household coverage in the three 5G pioneer bands is used in the DESI, as a proxy.

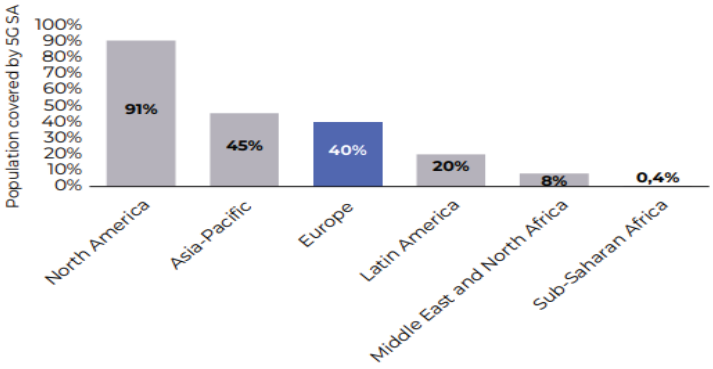
[24] Staff working document Digital Decade in 2025 progress and outlook Accompanying State of the Digital Decade 2025.

[25] For 5G mid-band coverage, different data sources use different methodologies and provide very different figures. For example, latest DESI 2025 data indicate mid-band coverage in the EU at 67.7% with however significant differences between Member States. To ensure comparability across regions, a consistent methodology must be applied. Here, estimates from Ericsson are used as they provide internationally comparable data, with figures for both Europe and other regions produced using the same methodology. Mid-band spectrum is key for efficient 5G deployment, as it provides the right balance between coverage and capacity. See also Annex 7, section 1.2.1, and Annex 11, section 5.4 (World population and mid-band coverage split per region, end of 2024).

[26] Source Analysys Mason, 2024.

UK, with 83% of areas outside of premises covered by at least one MNO at high confidence level.[27]

Figure 7: 5G SA coverage, by region, 3Q 2024, Source Analysys Mason, 2024



Europe is also significantly lagging behind in **5G SA take-up**. Only about 2% of 5G users in Europe are connected via 5G SA networks, compared with 24% in the United States, 25% in India and 77% in China.[28] In the UK, take-up of 5G SA already represents one third of total 5G traffic, reflecting an acceleration in the transition from earlier 5G NSA deployment.[29] The slow pace of 5G SA adoption in Europe has direct repercussions for the **quality** of user experience. The EU27 average download speed of 69.9 Mbps is lower than of South Korea (162.2 Mbps), the US (129.3 Mbps) and China (100 Mbps), and also below the population-weighted global average (70.4 Mbps).[30] Other sources likewise confirm that, despite recent improvement, Europe continues to lag behind in 5G SA take-up and speed performance.[31]

It was further estimated[32] that **investments** of around EUR 33.5 billion would be needed for densification, i.e. for the installation of additional base stations and small cells needed to

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[27] OFCOM: Connected Nation, UK report, November 2025.

[28] Annex 7 1.2 and MedUX data on Status of 5G Quality and experience in EU and Analysys Mason (2024). 5G Global Progress Report; OpenSignal (2024). 5G Experience Report Q4.

[29] OFCOM: Connected Nation, UK report, November 2025.

[30] MedUX data on Status of 5G Quality and experience in EU. Cf. Annex 11 and Appendix IIB and Annex 7 – 1.2 for Coverage and Quality of Service graphs. MedUX performed an analysis for all MS for the Commission with the EU download speed average that reflects a highly diverse situation at a granular level, showing marked differences between top- and low-performing Member States, and notable regional disparities within countries – see per MS speeds in Annex 4. In addition to coverage, lack of densification may be one of the reasons why the EU's 5G service quality lags behind that in some other regions. In general, network densification boosts high-capacity and high-quality network performance. It was estimated that in order to achieve high-quality 5G connectivity, around 500 000 new small cells would need to be deployed by 2030, particularly in urban and suburban areas; for example, France would need to increase its mobile site density by 57%, while Germany and Poland face gaps of 31% and 59%, respectively.

[31] For example, Ookla and Omdia, *A global evaluation of Europe's digital competitiveness in 5G Standalone*, 2025, https://www.ookla.com/articles/europe-5gsa-2025, find median 5G SA download speeds in the last quarter of 2024 of 221.17 Mbps for Europe, 384.42 Mbps for the Americas, 237.04 Mbps for Developed Asia Pacific and 259.73 Mbps for Emerging Asia Pacific. Country samples are selected based on having a high share of regional 5G SA measurements. The Americas sample includes the United States, Canada, and Brazil; Developed Asia comprises Australia, Singapore, Japan, Hong Kong, Macau, South Korea, and China; and Emerging Asia consists of India, Thailand, the Philippines, and Malaysia. South Korea is excluded from the Developed Asia sample for median latency calculations.

[32] WIK-Consult. (2023). Investment and Funding Needs for the Digital Decade Connectivity Targets.

achieve high quality 5G deployment.[33] An additional amount of EUR 26–79 billion would be needed to cover the main transport paths. These 5G investment needs are expected to be met mainly through private funding, as public funding for 5G is considerably lower than for fibre: State aid is justified only where a market failure has been clearly demonstrated and, historically, public intervention in mobile networks has been exceptional[34]. Funds available under CEF Digital (a dedicated budget of EUR 227 million for the programming period 2021–2027 and an additional EUR 106 million transferred from other strands) have focused on early 5G deployments for socio-economic drivers and on enhancing coverage along key transport corridors, and the available resources are already fully committed. Other public funding allocated to the rollout of 5G SA networks is limited and insufficient to achieve high quality mobile connectivity. It is thus crucial that the regulatory and market framework ensure the right conditions and **incentives for private investment** in high-quality 5G deployment, such as SA.

As there are significant differences between the performance and capabilities of 5G Non-Standalone (NSA) and 5G SA, lack of investment in high quality 5G affects broader EU industrial innovation and competitiveness, particularly for EU industries requiring advanced, quality-assured services.[35] An EU study confirms that **insufficient investment in high quality 5G**, including network densification and the deployment of fibre backhaul, is likely to limit mobile service quality and the availability of quality-assured services requiring high bandwidths and/or low latency. This contrasts with countries such as South Korea, where considerably higher mobile data usage coincides with greater investment in 5G networks, including small cells.[36] Noting that the uptake of 5G use cases is expected to deliver a range of **socio-economic benefits**, such as enabling safer mobility, BEREC also called for 5G SA deployment to exploit the maximum digitalisation potential of 5G.[37]

A report[38] analysing 5G-enabled digitization across different use cases, such as smart factories, mining and healthcare, found that full 5G networks can support a wide range of possible innovations in different market and industrial sectors. It estimated that 5G networks in Europe can deliver around **EUR 210 billion in benefits at a cost of EUR 46 billion approximately** (which equates to a cost–benefit ratio, CBR, of 4.5).

However, due to fast technological developments in networking technology since the adoption of the Open Internet Regulation (OIR), **legal uncertainty** has arisen regarding the interpretation of the OIR provisions on high quality specialised services. Stakeholders report difficulties in assessing ex ante whether an innovative service would comply with the OIR. Consequently,

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[33] Given the EU's mid-band 5G coverage of 67.7%, a 5G SA take-up of only 2% and the central role of densification in driving costs, the EUR 33.5 billion estimate suggests that only a small share of the total investment has been made so far. Stakeholders also regarded this estimate as conservative, as it assumes the deployment of a single network. In practice, with several MNOs per Member State, duplication or multiplication of 5G SA networks is a plausible scenario requiring further investment. The estimate might also not fully account for the coverage and capacity needed for full 5G use cases.

[34] See also Annex 7, section 1.2.2 on investment needs.

[35] RSPG25-006 FINAL, section 2.1. cf. on the difference of 5G SA and NSA. 5G SA brings ultra-low latency for real-time responsiveness, high bandwidth for data-heavy applications like AR/VR, massive device connectivity for large-scale IoT ecosystems, and enhanced reliability and security. See Annex 9, section 3.1.1. for quantification of 5G market opportunities for specific sectors/verticals and spill-over effects.

[36] Study on Finance and USO.

[37] See BEREC BoR (22) 144 Report on the 5G Ecosystem.

[38] New 5G use cases mean economic benefits for Europe - Ericsson. Analysys Mason for Ericsson and Qualcomm, 2020.

they highlight the need for more guidance and predictability in order to minimise a **chilling effect on investments and innovation**, particularly in relation to network slicing used to implement specialised services.

The speed of 5G deployment and the quality of service also depend on **the availability of sufficient spectrum**. The amount of spectrum used by mobile networks has doubled in the period 2014–2024 to ensure higher service quality and to bring 4G and 5G to consumers[39]. The growing demand for wireless services in general is increasing spectrum scarcity[40], especially in low and mid-bands needed for coverage and capacity. To access additional spectrum, MNOs compete with potential or incumbent spectrum users, such as broadcasters or the Wi-Fi industry. In addition, new players have entered the 5G ecosystem, like industrial verticals and wholesale only operators, including tower operators, with their own spectrum needs or ambitions. The lack of sufficient spectrum is also linked to limited deployment of private high quality mobile networks, with EU trailing other parts of the world.

Table 2 summarises the main findings of the evaluation on mobile connectivity and private networks spectrum sharing, with references to the detailed analysis in the relevant sections of Annex 11. The main evaluation evidence linked to lack of predictability, fragmentation and lack of Single Market, low financial attractiveness of 5G projects and inefficient use of spectrum are presented in section 2.2.2, Tables 8–10.

Table 2: Evaluation report findings on connectivity achievements and private networks

EVALUATION REPORT FINDINGS:	SECTIONS IN ANNEX 7 AND 11
Insufficient 5G mobile connectivity achievements - European High quality 5G Coverage (mid-band and SA) below leading world economies - Equally low availability and take-up and lower download speeds.	See Annex 11, section 5.4. 1. 5G Connectivity achievements
Limited uptake of private networks with EU trailing other parts of the world - Spectrum access remains uneven, due to lack of spectrum sharing between public and private networks, with only a few Member States offering transparent and affordable local licensing regimes. - Regulatory challenges for private 5G networks deployment (inconsistent availability of dedicated frequency bands, large variety of technical or administrative requirements, complexity of the licensing procedure and price variations).	See Annex 11, section 5.4. 3. Spectrum for industry: verticals and private networks Annex 7, section 1.2.1 and BEREC Report on the evolution of private 5G networks and interrelation with public networks in Europe (BoR (25) 33)

2.1.3. Lack of pan-European networks and services

2.1.3.1.*Barriers to cross-border innovative networks and services*

Developments such as IoT, AI, cloud and edge computing, data analytics, and content delivery networks are transforming the connectivity from a vertical sector into a highly converged ecosystem with newly emerging business models. As networks virtualise and shift to the cloud and edge, traditional telecoms, cloud, content, and software providers seamlessly integrate

[39] See Anex 8 1.2.4 GSMA data on Average MHz assigned to mobile operators for frequency bands below 7 GHz.
[40] See Annex 7, section 2.2.1 on Inefficient use of spectrum.

processing across the entire infrastructure[41]. Fragmentation of rules in such a converged ecosystem prevents scale economies and results in sub-optimal investments in next-generation connectivity. This is especially hindering for innovative services such as Network-as-a-Service (NaaS), network slicing, edge computing, and IoT-based industrial connectivity, which can only achieve viability as pan-European services. Their business models depend on seamless interoperability, cloud integration, and continuous data flows across Member States. With fragmented market entry conditions, divergent compliance rules across the EU and unpredictable regulation, these services remain confined within national markets, preventing operators from achieving economies of scale and end-users from accessing new digital solutions.

The economic potential of these services is substantial. The network slicing market alone could grow globally from EUR 1.8 billion in 2025 to EUR 12.6 billion in 2030[42], while the NaaS market is expected to expand from EUR 28.13 billion in 2025 to EUR 140.45 billion in 2032[43]. Europe currently holds the second-largest global market share and could capture 20–25% of global revenues from network application programme interfaces (APIs), equivalent to EUR 1.5–7.5 billion by 2030, if the potential is unlocked through an enabling regulatory framework, removing potential barriers[44].

The evaluation report (Annex 11) concludes that the fragmentation of rules, particularly the rules for market entry (the national approaches on the conditions that may be attached under

[41] This process has been described in detail under the pillar I of the 2024 EC White Paper 'How to Master Europe's Digital Infrastructure Needs'.

[42] Mordor Intelligence, 2024: https://www.mordorintelligence.com/industry-reports/network-slicing-market. The study defines the network slicing market as the revenue generated from commercial 5G Stand-Alone slices provisioned across virtualized RAN, core, and transport domains to meet customer-specific service-level agreements. The model captures software licenses, slice-management services, and enabling infrastructure directly tied to slice creation and life-cycle management for public mobile networks. Scope exclusion: legacy 2G/3G managed services, private campus Wi-Fi, and hardware sold for non-slice-aware 5G deployments remain outside the baseline.

[43] Fortune Business Insights, 2024: https://www.fortunebusinessinsights.com/network-as-a-service-market-106700

[44] Analysys Mason, 2025: https://www.analysysmason.com/research/content/regional-forecasts-/network-api-forecast-rdmm0-rma21/.

Additionally, as regards the IoT market, the industry has not provided any quantitative analysis linking directly the regulatory fragmentation to costs of foregone innovation; however, there is a wealth of qualitative sources with stakeholders arguing that fragmentation increases costs, reduces scale and cross-border service provision. (Thingsdata: https://thingsdata.com/information/the-european-iot-market-an-in-depth-analysis/.)

European Commission Final Report – sector inquiry into consumer *Internet* of Things:https://competition-policy.ec.europa.eu/system/files/2022-01/internet-of-things_final_report_2022_en.pdf.

Vodafone Group: Why a European Policy Framework for the Internet of Things Matters.2019.: https://www.vodafone.com/news/public-policy-news/why-a-european-policy-framework-for-the-internet-of-things-matters.

It is predicted that overall consumer IoT revenue worldwide will grow from EUR 105.7 billion in 2019 to approximately EUR 404.6 billion by 2030. Source: Transforma Insights (22 December 2020). https://www.statista.com/statistics/1183471/iot-revenue-worldwide-by-vertical/

the **general authorisation (GA) regime**[45]) prevent undertakings from deploying pan-European innovative services[46]. These rules vary considerably[47].

The most diverging rules are in the area of end-user protection as well as lawful access to data, data retention, cybersecurity or privacy, as well as specific national requirements such as different reporting formats and frequencies, notification of the beginning of the activity in national languages varying rules on digital identity verification. These existing divergences in national notifications, different national requirements laid down by pieces of national law different from electronic communications legislation cause barriers to the Single Market and were noted by BEREC[48]. The patchwork of rules means that identical services can face entirely different compliance requirements depending on the Member State(s) in which they are offered. This raises costs, delays market entry and deters innovation, particularly for SMEs and providers with a footprint in several Member States who must tailor their services to each jurisdiction[49]. The optional or selective application GA conditions to various providers further distorts competition and fragments the Single Market, creating an uneven level playing field and delaying the introduction of new services[50].

The absence of a harmonised regulatory regime limits the ability of European operators and other actors in the value chain, such as hardware and software suppliers, to fully exploit growth opportunities and to upscale innovative, investment-intensive digital services consistently and uniformly across the Union. The ongoing technological developments are increasing interdependencies within the digital ecosystem, yet collaboration among key actors (ECN providers, cloud services, CAPs, AI developers, device manufacturers, etc.) remains insufficient to address emerging challenges related to traffic efficiency, coordinated network capacity planning, sustainability, and the delivery of innovative services.

Combined recurrent and variable costs for a cross-border provider could range from EUR 15 million to EUR 25 million, with expenditure that is pure overhead, providing no competitive advantage or service improvement[51]. Detailed breakdown of this cost estimate is provided in

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[45] Under Title II (Institutional set-up and governance), Chapter II (General authorisation) of the EECC Art. 12-19.

[46] See section 4.3.2 of the Final 1st Interim Report on Completing the DSM and Evaluation Report p. 6.1. on effectiveness of general authorisation.

[47] This is the case both for the same type of network or service provided in more than one Member State (e.g. end-users' protection conditions remain nationally specific and are especially various for cross-border M2M services) or per types of networks and services (NB-ICS/NI-ICS, public ECN/non-public ECN and public ECS/non-public ECS).

[48] BEREC 2024 Opinion on the national implementation and functioning of the general authorisation, and on their impact on the functioning of the internal market, pursuant to Article 122, paragraph 3 EECC, page 6 and 12. BEREC noted that 'such inconsistencies fall outside the BEREC remit, but still BEREC would like to underline the importance of better looking into this matter, as further consistency in the overall notification-related fulfilments - beyond those already standardised by the EECC, enshrined in electronic communications legislation - would enhance the simplicity of market entry for ECN/ECS providers, hence the single market dimension.'

[49] However, it should be noted that certain data requirements, such as on sensitive data related to national security, state security, defence, or public security, remain excluded from the Union harmonisation efforts. Article 4(2) TEU remains basis for these exclusions and is consistently reinforced throughout data-related EU legislation.

[50] The differentiated national implementation of the EECC and the following detrimental effects to the Single Market that could arise by "gold-plating" is discussed by Letta, (2024), Much More than a Market, p. 125 and has been emphasised by a significant number of stakeholders who have contributed to the 2025 Call for Evidence on the DNA, 2024 White Paper 'How to master Europe's digital infrastructure needs' as well as the 2023 'Exploratory consultation on the future of the electronic communications sector and its infrastructure'.

[51] Cross-border (pan-European) provider for the purpose of this estimation means an operator with a meaningful physical presence and regulatory footprint in all 27 EU Member States.

section 7.3 of this report. Approximately EUR 0.40–0.70 million of the combined costs are related to GA (to apply for GA, notify NRAs and competent authorities and provide relevant updates if required, separately across 27 Member States). Combined with the total annual operational costs for compliance with legal obligations, the total cost would be in the order of EUR 0.50–1.20 million[52].

Currently there is no coherent and harmonised approach fostering the extension of **network resilience**, given that threats – whether cyberattacks, physical disruptions, or natural disasters – have increasingly cross-border effects. Annual cost of network outages for companies in Europe is estimated in the order of hundreds of millions[53]. The societal implications go far beyond costs for companies as network outage means unavailability of emergency calls, potentially leading to loss of life and threat to public safety[54].

Table 3: Evaluation report findings on resilience, general authorisation and end users

EVALUATION FINDINGS	SECTIONS IN ANNEX 11
Lacking pan-European approach to preparedness and resilience of connectivity networks: - Resilience of integrated electronic communications infrastructures (terrestrial, non-terrestrial/satellite, submarine) has become an important concern which had not been addressed by the EECC, only partially and in a limited manner. Resilience is only considered in EECC in the context of availability of services.	Annex 11, section 3.4 General objectives
General authorisation: - The EECC general authorisation regime successfully lowered barriers to market entry, enhanced transparency, and promoted consistency across the EU. However, divergences in national implementation and BEREC general authorisation database management (e.g., duplicate notifications, different templates, varying update practices) still create obstacles, particularly for cross-border operators. - Compliance costs under Art. 12 and 16 EECC are generally considered low and proportionate by both governments and stakeholders. Still, differences in national implementation (e.g., varying reporting obligations) impose extra administrative burdens, especially on smaller operators. - While internally coherent, the general authorisation framework lacks external coherence with other EU/national rules (cybersecurity, lawful interception, data retention, e-privacy). This undermines the single market and highlights the need for further harmonisation and coordinated security conditions. - The authorisation regime remains relevant, facilitating market entry and enabling NRAs to monitor compliance. However, some stakeholders call for expanding its scope (e.g., to NI-ICS providers) to ensure fair competition and consistent end-user protection.	Annex 11, section 6.1., Annex 11, section 6.2, Annex 11, section 6.3, Annex 11, section 6.4 and 6.5.

[52] While a significant number of respondents (95 out of 326) to the Call for Evidence have stressed that a simplified, harmonised GA and reporting framework are essential to reduce regulatory fragmentation, enable cross-border operations, and stimulate investment and innovation, they have not supplemented this with quantitative analysis on costs they incur due to the fragmented rules they face. However, this additional quantitative data was collected via desk research and further interview with stakeholders.

[53] Splunk, Splunk Report Shows Downtime Costs Global 2000 Companies $400B Annually, https://www.splunk.com/en_us/newsroom/press-releases/2024/conf24-splunk-report-shows-downtime-costs-global-2000-companies-400-billion-annually.html.

[54] The Connexion, Emergency numbers disrupted in France: Inquiry opened into 4 deaths, https://www.connexionfrance.com/news/emergency-numbers-disrupted-in-france-inquiry-opened-into-4-deaths/436843.

EVALUATION FINDINGS	SECTIONS IN ANNEX 11
- The evaluation also found a need for simplification, further harmonisation and consistency to reduce administrative burdens and support new, more software-based networks and virtualised communications services.	
End-Users: - The evaluation report found that the current sector specific rules are largely satisfactory and while they provide for maximum harmonisation, their effectiveness is reduced by the possibilities of derogation included in the articles; - The use by Member States of the possibility to derogate from sector specific rules has increased regulatory fragmentation of the consumer protection rules and has been mentioned as a barrier to the Single Market preventing operators to operate at scale or provide consistent cross border services.;	

2.1.3.2.*Barriers to pan-European satellite services*

Satellite systems provide broad regional or global coverage and have inherent cross-border nature and pan-European (or global) potential, as opposed to terrestrial mobile networks. In times of rapid expansion of innovative direct-to-device (D2D) services and related satellite constellations, the existing EU framework based exclusively on national authorisation of satellite services and on national spectrum resources creates barriers to the provision of pan-European services and forces satellite operators to respect unnecessary differences in authorisation rules and conditions in countries where they provide satellite services. Consequently, fragmentation of authorisation rules has a greater negative impact on satellite than on terrestrial networks, as it substantially limits the provision of pan-European satellite services, challenging the economic viability of satellite projects, and ultimately, undermining the EU global competitiveness and innovation capacity in satellite connectivity.

In particular, Low Earth Orbit (LEO) constellations for hybrid terrestrial-satellite systems (Non-Terrestrial Networks - NTN) are emerging as the modern equivalent of traditional mobile communication towers, offering Direct-to-Device (D2D) connectivity[55] and will be an essential element of the 6G mobile networks[56]. This infrastructure is vital for ensuring equitable access to high-speed internet, particularly in underserved and remote regions, while also strengthening European capabilities in critical communications (emergency and defence)[57], and a key component of resilient communication networks enabling continuous connectivity under challenging conditions.

Although Europe used to be a frontrunner in satellite communications, it has failed to anticipate the innovation potential of this market and was slow to invest in LEO constellation deployment[58]. With only 773 LEO satellites launched and 3120 planned, the EU lags China

[55] LEO constellations can provide global, uniform, low-latency coverage because they are constantly moving around the Earth, many moving satellites can cover every point on Earth eventually and hand over coverage/service to each other.

[56] 5G Non-Terrestrial Networks by Alessandro Vanelli-Coralli and Nicolas Chuberre, et al.

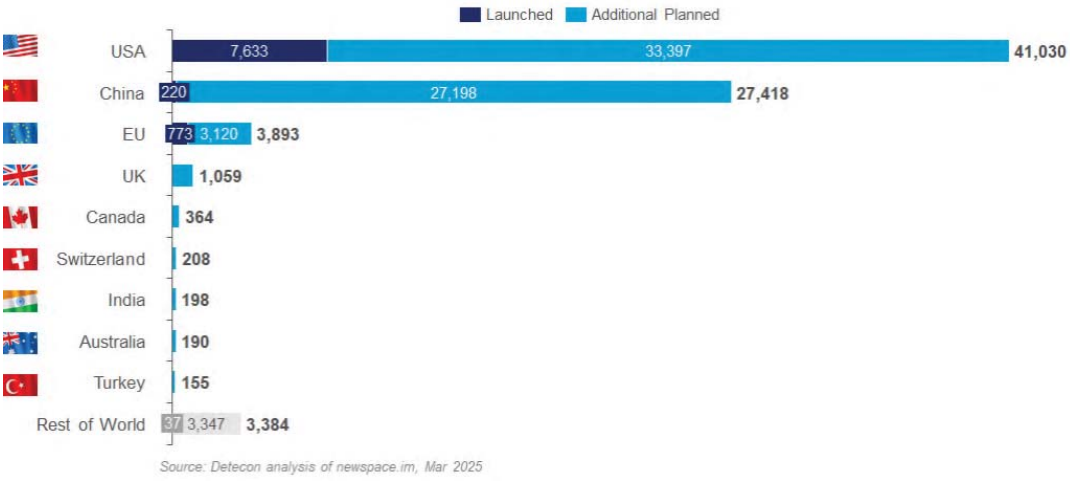
[57] Satellite technologies are inherently dual-use, designed to serve both civilian and defence purposes.

[58] The EU is the world's third largest player in most aspects of the satellite sector, following the United States and China. As of 2023, Europe's share of the downstream market was estimated to represent 23.0% (EUR 89 billion) of the total global market value (EUR 387 billion) – see Euroconsult (2023) as cited in the European Commission's Impact Assessment for the Space Act (SWD(2025) 335 final), part 1/2, p. 4.

(i.e. 220 launched, 27198 planned) and the USA (i.e. 7633 launched, 33397 planned) as reported in the Commission Study on the MSS in the 2 GHz band[59].

According to the Draghi report, satellite connectivity is increasingly vital for the EU's technological sovereignty, playing a crucial role in fulfilling the communication needs of citizens, businesses, and governments; yet this domain is increasingly coming under the dominance of non-EU players. Increasing dependence on third country constellations raises concerns around lock-in effects, creates the risk of arbitrary and voluntary "shut downs", and challenges European security and strategic autonomy, including its access to satellite orbits and spectrum resources.

Figure 8: Broadband Internet, D2D and IoT satellite constellations in terms of total number of launched and planned country/region[60]



In the coming years, the number of authorisations is expected to increase significantly, resulting in subsequent increases of compliance costs for operators and enforcement costs for authorities[61]. Continuation of the current complex division of competences and fragmented authorisation approaches risks delaying deployment of innovative satellite D2D services. In addition to their own compliance costs, new Union-wide satellite operators would face varying administrative costs depending on the specific Member State in which they operate. One-off administrative fees for authorisations (general and individual) range from a few thousand up to around EUR 110 000, plus annual fees typically between EUR 10 000 and 50 000. In addition, site authorisations for ground stations may entail a one-off permit cost of up to EUR 130 000

[59] European Commission: DETECON Study on mobile satellite services (MSS) in the 2 GHz band in the EU – Implementation of the current regulatory framework and an overview of the satellite connectivity market – Final report, 2025, https://data.europa.eu/doi/10.2759/5764760.

[60] Detecon International GmbH 2025. This data are to be considered with caution and as indicative. Detecon tabulates the launches and planned satellites adding up the satellite constellations by country of ownership (ignoring the complexities of multiple shareholders from different countries, unless it is close to a 50/50 split). Note that this metric excludes the most optimistic claims of some of the announcements, including Starlink's additional 4 450 to 12 000 satellites in the USA column (reported as submitted to the ITU in 2019) and the additional 10 700 satellites which the Thousand Sails constellation may expand to which would add to the China column. Note that counting satellites may also not be the most accurate metric, as it does not account for weight. Comparing kilograms in orbit is probably a more meaningful metric, if such ever becomes available.

[61] Cf. also Annex 7, section 1.3. for future authorisation needs of new constellations, as for example IRIS 2 and existing barriers.

per site and annual administrative costs of EUR 5 000–30 000, while spectrum usage charges can reach EUR 1000–10 000 per site annually.

Historically, access to spectrum for satellite services has been largely guaranteed at low fees given relatively low spectrum scarcity (particularly in the high frequency bands Ku and Ka), the limited number of operators and end-users and the possibility of spectrum sharing (See Annex 10, section 1 Spectrum essentials). Satellite spectrum was hence assigned on a first come first served basis at a low fee or assigned in comparative selection procedures.

There is an important economic potential related to D2D connectivity. It has been estimated that satellite D2D market could generate EUR 116.6 billion in total worldwide service revenue between 2022 and 2032[62].

Consequently, investment priorities in the satellite sector have historically concentrated on the development of space and ground infrastructure, including launch capabilities, while spectrum acquisition represented only a fraction of the cost. This contrasts with the terrestrial mobile sector where access to spectrum constitutes a key investment asset, representing a cost of around 7% of mobile service revenues and about 35–40% of Capex and is coupled with regulatory obligations related to coverage and quality of service. Since satellite spectrum in general is authorised at a much lower price than terrestrial mobile bands, the associated investment costs for satellite spectrum are far less than 7%. This is expected to change in the future with the development of D2D services, intensifying competition to access valuable spectrum in lower satellite bands, such as the 2 GHz MSS band.

Finally, against this background of proliferation of constellations and of regulatory fragmentation, the enforcement of ITU rules against harmful radio frequency interference represents a challenge[63]. Unlike terrestrial communications, the spectrum used for satellite communications requires a higher degree of international and national coordination because satellites operate across multiple countries and regions. The growing demand for LEO satellites to access spectrum significantly increases the risk of interferences. However, the current tools for addressing bilaterally satellite interference at the level of ITU are slow and inefficient and do not allow to leverage the strength of the internal market, e.g. threat of blocking access to the internal market. This shift of regulatory paradigms requires stronger EU coordination to develop and enforce efficiently common rules supporting the single market and advocate for them internationally[64].

The table below presents the main barriers analysed in further detail in section 2.2.4 of the evaluation report, in relevant studies[65] and in Annex 7, section 1.3.3 (Table on satellite spectrum

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[62] Analysis Mason, March 2024, Lluc Palerm and Jiachen Zhang: Satellite direct-to-device technology needs to evolve through four phases before reaching its full potential see link.

[63] The EU Space Act proposal envisages preventive interference measures for satellite operations in the EU (different from satellite communication services) by requesting the use of cryptography-encryption in the Union satellite operations and assessing the risks to lose control of assets with capacity to emit interferences susceptible to adversely impact the security of other space operations.

[64] Annex 7, section 1.3 Barriers to the development of advanced and resilient satellite connectivity.

[65] See also IDATE Study on Mobile Satellite Services (MSS) authorisation regimes, authorisations and enforcement in the EU Member States – Final report, Publications Office, 2019, https://data.europa.eu/doi/10.2759/974409 and DETECON, Study on mobile satellite services (MSS) in the 2 GHz band in the EU – Implementation of the current regulatory framework and an overview of the satellite connectivity market – Executive summary, Publications Office of the European Union, 2025, https://data.europa.eu/doi/10.2759/4700547.

fees), that negatively affect the deployment of pan-European satellite services in the 2 GHz band.

Table 4: Evaluation report findings on satellite connectivity

EVALUATION FINDINGS:	ANNEXES SECTIONS
Technical and legal obstacles to the provision of cross-border satellite services: The spectrum framework has been ineffective in ensuring a harmonized approach for satellite: great variability in - the form and conditions of authorisation (general authorisation or individual rights of use) and spectrum assignment, - timing of authorisation, - the fees charged (no fees, One-time administrative/ application fee, Annual radio spectrum user fees, Fixed amount etc.) - inconsistent reporting obligations and - the treatment of CGCs (separately or not). - risk that the service is not authorised in all Member States, i.e. coverage gaps.	Annex 7, section 1.3. Barriers to the development of advanced & resilient sat connectivity Annex 11, section 5.5.4. Supporting satellite EU-wide connectivity IA section 2.2.4 on Fragmentation of spectrum authorisation conditions for satellite services Annex 7, section 1.3.3 Fragmentation in sat authorisation - Table on fragmentation MSS Fees
Increasing risk of future interference that can distort competition especially if enforcement mechanisms are not effective, and do not ensure a level playing field in accessing spectrum resources leading to inefficient use of resources.	Annex 11, Appendix IIB Annex 7, section 1.3.2

2.1.4. Governance structure not fully suited to serve the requirements of the single market

The evaluation (Annex 11) showed that whilst significant progress in harmonisation has been made over time, the EU legal framework and the governance structure did not result in achieving a full Single Market in the electronic communications sector, and the EU is still characterised by fragmented national markets.

The articulation of competences and roles of the actors involved in the governance system (the European Commission, NRAs, and other competent authorities for spectrum and other specific areas, BEREC, and RSPG) is complex, not sufficiently clear for stakeholders, and not fully suited to support the Single Market. While all institutional actors pursue the general objectives as set out in Article 3 EECC, BEREC was established to ensure greater harmonisation of practices among the NRAs, promote an effective internal market in this sector, and act as an exclusive forum for cooperation among NRAs, and between them and the Commission. Moreover, according to Article 3 of the BEREC Regulation, BEREC must ensure a consistent implementation of the regulatory framework for electronic communications[66].

As the results of evaluation show, BEREC remains a platform for coordination among NRAs, but while it strives to achieve a common EU approach, its positions in some cases remain influenced by national perspectives. Consequently, its outputs often leave space for inconsistent implementation of the regulatory framework, diminishing their impact on harmonisation of

[66] EECC, Roaming Regulation (Regulation (EU) 2022/612 of the European Parliament and of the Council of 6 April 2022 on roaming on public mobile communications networks within the Union, OJ L 115, 13.4.2022, p. 1, ELI: http://data.europa.eu/eli/reg/2022/612/oj), Open Internet Regulation, Gigabit Infrastructure Act (Regulation (EU) 2024/1309 of the European Parliament and of the Council of 29 April 2024 on measures to reduce the cost of deploying gigabit electronic communications networks, amending Regulation (EU) 2015/2120 and repealing Directive 2014/61/EU, OJ L, 2024/1309, 8.5.2024, ELI: http://data.europa.eu/eli/reg/2024/1309/oj).

rules for the internal market[67]. For example, although the electronic communication networks and services are provided under GA, i.e., without prior authorisation, the GA notification templates differ significantly[68]. In some cases, consensual elaboration and adoption of BEREC guidelines on GA conditions and GA notification templates or common positions result in either guidance that is either overly complex, or too general and not specific enough[69]. The BEREC Office has only administrative/support functions, and hence its potential to provide more support on substantial matters, injecting thus a more neutral position in the development of BEREC preparatory work, remains underutilised as it is the smallest EU decentralised agency (yet with staff overrunning the authorised budgetary levels).

As for spectrum governance, results of evaluation show that fragmented national authorisation processes for satellite services across the EU create significant barriers to swift and efficient service rollout. These inefficiencies inflate costs and administrative burden without delivering added value to customers, ultimately undermining the competitiveness of EU satellite services and slowing down innovation.

The RSPG advises the Commission and other EU institutions on issues related to radio spectrum policy, including on the EU position in view of the periodic World Radiocommunications Conferences. Although valuable, RSPG opinions tend to focus on technical aspects. Inter alia due to the lack of a proper support structure (a small secretariat function is provided by DG CNECT, with the majority of the substance work based on resources of national authorities) the RSPG is not fully exploring its mandate to advise EU institutions on broader aspects of radio spectrum policy in general (e.g. economic, political, cultural, strategic, security, health and social issues). There is furthermore untapped potential to more systematically include the input of other expert groups for the formulation of RSPG positions. The voluntary mechanisms, such as a peer review under Article 35 EECC, have not been sufficient for strengthening the Single Market[70].

Moreover, even though the EECC requires close cooperation between BEREC and RSPG where spectrum issues have regulatory implications, in practice this coordination has been

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[67] According to industry views (Study on Digital Single Market), BEREC has insufficiently contributed to harmonisation, e.g. in the area of end-user rights, where national legislation and practices diverge.

[68] The BEREC guidelines for the notification template have not eliminated differences in notification forms used at national level. The differences in both templates as well as, more significantly, in the conditions applied nationally, are either hindering the undertakings from providing their networks and services cross border or are generating compliance costs and administrative (e.g. translation) burden. It has influence on the competition (lack of cross-border provision of services), as well as on investment decisions of undertakings to develop or consolidate cross-border.

[69] The BEREC Guidelines on conditions and criteria for the assessment of the co-investments in very high capacity networks adopted pursuant to Article 76 EECC were developed without hindering NRAs experiences (i.e. in Spain, France) resulting in a very complex set of provisions de facto never used, thus depriving stakeholders of a legal framework that could have provided a stable and predictable regulatory framework for co-investments in fibre deployments.

Another example could be BEREC Guidelines on Common Approaches to the Identification of the Network Termination Point (NTP) in different network topologies from March 2020, which were intended to assist NRAs in consistently identifying the NTPs and provide guidance how to consistently define the NTP, but they left room for different specific interpretations and did not bring desired harmonisation effect across EU.

[70] In particular, it was not successful in shifting auctions from money making into more pro-investment oriented and in rectifying cases of artificially induced spectrum scarcity or artificially induced unsuccessful market entry which resulted in inflated spectrum prices. This in turn affected the ability of operators to invest in high quality 5G connectivity (e.g. DE or CZ).

limited to few joint opinions or reports. Regarding other issues, the synergies between BEREC and RSPG also remain unexploited resulting in non-holistic RSPG opinions, like is the case of the D2D satellite service[71], where RSPG signalled that some of the issues need to be addressed by BEREC. Both BEREC and RSPG are adopting their opinions aiming for compromise on sensitive issues, accommodating different national views, in some cases to the detriment of the broader EU perspective. Both BEREC and RSPG rely on the resources of their members for the work on substance, which bears certain limitations[72].

Furthermore, a governance set up with multiple layers and involvement of different authorities at national and EU level affects also the ability of the actors to have a full overview of all aspects of the market. For example, as regards network resilience, although NIS2 and CER harmonise minimum requirements for risk management by digital infrastructure entities, enforcement is left to the Member States. Approaches that focus on risks at the national level tend to overlook interdependencies affecting multiple Member States simultaneously. There is lack of sufficient strategic coordination when it comes to network resilience and preparedness[73].

The identified flaws affect the functioning of the market, as the governance set up has impact on how and at what level regulatory decisions are being taken. The governance determines which authorities and to what extent can influence those decisions, whose impacts on connectivity, investment and competition are intertwined, and – as observed in the Letta report – the divergences in the approaches of the involved authorities at different regulatory levels hinder the long-term objective of a genuine Single Market.

The above analysis is further supported by the findings of the evaluation report, as summarised in the below table.

Table 5: Evaluation report findings on governance

EVALUATION FINDINGS:	ANNEXES SECTIONS
Independence of NRAs: - The EECC introduces stronger formal safeguards for NRA independence, especially concerning the appointment and dismissal of leadership. - Member States retain substantial discretion in implementing these provisions, resulting in varied national approaches. - Despite a harmonised EU-level framework, both de jure and de facto independence of NRAs continue to differ across countries. - Adequate financial and human resources for NRAs remain essential to ensure effective performance and contribution to EU-wide regulatory coordination through BEREC.	Annex 11, section 9.1

[71] Radio Spectrum Policy Group, Opinion on the EU-level policy approach to satellite Direct-to-Device connectivity and related Single Market issues, 17.06.2025, RSPG25-020 FINAL, https://radio-spectrum-policy-group.ec.europa.eu/document/download/72e52901-fa1a-474a-9480-a222c5b36545_en?filename=RSPG25-020final-RSPG_Opinion_on_D2D_and_Single_Market_Issues.pdf

[72] Relying fully on the resources of their members for the work on substance means that any constraints that the relevant authorities have, be it of budgetary nature, staffing or workload, are reflected in their ability to effectively contribute to the work of BEREC and RSPG.

[73] See also the last conclusion in the evaluation findings on the lack of pan-European approach to preparedness and resilience of connectivity networks.

EVALUATION FINDINGS:	ANNEXES SECTIONS
BEREC and BEREC Office: - BEREC has effectively delivered on its core objectives and guidelines, though these alone cannot fully drive single-market integration due to necessary national flexibility. - Rapid expansion of EU digital regulation—including the DSA, DMA, Data Act, Data Governance Act, and AI Act—has created new responsibilities for national authorities that are not reflected in BEREC's mandate, limiting coherent EU-wide action. - NRAs lack many of the powers needed in new digital areas, making BEREC increasingly dependent on structured cooperation with other authorities and on developing new skills. - Technological convergence involving cloud, edge computing and AI requires BEREC to broaden its expertise and adapt to a more EU-focused governance approach addressing resilience and sustainability. - Even when taking into account existing instruments addressing the physical or cyber resilience of infrastructures, not sufficient emphasis is given to the EU preparedness for crisis and to the role of national regulatory authorities and BEREC in enhancing the EU preparedness based on an EU networks' contingency plan. - The BEREC Office provides solid support but needs stronger analytical, data and professional capacities to meet growing regulatory and technological challenges. - Efficiency is hindered by reliance on larger NRAs, uneven expertise across authorities, high staff turnover in the BEREC Office, and insufficient IT tools; providing more content-related support could improve balance and the quality of outputs. - BEREC's ability to produce coherent outputs would improve through deeper work on emerging topics such as AI, cybersecurity, sustainability and spectrum, particularly for cross-border satellite services. - Although BEREC brings clear EU added value, its consensus-driven structure and limited mandate restrict its role in advancing harmonisation and ensuring relevance as markets become more pan-European and complex.	Annex 11, section 9.2 and appendix III to the Evaluation Report. Annex 11, section 3.4 General objectives (on the resilience of infrastructures)
RSPG: - The RSPG provides high added value to EU spectrum policymaking through its opinions, reports, and strong contribution to WRC preparations, despite operating with very limited administrative resources. - The RSPG has a tendency to focus mainly on technical issues, and to a lesser degree on economic, political, cultural, strategic, health and social considerations, which are also part of its mandate. Sometimes, the opinions lack the EU vision. - Effectiveness of its peer review mechanism is increasingly constrained: it has not influenced national authorisation practices, and voluntary participation prevents consistent alignment with EECC objectives. - The RSPG Good Offices lack appropriate tools for solving interference issues with third countries or, between Member States involving the non-EU harmonised spectrum. - Member State participation and engagement vary significantly, with smaller administrations often unable to contribute across all workstreams, limiting the group's ability to produce balanced and comprehensive outputs. - Cooperation with other EU bodies—especially BEREC—is insufficient, hindering the development of holistic, cross-sector spectrum policies and weakening coherence across the governance framework.	Annex 11, section 9.3.

2.2. What are the problem drivers?

2.2.1. Fixed networks

The deployment of fibre networks and the take-up of fibre-based services has developed differently across the EU.

Regulatory approaches and business choices have had a significant but varied influence on fibre deployment and on the FTTH coverage achieved to date. The first section below presents the effects of the various regulatory approaches and business choices on fibre deployment. The second section describes why the persistence of copper networks has been detrimental to fibre deployment and take-up.

It should be mentioned that other aspects are also relevant but are not analysed in detail because they cannot be directly addressed by policy interventions. These are for example, consumer inertia, social/cultural preference for fibre technology, income levels and price sensitivity.

The table below provides a concise overview of the problem drivers and how they relate to the core issue i.e., slow deployment and adoption of fibre.

Table 6: Causal link between root causes/problem drivers and problem

Problem drivers/root causes	Causal link with slow deployment and adoption of fibre
1) Regulatory approaches and business choices	The delay in regulating ducts and poles, the technology choices made by incumbents and the incentives for FTTC deployment have reduced FTTH investments in certain countries.
2) Persistence of copper networks	The persistence of legacy copper infrastructures decreases operators' incentives to deploy FTTH networks and, where FTTH exists, end-users' willingness to adopt fibre services.

2.2.1.1. Regulatory approaches and business choices

The current EU regulatory framework aims at creating a pro-competitive and investment-friendly regulatory environment. One of the objectives is the promotion of connectivity and access to and take up of VHCN. The market environment has changed dramatically as a consequence of investments required to replace the copper networks by fibre and the emergence of players other than the historic telecom incumbents that are deploying FTTH networks. Nevertheless, the EECC has no provisions specifically promoting FTTH investments.

However, the various national implementation by NRAs, choices by other national authorities as well as business choices by operators led to differentiated results across and did not ensure the implementation of strategies to achieve (close to) full FTTH coverage across the UE as defined in the DDPP.

Overall, the regulatory approaches described below do not offer an EU-wide solution to rapidly and effectively increase FTTH coverage and take-up but provide overview of which practices seem to have worked in which specific circumstances.

A more detailed description of the different countries and the various regulatory approaches can be found in Annex 7.

Competition driven fibre deployment

Bulgaria and Romania have achieved high fibre (FTTP coverage above 90%) through competition driven fibre deployment. Alternative network operators did not use wholesale access to the incumbent's copper network; they grew through investing into their own network. In Romania, the main alternative operator initially invested in coax and afterwards replaced its network with fibre. In Bulgaria, numerous local operators of LAN (local access networks) and coax networks (DOCSIS 3.0), replaced their networks with fibre in response to the increased demand, indirectly incentivising the incumbent to deploy fibre networks as well. Hereby, low deployment costs was a crucial factor enabling this strategy, especially due to commercial access to poles and less stringent rules (regarding deployment) in Romania, and the effective access to physical infrastructure (initially as a remedy under SMP regulation, and afterwards through symmetric rules under the Broadband Cost Reduction Directive BCRD[74]) in Bulgaria.

In Poland and the Baltic states, fibre deployment has been primarily driven by competition from hybrid coax-fibre networks. In large cities in Poland, the presence of upgraded cable networks with good service quality forced the incumbent to replace its copper network with fibre. Similarly, in large cities in Latvia and Estonia infrastructure-based competition drove the incumbent to invest into fibre. However, since infrastructure competition emerged mainly in densely populated urban areas, full fibre coverage is unlikely to be achieved solely based on this type of competition.

Countries characterised by the historic presence of two nationwide parallel networks i.e. a copper and a cable network are Belgium, the Netherlands and Malta. While there are some similarities in market structure (i.e. nationwide duopoly), there are significant differences in outcome.

In the Netherlands and Malta, competition between the copper and cable networks has led to fibre deployment by the operators. However, a similar starting situation in Belgium (presence of parallel copper and cable network) has not yet led to significant fibre deployment, possibly due to higher deployment costs.

Access to physical infrastructure (PIA)

Access to PIA, especially a well-developed duct system can greatly facilitate fibre deployment. The Spanish regulator decided early on to regulate access to the ducts and copper network but left newly deployed networks unregulated. As a result, alternative operators could receive wholesale access to the copper network to start developing their business (short term solution) and deploy their own fibre network in the ducts as a longer-term strategy. The success of this approach relied on the extensive duct system of the incumbent (117 000 km of ducts were used by network operators) and the fact that access seekers use only regulated passive networks of Telefónica to deploy own fibre.

The approach in Portugal has also been based on the promotion of access to PIA, which allowed for partial deregulation of wholesale access.

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[74] Directive 2014/61/EU of the European Parliament and of the Council of 15 May 2014 on measures to reduce the cost of deploying high-speed electronic communications networks, OJ L 155, 23.5.2014, p.1, ELI: http://data.europa.eu/eli/dir/2014/61/oj.

The French regulatory model (since 2009) relies strongly on access to Orange's PIA (instead of access to the fibre network). This is combined with symmetric access to the in-building wiring or to cables going beyond the building (depending on the area).

In all the above cases, access to the SMP operator's PIA was a crucial element. However, even with the presence of a well-developed PIA, State aid and a long-time horizon (at least 10 years) was necessary to reach a high level of fibre coverage.

Fibre deployment by municipal or public companies

In the Nordic countries, public and local authorities have invested in fibre deployment via their utility companies. Those networks were built in parallel with the existing infrastructures of the local incumbent operators. Part of these networks is based on a wholesale-only model, meaning the network operator has no downstream retail business but offers wholesale access to its network. Access seekers can use the utilities' fibre networks and do not need to invest in their own networks.

In Ireland, the joint venture between an energy company (SIRO) and an alternative operator (Vodafone) has been deploying a fibre wholesale-only network. The vertically integrated incumbent has also been rolling out a fibre network.

Choice of FTTC over FTTH

The incumbent operators in Germany, Italy, Greece, Belgium, Czechia and Austria followed a partial network upgrade strategy. They have replaced the copper wires with fibre until the street cabinet (fibre-to-the-cabinet or FTTC) but left copper for the final part. Such a network, combined with vectoring (a technology allowing to increase the speed over copper at relatively low costs) provides better level of services for end-users. The business choice of the incumbents was influenced by the topology of the network, the specificities of the countries concerned and the motivation to improve service quality quickly and cheaply. However, the short-term success of the strategy reduced the incumbents' incentives to invest into FTTH and has resulted in very low FTTH coverage in the mentioned countries.

Regulators in these countries did not adopt measures to effectively incentivise FTTH deployment. In particular, they did not give access to PIA (or imposed this only recently), but mandated access to active products. This allowed for service-based competition at retail level but did not stimulate infrastructure competition and fibre deployment.

Based on the above analysis (more detailed in Annex 7), although there is no one solution fitting all circumstances, some general trends can be identified, for example countries that chose upgrading the legacy copper networks (FTTC) currently lag behind with fibre deployment. When it comes to access regulation, countries where regulators followed the incumbent's choice of FTTC are characterized by persistence of copper networks and slow deployment of fibre. Conversely, countries in which NRAs decided to facilitate access to civil infrastructures have been more successful in fibre deployment.

In addition, the following factors were key for the roll out of fibre: 1) central planning based on geographic surveys (e.g. France); 2) the use of symmetric measures. Public authorities support either by state aids or by direct investment via publicly owned company has also played an important role.

Finally, the Evaluation report (Annex 11) underlines that the provisions of the EECC setting out the conditions for copper switch off by operators having significant market power were not aimed at facilitating copper switch off and in many cases delayed the process.

2.2.1.2. Persistence of copper networks

The persistence of legacy copper infrastructures decreases operators' incentives to deploy FTTH networks and, where FTTH exists, adoption of fibre-based services by end-users.

In general, countries with a high share of copper networks have lower fibre coverage than those with a low share[75]. One of the reasons for that is that the presence of a copper network reduces the incentives of **deploying** a fibre network in the same area. Deploying a new fibre network is capital intensive, therefore it is crucial that the new network attracts significant number of customers within a relatively short period. To reduce the risk of not reaching a critical number of customers (demand risk), network operators typically collect commitments from a minimum number of potential customers to subscribe to fibre-based services before they go ahead with deployment. In areas covered by a copper network, end-users' incentives to commit to subscribe to fibre-based services is lower than in areas without a copper network, especially if the copper network can provide speeds above 100 Mbps). This can translate into insufficient demand at the stage of assessing the economic feasibility of deployment and ultimately result in no or delayed deployment of the FTTH network.

The link between the presence of a copper network and the **adoption** of fibre-based services is more direct than with deployment. Customers on copper networks may delay the migration to fibre due to inertia, higher price, the possible works needed for bringing fibre to their homes or (perceived) lack of need. This can result in low take-up of fibre-based services (39% of broadband subscriptions in 2025)[76] and insufficient revenues for the fibre network operator. In turn, the low take-up can lead to charging relatively high prices for fibre services to cover investment costs[77]. Higher prices will further reduce demand and take-up. If new fibre networks turn out to be unprofitable, investors will be unwilling or at least less likely to finance the deployment of new fibre networks. This means that the low take-up on existing fibre networks can also slow down further fibre deployment.

As can be seen from the following chart, a common factor amongst the countries with the lowest fibre deployment (Greece, Austria, Czechia, Germany, Belgium and Italy) is the high share of upgraded copper networks (specifically FTTC). As previously explained, FTTC deployment, which allows for the achievement of increased speed with relatively low capital investment, appears to have reduced the relevant operators' incentives to invest into FTTH.

In the absence of any rules to limit an incumbent from discriminating against alternative networks in the copper switch-off process, the incumbent's business case for fibre deployment

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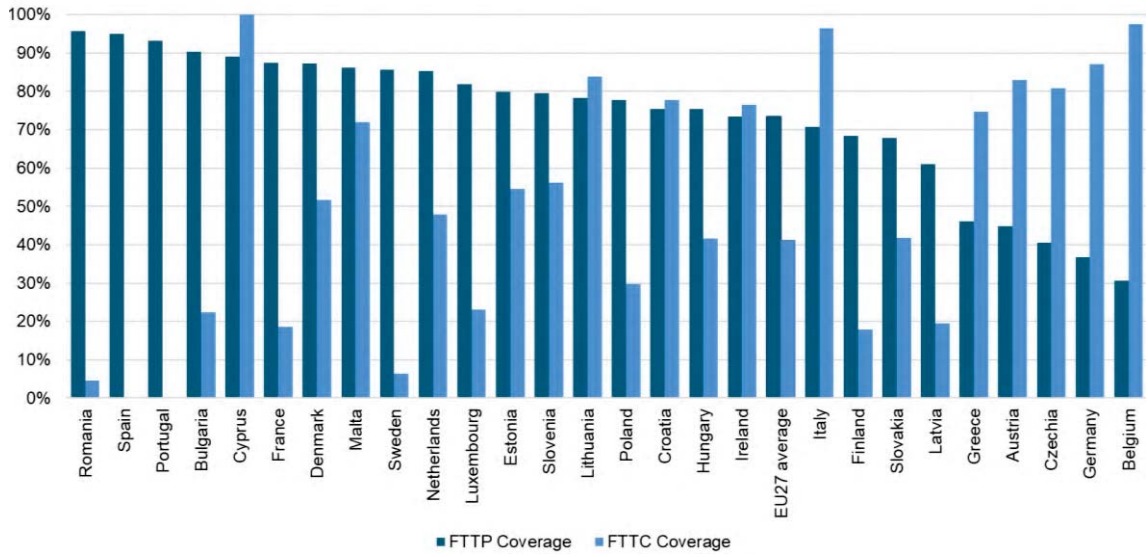
[75] A common factor amongst the countries which lag furthest behind in FTTP deployment is upgraded copper networks (FTTC/VDSL) were widely deployed by the incumbent. The deployment of this interim technology may have provided short term gains for incumbents in terms of lower capital intensity, while allowing them to improve the speeds they offered to customers. However, it also implies that the required investments in FTTH (i.e. the deployment of fibre from the distribution point to the premise, and (for MDUs) in-building) were deferred to a later stage. Those countries are: Belgium, Germany, Czechia, Austria, Greece.

[76] Study on Access Regulation.

[77] A comparison of OECD price baskets from 2023 also shows a higher price level for retail Gigabit broadband in countries where there is lower fibre coverage, showing that Gigabit has been priced at a premium – presumably to differentiate from lower bandwidth offers available via VDSL and cable.

is considerably stronger than that of entrants. This is particularly true for wholesale only companies which lack any retail customer base of their own, but is also true for alternative operators, which typically have lower broadband retail market shares than that of the incumbent, and therefore a smaller customer base which could be transferred to a new fibre network. Indeed, fibre networks that were deployed by alternative fibre investors in countries where there is widespread persisting competition from legacy upgraded copper (FTTC) or cable networks have struggled to reach profitability, due to the low take-up on the new fibre networks, which restricted the revenues needed to make a return on the levels of capex invested.

Figure 9: FTTP and FTTC coverage per Member State



Source: WIK based on European Commission / OMDIA and Point Topic (2025).[78]

2.2.2. Mobile networks: Spectrum regulation and market factors slowing down investment in high quality mobile connectivity

Currently, **investment incentives** for high-quality 5G deployment are **negatively affected by** several interrelated **problem drivers and root causes,** most notably market factors limiting monetisation opportunities and fragmented, insufficiently investment-conducive spectrum regulation. Table 7 summarises these drivers and their link to insufficient investment in high-quality mobile connectivity.

Table 7: Causal link between Root causes/Problem drivers and Problems for mobile networks

Problem driver/root causes	Causal link with the underinvestment problem
1) Spectrum related **regulatory fragmentation and disincentives** to invest in high quality mobile connectivity	The **discrepancy in assignment timelines, auction conditions** (market shaping measures, coverage obligations, reserve prices, insufficient flexibility for spectrum sharing) **negatively affects predictability and leads to different market outcomes** (in terms of spectrum costs per MHz, investment, mid-band coverage (from 30% to 100%) and network speeds. **Cost of spectrum** rights could be **artificially inflated** by e.g. limiting the amount of auctioned spectrum, use of market shaping measures, **negatively**

[78] European Commission/OMDIA and Point Topic (2025): Broadband coverage in Europe 2024 – Mapping progress towards the coverage objectives of the digital decade – Final report, https://data.europa.eu/doi/10.2759/9441597 (last accessed on 14.07.2025).

Problem driver/root causes	Causal link with the underinvestment problem
	affecting mobile operators' investment capacity. Cost of capital employed for new spectrum rights' acquisition or retaining the existing ones **without guaranteeing adequate return** could impede mobile operators to invest more in the network deployment.
2) Lack of **financial attractiveness and predictability**	**Uncertainty** about **revenue opportunities** for mobile network operators: Operators do not deploy if they are not certain to monetise investments, especially if average revenue per user (ARPU) levels are already low compared to international competitors (see comparison in Annex 11). **Decreasing revenues** per MHz, compared to the **increasing amount of spectrum needed** to provide high quality 5G services. **Financial investors are reluctant to support mobile projects** due to risks related to **low predictability** (recurrent spectrum reauctioning with unpredictable auction conditions, insufficiently long licences). Low predictability of 5G SA projects **affecting cost of capital.**
3) L**ow demand** for high quality 5G connectivity and "chicken and egg" effect	There is **low take up** of bandwidth-intensive quality assured services which would offer **monetisation opportunities** through network slicing, but demand also does not develop due to **lack of availability of quality assured services**.
4) **Inefficient spectrum use** due to insufficient sharing	**Unexploited potential of sharing**, **secondary spectrum trading** and **local licencing** have led to underutilisation of spectrum & inefficiencies inhibiting optimal spectrum reallocation, despite increasing spectrum needs, including from private networks
5) **High cost** of high quality 5G/6G and **unexploited economies of scale**	Investment decisions are more difficult when **investments costs** for high quality 5G deployment are **increasing**, as for example for network **densification and economies of scale** are not exploited.

The problem drivers summarised above and further analysed below aim to provide a comprehensive picture of the main factors leading to insufficient investment in high-quality mobile connectivity. However, while low demand and limited monetisation opportunities are significant contributors to underinvestment in high-quality 5G, **spectrum regulation** remains primarily a **supply-side intervention**. Consequently, spectrum options presented in section 6.2. address supply-side drivers, namely regulatory fragmentation, limited predictability and inefficient spectrum use. Nonetheless, spectrum measures may also generate **demand-side effects**: Improved quality of service, wider network coverage and, potentially, lower retail prices (to the extent they depend on spectrum costs) can stimulate demand, e.g. by enabling quality assured services and addressing the "chicken and egg" issue. The options also aim to broaden access for specific private and temporary use cases. Demand is further expected to be supported by the ongoing spectrum harmonisation for private networks.

2.2.2.1. Spectrum related regulatory fragmentation and lack of predictability

The speed of 5G deployment and the quality of service also depend on the availability of sufficient spectrum accessible under **predictable, investment-friendly conditions.** In this context, the Draghi report highlights a problem of fragmented, "uncoordinated spectrum policies across Member States mostly designed to maximise frequencies pricing". This is contrasted with the situation in the US, where centralised spectrum governance supports large-scale, nationally coordinated auctions with uniform licensing conditions, thereby facilitating rapid deployment of new technologies and cross-border service provision.[79] The Draghi report further stresses the "costly proliferation of different obligations for EU telecom operators, with

[79] See Annex 10.

limited consideration for investment commitments, service quality or innovation". Although the EECC harmonised certain aspects of assignment of 5G spectrum, Member States still retain a significant degree of discretion over auction design and conditions attached to spectrum use rights. This has led to significant discrepancies in assignment timelines and **fragmented application of award and authorisation conditions associated with different outcomes in terms of 5G coverage, quality of service and underlying investment**.[80]

Fragmentation in spectrum regulatory approaches outlined above is reflected in **substantial differences in market outcomes** across the EU in terms of 5G mid-band coverage, download speeds, upload speeds, latency and consumer prices. The box below summarises the analysis of regulatory design in 5G auctions and its relationship with market outcomes and investment incentives.

Evidence of regulatory fragmentation and lack of predictability in EU spectrum assignment

The fragmented nature of European spectrum governance was particularly evident in the **assignment of the 5G pioneer bands** (700 MHz, 3.6 and 26 GHz). These bands were made available at different times across the EU.[81] The overall authorisation process spanned over a decade and about half of Member States did not meet the deadline of 31 December 2020. Some auctions applied demanding coverage and quality of service obligations as well as reasonable spectrum prices aligned with investment needs, while others pursued higher revenues, resulting in weaker coverage outcomes. **Auction designs reflecting long-term infrastructure goals** have proven more effective in promoting rapid deployment.[82] In some Member States, **market-shaping measures** intended to promote competition, such as spectrum reservations and set-asides for new entrants and vertical users, instead deprived operators of spectrum needed to ensure quality of service and contributed to higher spectrum prices, reducing operators' investment capacity.[83] At the same time, increasing cost of new 5G and 6G deployment appears to reduce the feasibility of maintaining several parallel infrastructures, thereby weakening the potential of set-asides to sustain infrastructure-based competition.

Fragmentation is also evident in the wide divergence of **average spectrum prices** (€/MHz/pop). For the 700MHz band, prices range from €0.08 per MHz per population in Croatia and Estonia to more than €0.69 in France. For the 3.6 GHz band, values range from below €0.01 in Romania and Bulgaria to €0.38 in Italy. Lowest prices, generally below €0.002, are observed in the 26 GHz band due to limited range and early market stage. Although many factors influence auction prices, including broader economic conditions and competitive dynamics, national regulatory choices such as market-shaping measures and reserve prices also play a role. Such interventions may distort price formation in the auction process and push final prices above economically sustainable levels, reducing the resources for network investment.

Fragmentation also extends to licence duration and renewal conditions, **limiting predictability and creating uncertainty for long-term investment.** The EECC required Member States to ensure at least 20 years of regulatory predictability for wireless broadband services by granting

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[80] See analysis in the section *Evidence of regulatory fragmentation in EU spectrum assignment* below.

[81] Operators need a combination of spectrum bands to deliver high-quality 5G services, since no single band can effectively meet all 5G technical requirements on its own. Cf. Annex 10, section 2. Spectrum for 5G.

[82] See Annex 11, section 5.4.4. Conditions of assignment (duration, coverage, price).

[83] See Annex 11, section 5.4.6 Market shaping measures. Corresponding correlations confirmed in the below analysis.

licences with a minimum duration of 15 years, plus a possible 5-year extension based on clear criteria relating to spectrum utilisation and competition. In practice, Member States have interpreted and implemented this requirement in different ways. While 92% of pioneer band licenses from 2020 onwards were issued for 15 years or more, the duration of licenses has often been insufficient to ensure adequate return on investments or to encourage more ambitious deployment of high-quality 5G networks and services.[84] The need for operators to obtain licences in several bands, combined with limited licence duration, requires participation in frequent re-auctioning, which increases uncertainty about the ability to reacquire existing rights and reduces operators' incentives for long-term network investment as well as the attractiveness to investors. According to GSMA, approximately 500 licences will expire in the next decade. Stakeholders increasingly call for longer durations, automatic renewals or indefinite licences with clear revocation safeguards and incentives for secondary trading. In the US, the FCC streamlined and harmonised licence renewal and service-continuity rules in 2017 to provide a consistent framework and predictable, expedited renewals where licensees continue to meet the initial requirements and use the band at or above those levels.[85]

Analysis of the link between market outcomes and regulatory approaches on 5G auction design

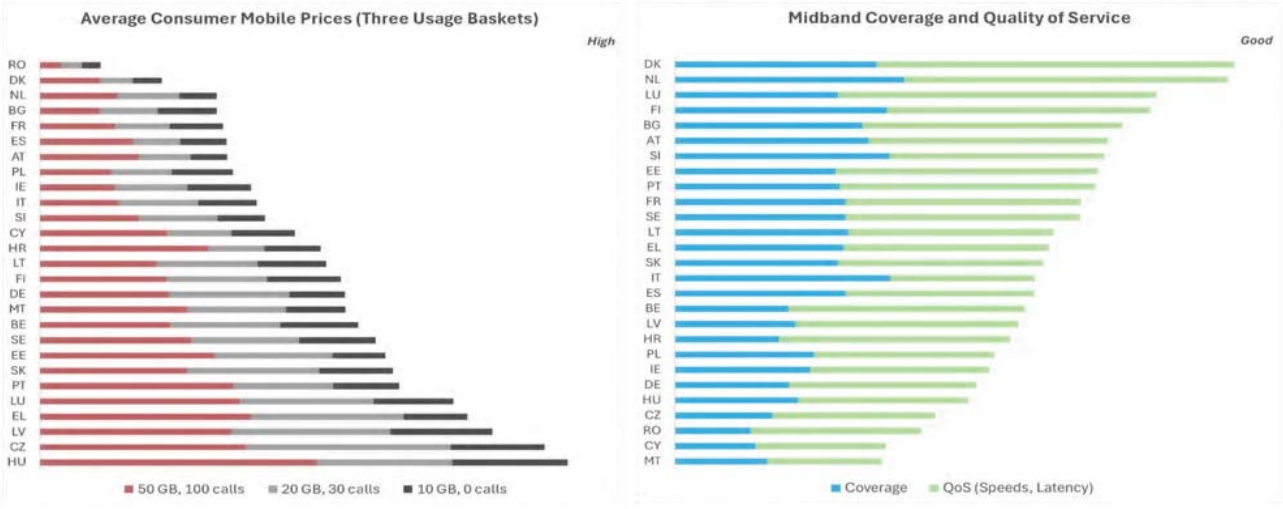
As regards the effects of regulatory approaches on investment incentives, several conclusions can be drawn from the comparison of market outcomes and auction design across Member States. EU mobile markets are largely competitive, typically with three to four MNOs and consumer prices remaining relatively low by international standards. For example, EU mobile broadband prices are significantly lower than in the US.[86] Yet, consumer prices vary considerably across the EU. A similarly diverse picture emerges for Mid-band coverage and Quality of service: a combined indicator (based on mid-band coverage, latency, download and upload speeds) reveals substantial differences between Member States. The left panel of Figure 10 presents average consumer mobile prices across three usage baskets, with stacked bars indicating the contribution of each basket to the overall average. The right panel reports normalised mid-band coverage and quality-of-service scores, showing their respective contributions.

Figure 10: *Consumer Prices, Mid-Band Coverage and Quality of Service across EU Member States*

[84] See Annex 11, section 5.4.4. Conditions of assignment (duration, coverage, price).

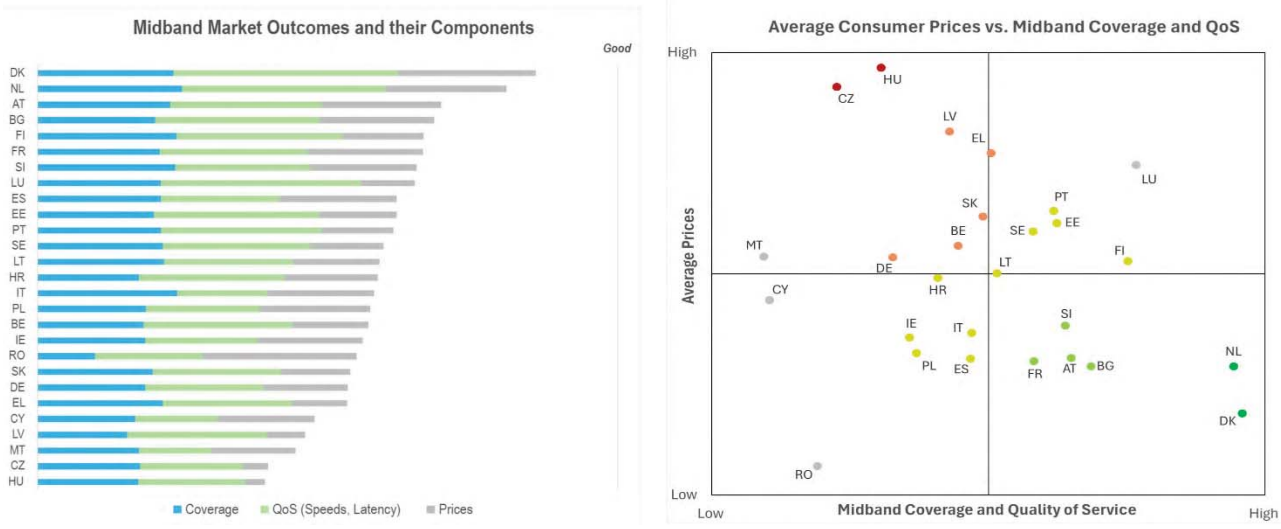
[85] FCC Reforms License Renewal Rules for Wireless Spectrum | Federal Communications Commission. For basic info on spectrum governance in the US, see also Annex 10, section 2.

[86] Mobile and Fixed Broadband Prices in Europe 2022, p. 23.



Left panel of Figure 11 shows overall mid-band performance by decomposing market outcomes into normalised coverage, quality and consumer price components (with higher price bars indicating lower prices here). The right panel plots z-standardised average prices against z-standardised coverage and quality scores, highlighting the diverse performance patterns observed across the EU.

Figure 11*: Overall mid-band performance and Consumer Prices in Relation to Mid-Band Coverage & Quality of Service*

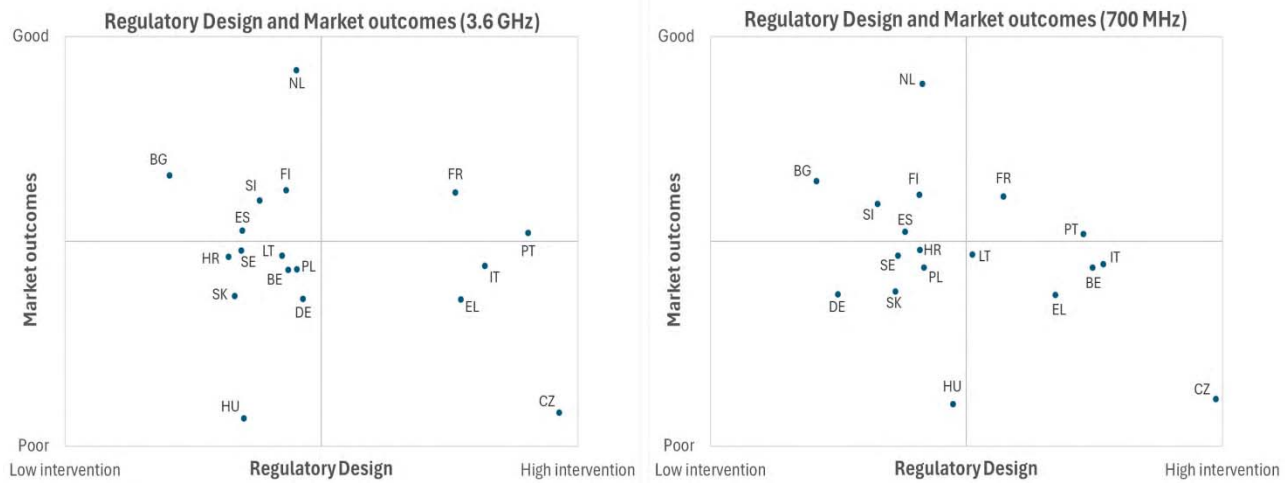


Differences in consumer prices, coverage and quality of service may be linked, alongside other factors such as demand, competition and GDP per capita, to Member States' diverse regulatory approaches to 5G spectrum assignment. The following analysis examines the **potential relation between market outcomes and key elements of regulatory design** in the 3.6 GHz and 700 MHz auctions. For initial insights, **Error! Reference source not found.** compares a composite measure of market outcomes, based on consumer prices, mid-band coverage and quality of service, with a composite measure of regulatory design that reflects spectrum caps, access obligations, auction prices and reservations or set-asides for new entrants and vertical users.[87] The **visual analysis** suggests that more interventionist regulatory approaches may, in some

[87] Construction of these standardised measures, including the underlying scoring and weighting, is set out in Annex 4.3.

cases, be associated with less favourable market outcomes, particularly in the 700 MHz band. This might indicate that the more intrusive and less investment-oriented auction and award conditions currently applied in certain Member States may be linked to more limited coverage and quality of service as well as higher consumer prices. At the same time, the patterns observed in this simplified descriptive representation are not conclusive and do not amount to a statistical correlation. Rather, they motivate the subsequent regression analysis.[88]

Figure 12 Regulatory Design and Market Outcomes in the 3.6 GHz and 700 MHz Bands



The **regression analysis**[89] performed for this impact assessment confirms that some elements of regulatory design are associated with material differences in market outcomes. While non-regulatory factors such as GDP per capita, population density, rural share and competitive structure – which are controlled for in the regression specifications – remain important determinants of investment and performance, several regulatory choices show consistent correlation with both operator incentives and end-user outcomes. Across the different model specifications, spectrum reservations and set-asides emerge as the regulatory variable most consistently associated with weaker outcomes. Higher set-aside and reservation shares tend to coincide with higher auction prices (€/MHz/pop), higher consumer prices, and lower 5G download speeds. Given that regulatory choices may also react to pre-existing market conditions, these results do not establish a causal link. Nonetheless, the observed associations are consistent with the intuition that restricting the effective supply of spectrum increases cost pressure on operators, dampens investment incentives and leads to weaker quality of service and higher consumer prices. While targeted access obligations may lower consumer prices, they also display a marginally significant negative correlation with overall 5G coverage, indicating a potential trade-off between affordability and investment incentives. Spectrum caps, although potentially useful for safeguarding competition when appropriately applied, do not appear to be

[88] Figures 10-12 and the indicative visual analysis rely on composite indicators of regulatory design and market outcomes, constructed using weighted underlying indicators. The weighting choices are described in Annex 4.2.5 and 4.3.10. While the weighting was designed carefully to reflect the most relevant factors, any aggregation of heterogeneous indicators involves methodological choices that may affect the presentation of outcomes. Accordingly, the figures and the associated visual analysis are included for illustrative purposes and are intended to be descriptive rather than conclusive and do not preclude the outcomes of the regression analysis done for each variable separately.

[89] Details and methodology of the analysis are set out in Annex 4.3 and in the Study on Digital Single Market.

systematically associated with differences in market outcomes. Coverage obligations also display little explanatory capacity for the observed variation in market outcomes, which, however, may reflect the difficulty of comparing such obligations across Member States given their diverse design, geographic context and implementation conditions.

The results suggest that certain auction and award conditions may provide insufficient incentives for investment in high quality mobile networks, as reflected in weaker outcomes in terms of coverage, consumer prices and quality of service, particularly where spectrum availability is restricted, or obligations reduce operational flexibility.[90] Our findings broadly align with recent empirical literature. Jung and Katz (2022) show that flexible and predictable spectrum policies, such as secondary markets and sharing frameworks, support higher investment, improved coverage and lower prices. Bahia and Castells (2022) link greater spectrum availability to higher coverage and faster download speeds. Zagdanski, Castells and Bahia (2025) find that higher spectrum prices correlate with weaker coverage and lower speeds. Sridhar and Prasad (2021) demonstrate that restricted spectrum supply and high reserve prices tend to elevate spectrum prices.

The above driver is supported by the analysis in the evaluation report as summarised in Table 9.

Table 8: Evaluation report findings on limited predictability, fragmentation, lack of Single Market

EVALUATION FINDINGS	ANNEX SECTIONS
Limited Predictability EECC's goal of ensuring 20-year predictability and enhancing investment certainty and business efficiency by supporting long-term planning has been only partially met Insufficient licence duration and insufficient guarantees for renewals Increased spectrum needs and need to participate to periodic spectrum re-auctioning under uncoordinated conditions.	See Annex 11, section 5.4.4. Conditions of assignment (duration, coverage, price)
Significant delays in the assignment of all three 5G pioneer bands - authorisation of 5G pioneer spectrum across the EU spanning over 10 years - about half of MSs has not met the overall deadline of 31 December 2020 - correlation exists between time of 5G spectrum assignment and 5G deployment and 5G population coverage	See Annex 11, section 5.4.2. Delays in 5G pioneer band assignment
Fragmented authorisation conditions across MS, however auction designs aligning spectrum awards with long-term infrastructure goals more effective in promoting rapid deployment. Market shaping measures leading to occasionally very high spectrum prices hampering operators' investment capacity. Reserve prices, leading to occasionally very high spectrum prices. Cost of spectrum: Average spectrum prices (€/MHz/pop) for 5G band (700 MHz, 3.3–3.8 GHz) in MS show a significant discrepancy in prices per MHz per population:	See Annex 11, section 5.4.7. Market shaping measures See Annex 11, section 5.6.3. Reserve prices for the 5G auctions See Annex 11, section 5.6.2. Spectrum costs

[90] The methodology and possible limitations for this multiple regression analysis are explained in Annex 4, section 3.

EVALUATION FINDINGS	ANNEX SECTIONS
For 700 MHz, from €0.08 (€/MHz/pop) (Croatia, Estonia) to over €0.69 (France). For mid-band (3.3–3.8 GHz), prices vary widely, from under €0.01 (Romania, Bulgaria) to €0.38 (€/MHz/pop) in Italy, highlighting differing national auction strategies and demand levels.	
Lack of Single Market approach Ineffective assignment harmonisation due to voluntary peer review with limited impact. Unused voluntary joint authorisation procedure, as prospective users have cannot request it. Insufficiently effective support and solidarity provided by the EU and Member States in case of interference caused by a third country. RSPG good offices mechanism has not been fully effective in tackling cross-border harmful interferences (does not apply for non-harmonised bands & missing legal basis for coordination issues linked to interferences with third countries). Spectrum sharing is voluntary and has seldom been used and there has only been a limited and fragmented secondary trading market.	See Annex 11, section *5.5.1. Coordination/harmonization of assignments - Peer review* Annex 11, section 5.6.3. on the Cost of Peer review See Annex 11, section 5.5.2 Spectrum coordination and addressing cross border harmful interferences See Annex 11, section 5.5.3. Spectrum sharing, transfer and leasing

2.2.2.2. Lack of financial attractiveness

Investment incentives for high-quality 5G are weakened by limited monetisation prospects and low demand for advanced mobile services. European mobile markets continue to generate considerably lower average revenue per user (ARPU) than major international peers, [91] possibly due to highly competitive, low-price European markets.[92] The Draghi Report similarly notes that revenues per subscriber are less than half of the levels observed in the US and Japan.[93] Moreover, revenue per MHz in Europe has declined sharply over the past decade, with GSMA data showing a 58% decrease between 2014 and 2024. The absence of tailored 5G offers based on network slicing further limits the revenue opportunities originally envisaged when operators bid for the 5G pioneer bands. At the same time, spectrum represents a substantial cost, accounting for around 7% of mobile service revenues and about 35–40% of capital expenditure, and operators' spectrum needs for delivering high-quality 5G are rising.[94] In addition, fragmented or insufficiently predictable spectrum conditions, including divergent licence durations and the need to participate frequently in re-auctioning processes[95] increase investment risk and constrain operator's ability to secure necessary financing. Financial investors echoed these concerns, highlighting the high and uncertain costs and demand risks associated with 5G

[91] Connect Europe, State of Digital Communications, 2025. EU mobile ARPU (14.8 EUR/month) is considerably lower than in the US (41.70 EUR/month). Even when adjusted for GDP per capita, the US ARPU remains 67% higher (24.9 EUR/month). ARPUs in Japan, South Korea and China are all at least 33% higher than in the EU. Moreover, EU ARPU has been declining at a faster rate than in other economies having fallen 5.9% in 2022-2023, compared to a fall of 3.5% in the USA and a rise of 2.2% in China. (see Figure 11 in Annex 11, section 5.4.5).

[92] In global comparison, Europe stands out as the region with the most affordable broadband services (See Annex 11.8).

[93] Mario Draghi, *The future of European competitiveness*, European Commission, Publications Office of the European Union, Luxembourg, September 2024. The report notes a similar relative position for European capex per capita.

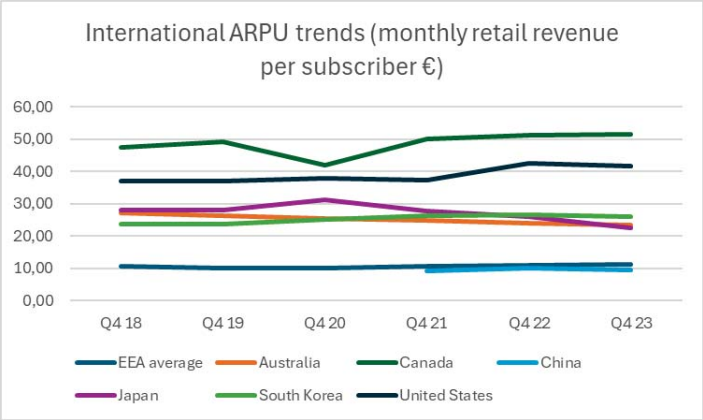
[94] GSMA, *Global Spectrum Pricing*, GSMA, May 2025, accessed 4 December 2025, https://www.gsma.com/connectivity-for-good/spectrum/wp-content/uploads/2025/05/Global-Spectrum-Pricing-v2.pdf.

[95] See section 2.2.2.3.

deployments.[96] This contrasts with more positive attitudes to FTTH, which has attracted significant investments from long-term infrastructure funds.

This combination of low expected returns, uncertain monetisation prospects and non-negligible investment risk weakens operators' incentives and capacity to invest in high-quality 5G.[97]

Figure 13 International ARPU trends



Source: BEREC International Roaming Benchmark Data for EU, Connect Europe for China, Japan, South Korea and the US, Canadian Radio-television and Telecommunications Commission (CRTC): Communications Market Reports, Current Trends - Mobile Wireless

The above driver is supported by the analysis in the **evaluation report** as summarised in Table 9.

Table 9: Evaluation report findings on financial attractiveness of 5G projects

EVALUATION REPORT FINDINGS:	**ANNEX SECTIONS:**
Low financial attractiveness of 5G projects: Limited and decreasing mobile profitability /ARPU. Relatively high spectrum prices if compared to declining/low mobile revenues. While spectrum needs have increased over the last decade, average revenue per MHz in Europe declined by 58% between 2014 and 2024. Spectrum costs account for some 7% of mobile service revenues across Europe with spectrum costs represent about 35-40% of their capital expenditures. Spectrum cost negatively impacts coverage, speeds and services provided to end users: 10-percentage point (p.p.) higher spectrum cost to recurring	See Annex 11, section 5.4.6. Mobile profitability and financial attractiveness Annex 11, section 5.6.2. Spectrum cost

[96] Study on Finance and USO.

[97] The Draghi Report warns that Europe's telecom sector's lower investment capacity compared with major peers may constrain the rollout of state-of-the-art connectivity required to digitise manufacturing, supply and distribution chains.

EVALUATION REPORT FINDINGS:	ANNEX SECTIONS:
revenue ratio decreased 4G and 5G coverage by up to 6 p. p. and average speeds by up to 8%.	

2.2.2.3. Low demand for high quality 5G connectivity and "chicken and egg" effect

Demand-side conditions, including relatively low 5G take-up and low consumer willingness to pay for high-quality 5G, reinforce these challenges. Only around 40% of mobile data connections in Europe were 5G-based in 2025,[98] and full take-up is not expected before 2035.[99] This is partly due to operators initially deploying 5G largely in NSA mode in lower spectrum bands and delaying the launch of high-quality 5G networks. As a result, **users often experience limited performance improvements** compared with 4G and are sceptical about the potential advantages of high-quality 5G. Concerns about pricing of high quality 5G connectivity and insufficient information on expected download and upload speeds further limit consumers' willingness to upgrade. Demand for high-quality 5G is also held back by extensive off-loading of bandwidth-intensive content on mobile devices to Wi-Fi,[100] limited involvement of SMEs as main beneficiaries in pilot projects for enhanced services,[101] and low adoption in the public sector.[102] BEREC likewise identifies low demand and delayed availability of 5G SA as an important factor contributing to the slow 5G take-up in Europe.[103]

As confirmed by the WIK Financial Study,[104] this creates a clear **"chicken-and-egg" dynamic**: On the one hand, operators hesitate to deploy high-quality 5G beyond mandatory (coverage) obligations where demand is uncertain and revenue prospects are limited. On the other hand, the absence of widespread high-quality 5G is a key factor behind the low take-up of bandwidth-intensive, quality-assured services, which would otherwise offer monetisation opportunities for operators.

2.2.2.4. Inefficient spectrum use due to insufficient sharing

A further driver of insufficient investment in high-quality mobile connectivity is the additional cost created by inefficient spectrum use. This inefficiency results from growing spectrum

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[98] See GSMA (2025): The Mobile Economy Europe 2025, https://www.gsma.com/solutions-and-impact/connectivity-for-good/mobile-economy/wp-content/uploads/2025/01/0125-Mobile-Economy-Europe-2025-web.pdf , page 11.

[99] Study on Finance and USO.

[100] https://wifinowglobal.com/news-and-blog/germany-wi-fi-carries-87-of-smartphone-traffic https://www.opensignal.com/2024/10/31/wi-fi-drives-smartphone-data-consumption-in-the-us-but-trends-vary-across-operators.

[101] This may explain scepticism about the potential advantages this technology, as they have not yet experienced them (cf. interviews conducted in the context of the WIK (2023) study for BEREC on wholesale mobile connectivity and Realising the Benefits of 5G (publishing.service.gov.uk); DD 2030 Cyprus Report_final.docx.pdf (dmrid.gov.cy)).

[102] This is also indicated from interviews with MNOs conducted for WIK financial study.

[103] BEREC input to the consultation on the White Paper BoR (24) 100_1 and to the Call for Evidence.

[104] WIK Financial Study.

demand and scarcity, suboptimal use of sharing and trading mechanisms and fragmented local access frameworks.

Growing demand for wireless services is making access to spectrum increasingly difficult. **Spectrum scarcity** reduces spectrum utilisation, limits opportunities for new entrants, and delays the roll-out of high-quality 5G and other innovative services. Where operators cannot obtain sufficient spectrum, they must densify their networks to maintain quality of service, increasing their investment needs.[105] At a time of increasing spectrum scarcity, spectrum use is also hindered by inflexible authorisation conditions that complicate and increase the cost of spectrum sharing, transfers and leasing.

Despite its recognised benefits and practicality, **spectrum sharing** in the EU remains limited.[106] Where applied, it is typically implemented in static rather than more flexible dynamic forms.[107] Often, unclear compliance requirements for coverage and quality-of-service obligations further discourage shared-use arrangements. Although the EECC promotes the **transfer and lease of spectrum usage rights**, inconsistent national implementation and the absence of centralised guidance have kept their uptake low. Feasibility and value of these mechanisms are often reduced by delays and additional costs arising from burdensome approval requirements and licence conditions, such as strict coverage obligations or short licence durations. While some Member States have introduced more flexible spectrum leasing models, others maintain rigid frameworks that hinder optimal reallocation. As a result, **secondary spectrum trading** remains rare, with only a few transactions in recent years.[108]

In addition, **nationwide licences** remain the norm in the EU. While appropriate for MNOs serving the mass market, this limits industrial verticals such as manufacturers, ports or airports from obtaining spectrum rights on a location basis, often necessary for 5G high-quality assured service or reliability requirements. Where **local access** exists, it remains fragmented: At least 13 Member States have made spectrum available for local use, but in different frequency bands, through different procedures (auctions or on a first-come, first-served basis) and under diverse conditions, including variation in prices and licence durations (ranging from 5 to 20 years).[109] With no united EU framework in place, divergent national rules create uncertainty, limit economies of scale for equipment and replication of vertical use solutions and ultimately discourage investment in high-quality industrial 5G use cases.

Given the limited uptake of sharing and trading mechanisms and constrained local spectrum access, spectrum remains underused. This underutilisation is further reinforced by weak enforcement of tools such as **"use-it-or-share-it-or-lose-it"** provisions, intended to enable regulators to revoke or reassign unused spectrum to prevent hoarding.[110] Their implementation

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[105] See Annex 7, section 2.2.1. on Inefficient use of spectrum.

[106] Cf. Radio Spectrum Policy Group Opinion and Report on the status and outlook of spectrum sharing (see documents RSPG21-022 and RSPG21-016); A prominent recent *international* example is the 2018 3-tier (military, licensed or unlicensed WBS) sharing arrangement for the 3 550 MHz to 3 700 MHz band within the frame of the so-called Citizens Broadband Radio Service (CBRS).

[107] As highlighted in the 2021 RSPG Report on Spectrum Sharing (RSPG21-022).

[108] Examples include flexible models in the Netherlands and Finland, and more restrictive approaches in Poland. Recently, trading transactions have been recorded, for example, in Slovakia, Belgium and Latvia. See Annex 11, section 5.5.3.

[109] See Annex 11, section 5.4.3. Spectrum for industry: verticals and private networks.

[110] See Annex 7, section 2.2.2. Insufficient flexibility for inter-service and intra-service sharing ("use-it-or-lose-it").

varies across Member States. While Germany includes clear rollout obligations in some licences, others (e.g. Poland, Slovakia, Hungary) apply the principle more cautiously. In several states the clauses exist in legislation, but enforcement is poorly documented, raising uncertainty about their effectiveness. Outside the EU, "use-it-or-lose-it" rules are applied more consistently, with active enforcement in the UK, Canada and Australia.[111]

Tailored local or shared-access regimes in other jurisdictions illustrate that more **flexible approaches** can unlock previously suppressed demand. Several **global peers** are taking advantage of **innovative technological tools** such as AI and real-time databases to improve spectrum utilisation. In the UK, Ofcom's shared-access licences across several bands (1.8 GHz, 2.3 GHz, 3.8–4.2 GHz, 26 GHz) offer low administrative burden and affordable fees, attracting nearly 900 licensees by July 2024 and encouraging further expansion. In the US, the Citizens Broadband Radio Service (CBRS) framework enables dynamic sharing in the 3.5 GHz band among licensed, unlicensed and government users (e.g. maritime military radar), supporting thousands of deployments by 2023 and unlocking significant economic benefits.[112] By lowering entry barriers, CBRS has opened previously underutilised spectrum to a wide range of applications, including private enterprise networks, industrial sites and rural broadband, with estimated annual consumer surplus of USD 8–26 billion[113].

The above driver is supported by the analysis in the evaluation report as summarised in Table 10.

Table 10: Evaluation report findings on inefficient use of spectrum

EVALUATION FINDINGS	ANNEX SECTIONS
Inefficient use of spectrum - Massive **increased needs of spectrum** to provide higher quality of mobile services and to satisfy needs beyond the electronic communications sector. - **Insufficient network sharing and fragmented secondary market** across the EU with limited uptake of spectrum trading/leasing, with restrictive national policies inhibiting optimal spectrum reallocation. Growing importance of interservice spectrum sharing, i.e. between different users providing different services.	Annex 7, section 2.2.1. Inefficient use of spectrum: difficulty to satisfy increased demand due to spectrum scarcity. Annex 11, section 5.4.3. Spectrum for industry: verticals and private networks, and section 5.5.3. Spectrum sharing, transfer and leasing and Use it or lose it principle. Annex 7, section 2.2.2. Insufficient flexibility for interservice and intra service sharing.

2.2.2.5. High cost of networks and unexploited economies of scale

Further factors limiting investment in high-quality mobile connectivity are the high cost of deploying advanced networks and the limited scope for economies of scale in the EU, where several MNOs in each Member State operate largely parallel infrastructures under fragmented regulatory conditions.

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[111] See Annex 11, section 5.5.3. Spectrum sharing, transfer and leasing ("use-it-or-lose-it").

[112] See Annex 7, section 2.2.2. Insufficient flexibility for inter-service and intra-service sharing (CBRS)

[113] Harold Furchtgott- Roth, "The Potential Market Value and Consumer Surplus Value of the Citizens Broadband Radio Service (CBRS) at 3550-3700 MHz in the United States" (2017).

High-quality 5G networks as well as future 6G networks are **significantly more costly to deploy than previous generations**. A major cost driver is network densification required to deliver high-quality service in terms of latency, data speeds and reliability.[114] The need for densification stems from the use of mid-band and high-band spectrum, which can carry large volumes of data but provide limited coverage because of their propagation characteristics.[115] To cover the same area, operators must deploy many more base stations and cells. In addition, many existing 4G base stations and backhaul links are insufficient for 5G performance, requiring operators to upgrade backhaul capacity, often through new fibre deployment or other high-capacity links. Standalone 5G also requires a new core network ("5GC"). These densification efforts, backhaul upgrades and the rollout of a virtualised 5G core with cloud-native functions substantially increase investment needs with the cost increase, depending on the deployment strategy.[116] Precise cost estimates for 6G deployment are not yet available. Nevertheless, many of the structural drivers[117] of higher 5G costs are likely to persist, suggesting that deployment costs will remain high. Moreover, operating multiple network generations simultaneously (2G/3G/4G before switch-off, alongside 5G SA and later 6G) entails parallel infrastructure and maintenance costs.

The high fixed costs associated with deploying advanced networks also increase the relevance of **economies of scales**. Traditionally, economies of scale have been assumed less pronounced in mobile than in fixed markets, where infrastructure duplication is typically uneconomical. Spectrum policy for mobile networks was therefore designed on the expectation that several parallel mobile networks could be viably sustained. Currently, three to four MNOs are present in most Member States.[118] With the cost-intensive transition to high-quality 5G, however, recovering fixed investments over each operator's customer base has become more challenging, weakening the business case for full 5G roll-out, particularly in less densely populated and lower-revenue areas.[119] Several studies confirm that limited economies of scale arising from the high fixed costs of 5G deployment can constrain the number of economically viable parallel networks.[120] A WIK study on 5G network development in Denmark highlights the economic challenges of replicating full 5G infrastructures across multiple operators.[121] An EU study suggests that regulatory attempts to achieve four-player mobile markets through, inter alia,

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[114] Such performance enables advanced 5G and future 6G features, such as ultra-reliable low-latency communications.

[115] For further details see Annex 10 for Radio spectrum essentials and properties of 5G pioneer spectrum bands.

[116] Studies indicate that full 5G deployment can cost 50–70 % more than 4G see GSMA: 5G-era Mobile Network Cost Evolution (2019). WIK-Consult 2023 study on investment and funding needs for the Digital Decade indicates that investment requirements for full 5G in midband spectrum are three times higher than that for basic 5G.

[117] These include densification requirements, higher-capacity backhaul, increased core and edge complexity linked to virtualised and cloud-native architectures, and the need for new spectrum bands to meet higher performance requirements.

[118] For a distribution of mobile markets with three and four MNOs in the EU, see Annex 7, section 2.2.3.

[119] See WIK financial study findings.

[120] "Investment and funding needs for the Digital Decade connectivity targets" https://digital-strategy.ec.europa.eu/en/library/investment-and-funding-needs-digital-decade-connectivity-targets and the economic challenges of replicating full 5G mobile networks are also referenced in a study by WIK on the implications of 5G for network development in Denmark https://digst.dk/media/anppemw3/final_mobile_report_denmark_clean_non-confidential.pdf.

[121] https://digst.dk/media/anppemw3/final_mobile_report_denmark_clean_non-confidential.pdf.

spectrum reservations or caps may have weakened investment incentives by assuming levels of duplication that are not sustainable under the cost structure of full 5G.[122]

A comparison with the U.S. illustrates how **centralised spectrum governance facilitates economies of scale**, while **regulatory fragmentation limits the scope for similar efficiencies in the EU**. In the USA, three nationwide mobile service providers – AT&T, T-Mobile and Verizon – collectively account for around 371 million connections and hold approximately 82% of spectrum available to mobile communication.[123] Together with smaller operators, they benefit from a highly centralised spectrum governance system: A single federal licensing regime, uniform coverage conditions and centralised interference management reduce transaction costs and allow consolidation of compliance, engineering and legal tasks, thereby supporting nationwide planning and investment.[124] In the EU, similar economies of scale cannot be fully replicated. Even if new spectrum were assigned at EU level or under fully harmonised authorisation conditions, other regulatory frameworks such as data protection security, privacy, lawful interception, data retention and end-user protection would remain nationally fragmented. These divergent requirements result in higher compliance costs and the need to address national specificities, limiting operators' ability to achieve comparable efficiencies.[125]

2.2.3. Fragmented authorisation conditions, not allowing to operate across the EU

2.2.3.1. Fragmented general authorisation conditions

The key drivers of problems with the **general authorisation (GA)** regime in the EU electronic communications sector arise from the Directive's regulatory flexibility, which has led to fragmentation and inconsistent application of the GA conditions. The EECC harmonised the list of possible GA conditions, but it remained maximum and national discretion was kept on attaching the conditions. Consequently, Member States did not take a uniform approach to GA regime and introduced divergent secondary legislation and/or administrative (regulatory) decisions to further specify the conditions. This situation results in potentially up to 1 053 conditions specified at national levels, a cross-border operator (present or with a regulatory footprint in 27 Member States) could be required to comply with. This complexity makes compliance burdensome and fragmentation costs linked to GA, for staff necessary for compliance with the divergent conditions for such an operator could range between EUR 0.50–1.20 million per year, or even up to EUR 6–11 million per year/operator if the totality of compliance costs (the need to align with all the national conditions) is taken into account.[126]

Additionally, diverging security, data-related and privacy requirements further complicate operations for cross-border providers, particularly due to differences in rules on data retention, lawful interception, and network localisation. For instance, according to the EECC[127] NI-ICS are exempted from the condition for enabling lawful interception and hence, some Member

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[122] See WIK financial study, section 4.1.3. on economies of scale.

[123] 2024 COMMUNICATIONS MARKETPLACE REPORT, FCC, December 30, 2024.

[124] See Annex 10.

[125] For an analysis of elements related to an EU-level authorisation for terrestrial spectrum see section 6.2.3, as well as sections 2.1.3, 7.2 and 8.1.2. General authorisation aspects are discussed in section 1.4. of Annex 11 (Evaluation report).

[126] See section 2.1.3 of the IA and Annex 3, section 2.3. and Annex 4, section 1.6 to this report with more detailed information on that estimation.

[127] Part A, Nr 4 Annex I of the EECC.

States took a different approach towards such services providers[128]. Next, procedural inconsistencies, such as the non-mandatory use of BEREC's notification template or no notification requirement at all[129] and the lack of standardised reporting formats, lead to varied administrative obligations across Member States. For a detailed analysis and evidence see evaluation report, Annex 11.

The lack of Single Market is becoming more evident especially with the ongoing technological and market transformation taking place in the electronic communications sector. Content and Application Providers (CAPs) and cloud providers are increasingly entering the electronic communication networks market with investments into content delivery networks, submarine cables, backbone networks, and edge/cloud platforms; however, they benefit from a 'Country of origin' regime for their operations, while traditional telecom players currently need to comply with 27 sets of rules, as further detailed in section 2.2.4. and are hence disincentivised from providing cross-border services. This leads to limited deployment of advanced and resilient connectivity and opportunity cost of foregone innovation (for examples of innovative services see section 2.1.3). Similarly, lack of cooperation between actors in this extended connectivity ecosystem limits the delivery of such innovative services. Moreover, the provision of such services (e.g. network slicing to provide "specialized services" under the OIR) may require further regulatory predictability.

Table 11: Causal link between root causes/problem drivers and problems

Problem driver/root causes	Causal link with the general authorisation problem
Divergent national implementation of GA rules	Produces inconsistent conditions and fragmented authorisation practices across the EU.
Limited coordination and inconsistent procedures	Leads to varying notification and reporting obligations, reducing predictability for operators.
Insufficient EU-level oversight and alignment mechanisms	Allows divergence to persist over time, maintaining complexity and compliance burdens.
Asymmetry with CAPs/cloud providers and weak cooperation within the connectivity ecosystem	Creates unequal treatment, hampers coherent development of cross-border/innovative services, and discourages telecom operators from scaling across the Single Market.
Lack of mechanisms for gradual alignment of national rules,	Prevents convergence over time and maintains high compliance burdens for multi-country operators

2.2.3.2. Fragmented satellite authorisation conditions

Table 12: Causal link between root causes/problem drivers and problems

Problem driver/root causes	Causal link with the satellite authorisation problem
Diverse satellite selection and spectrum authorisation and procedures inadequate to address D2D challenges	Delays in the provision of pan-European satellite services, lack of EU satellite spectrum selection procedures representing a potential barrier to EU provision of certain services

[128] Reference in section 4.3.3 and 4.3.4 of the Final 1st Interim Report on Completing the Single Market.
[129] In France.

	undermining EU global competitiveness in satellite connectivity
Unexploited economies of scale due to fragmented satellite spectrum authorisation conditions	Cost of dealing with fragmented satellite spectrum authorisation processes and conditions in 27 MS, and risk of having authorisation gaps in some MS, represent an operational barrier to scale up and ensure pan-European provision of services constraining the EU's ability to act on a global stage.
Increased number of the new LEO constellations and related expected increase of EU satellite spectrum authorisation requests	Increase of cost for authorities to process satellite authorisation requests and for enforcement and increased cost for operators to comply with authorisation conditions Increased risk of harmful interferences due to increasing connectivity provided via LEO satellite networks
Inefficient enforcement of ITU rules against harmful interference and lack of level playing field	Slow and inefficient bilateral tools prevent the EU from fully leveraging the strengths of its internal market to solve harmful interference issues and to ensure a level playing field for all operators in the provision of satellite services

In the present context of rapid development of satellite services, including innovative D2D services, the existing framework based exclusively on national authorisation of **satellite services** and spectrum resources prevents the development of a single market for satellite services**.** To date, the only exception has been the selection at EU level of licensees for the 2 GHz band spectrum, which aimed to facilitate the provision of pan-European Mobile Satellite Services (MSS)[130]; but, even in that case, spectrum authorisation remained at national level, leading to different licensing approaches[131] and not fully harmonised authorisation conditions, with different fees or conditions attached to the licences.

There is wide evidence on the fragmentation of the satellite authorisation systems in 27 Member States, confirmed by the 2025 Mobile Satellite Services (MSS) study[132], previous MSS studies[133] and an RSPG opinion[134]. Firstly, the precedent of the **several years long authorisation process for MSS operators** selected at EU level provides concrete evidence of how fragmentation of rules hinders the supply of satellite services with high cost for the

[130] MSS support various types of pan-European services, such as broadband, public protection and disaster relief (PPDR) services, broadcasting and multicasting, covering in particular hard to reach areas.

[131] For example, 24 Member States issued individual licences for the Complementary Ground Components (CGC), whereas 2 Member States followed a general authorisation approach. With regards to the MSS spectrum, 20 Member States issued individual licences, 2 Member States authorised them under general authorisation, one Member State took a hybrid approach, and another one issued a "block licence".

[132] Mobile satellite services (MSS) in the 2 GHz band in the EU - Implementation of the current regulatory framework and an overview of the satellite connectivity market, July 2025, Detecon International GmbH, available at https://op.europa.eu/en/publication-detail/-/publication/4c769094-41b5-11f0-b9f2-01aa75ed71a1/language-en.

[133] Gerus, V., Manero, C., Pujol, F.et al., Mobile Satellite Services (MSS) authorisation regimes, authorisations and enforcement in the EU Member States – Final report, Publications Office, 2019, https://data.europa.eu/doi/10.2759/974409.

[134] RSPG24-007 Opinion on assessment of different possible scenarios for the use of the frequency bands 1980-2010 MHz and 2170-2200 MHz by the Mobile Satellite Services beyond 2027.

operators[135]. The MSS study concludes that although the MSS Decision harmonises certain authorisation conditions, the implementation in practice has been rather uneven and resulted in authorisation delays. Several national conditions attached to the various licences and authorisations were not justified by national laws and, this undermined the objective of the previous regulatory harmonisation of spectrum. The divergences in procedure, conditions and fees were so significant that operators could not reasonably estimate the timeline and regulatory cost for their business plans and secure financing, thus, delaying the provision of satellite services[136]. Further, the experience of fragmented regulation in this band confirms that delays in the authorisation significantly impact revenue timing. For satellite communication service providers, the most substantial cost burden arises from postponed commercial launches, potentially resulting in tens of millions of euros in lost revenues (see details in section 6.3.2).

Secondly, a more recent study confirms that although many Member States are authorising satellites under general authorisation, the conditions attached to the general authorisation differ significantly and, are not always suited to satellite services[137]. Moreover, the procedures for obtaining individual authorisations for the ground segment are lengthy and the requirements in some Member States complex, and difficult to satisfy for new-comers, SMEs[138].

Thirdly, apart from the 2 GHz band, for which selection is done at EU level, there is currently no process or guarantee for providers to obtain spectrum at pan-European level and a high risk of having coverage gaps.

Finally, enforcement of authorisation conditions and ITU rules is uncoordinated at EU level and depends on the good will of national administrations to implement them through a slow and complex bilateral process, with RSPG having no mandate to address interference from third countries.

In sum, the fragmentation of national regulatory competences for satellite authorisations delays the deployment of innovative satellite services and undermines EU's competitiveness in a rapidly evolving global satellite market. This delay would be driven by: (i) lack of, or unequal access to spectrum throughout the EU, (ii) inconsistent conditions and interpretation of compliance and reporting obligations (in terms of format, frequency and requirements) increasing administrative costs; and (iii) operational challenges caused by the inability to enforce compliance when harmful interference from other constellations occurs, a probability which is likely to increase in the next years.

2.2.4. Insufficient cooperation and fragmented regulatory approaches

As regards governance, the main driver is the insufficient cooperation between different authorities and fragmented regulatory approaches.

This main driver is composed of smaller root causes; one example is national influence on BEREC and RSPG that may result in some cases in limiting EU single market perspective. BEREC consists of NRAs, and positions are shaped mainly by national perspectives rather than

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[135] Both existing operators had difficulties implementing their systems on a timely basis. While these operators were selected in 2009 (EC Decision 2009/49), they were subject to an enforcement process in 2013, delaying the provision of actual services for many years.

[136] See Annex 7, section 1.3. Table on MSS fee structure, per Member State.

[137] SM enablers study.

[138] SM enablers study.

by a common EU-wide vision. Moreover, a lack of a more structured coordination mechanism between BEREC and RSPG led to a very limited cooperation between the two bodies where spectrum issues have regulatory implication. Another example is the expanding regulatory scope of NRAs' creating inconsistencies among the NRAs and between the tasks of NRAs and BEREC. While some NRAs take on responsibilities beyond electronic communications under frameworks such as the DSA, Data Act, or NIS2, in other Member States these tasks are entrusted to other CAs. The expanding responsibilities and non-uniform allocation of tasks at national level also affecting EU-level coordination create diverging approaches to the implementation of the regulatory framework and oversight at national level, resulting in lack of holistic overview of authorities over all aspects of the electronic communications market, including e.g. network resilience. It also perpetuates differences in standard procedures, compliance obligations and administrative processes going beyond those justified by differences in the functioning of national markets, as observed also by Letta in his report. Furthermore, resource constraints and structural weaknesses also contribute to driving the problem as many NRAs and other competent authorities face challenges in terms of funding and staffing. It affects their ability to carry out both existing and newly assigned functions, while also remaining active in BEREC or RSPG and contributing to their work.

Finally, the growing need for specialised expertise adds pressure to an already stretched governance framework. As responsibilities expand into new areas linked to digital markets and emerging technologies, the demand for skilled human resources increases. Without sufficient expertise, the risk is that responses remain incomplete or inconsistent, reinforcing fragmentation. This hampers both the functioning of the Single Market and the creation of a level playing field in the broader connectivity ecosystem, as not all Member States or operators are equally equipped to deal with evolving regulatory and technological challenges (further details in section 2.4 of Annex 7).

Table 13: Causal link between root causes/problem drivers and problems

Problem driver/root causes	Causal link with governance related problem
National influence on BEREC and RSPG	Limits development of a coherent EU Single Market perspective.
Weak coordination between BEREC and RSPG	Leads to fragmented approaches to spectrum-related regulatory issues.
Diverging NRA mandates and expanding responsibilities	Create inconsistencies in regulatory tasks and weakens coherent EU-wide governance.
Diverging approaches to implementation and oversight by competent authorities at national level.	Results in lack of full overview at national and EU level. Perpetuate differences in standard procedures, compliance obligations and administrative processes not justified by differences in the functioning of national markets.
Uneven allocation of new digital regulatory responsibilities	Produces asymmetric governance structures and cross-border supervision gaps.
Resource and capacity constraints within NRAs and other competent authorities	Hinder effective fulfilment of tasks and consistent participation in EU-level governance.
Growing need for specialised expertise	Leads to uneven regulatory responses and reinforces fragmentation across the Single Market.

2.3. How likely are the problems to persist?

2.3.1. Fixed networks: Slow deployment and adoption of fibre networks and services

The likelihood of slow deployment and adoption of fibre networks and services is high. If no proactive steps are taken, FTTP coverage in the EU is expected to reach 90% in 2030[139]. However, full FTTP coverage at EU level, according to the predictions based on 'business as usual' scenario, show that the 100% coverage will be only achieved by 2051 if no further action is taken[140] while the Digital Decade Policy programme calls for 'Gigabit connectivity for all by 2030[141]. Especially Member States with a high share of copper networks are unlikely to achieve full fibre coverage by 2030 or even by 2035.

If copper networks remain widespread[142], the EU risks insufficient investments in fibre deployment, which will perpetuate significant differences in connectivity between Member States, hindering the creation of a single market and the cohesion of our society. Ultimately, the EU's connectivity infrastructure will be ill-prepared to support the development of an AI-driven continent and will lack the necessary resilience to ensure reliable and secure digital services.

Though there is no lack of available capital to deploy FTTH to reach nearly all EU households and businesses, the problem is that it is not financially viable to deploy FTTH to the last 10% unless there is only one FTTH network in the rural areas. The existence of copper and FTTC networks in parallel splits the userbase and thus the available revenues, which makes FTTH non-viable in those areas, when, otherwise, it would be viable, with a mixture of available state aid and private financial resources. The high profits that can be made on this largely fully depreciated legacy infrastructure also limit incentives for the owners of that infrastructure to upgrade it to FTTH themselves. Indeed, as experience shows, in countries/areas where the incumbents do not face competition from a rival, they are reluctant to upgrade their legacy networks to FTTH. A definite plan for copper switch-off when there is a given coverage of FTTH in a certain area would make it viable for an alternative fibre investor to deploy FTTH and would in consequence also create incentives for the copper owner to upgrade its infrastructure to FTTH. Thus, the transition to fibre is inextricably linked with copper switch-off, the selected policy of which would lead to an increased FTTH coverage FTTH take-up. By this, it would be aligned with the digital decade target of gigabit connectivity for all citizens.

As has been shown in literature[143], full coverage of FTTH would require EUR 40 billion of subsidy and EUR 29 billion in the case where 5G FWA is also used, while EUR 19 billion had already been allocated to broadband deployment via EU funding alone. It is obvious that when the significant additional EU funds allocated after that date are taken into account, along with

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[139] Study on access policy including review of the relevant markets recommendation, and review of access provisions of the EECC.

[140] Annex 1 - State of EU digital transformation in 2025: progress and horizontal recommendations, 16.6.2025, SWD(2025) 290 final, p. 5. SWD Digital Decade in 2025: progress and outlook, 16.6.2025, SWD(2025) 290 final, p.16.

[141] Study on access policy including review of the relevant markets recommendation, and review of access provisions of the EECC.

[142] The share of copper is estimated to decrease to around 19% by 2030 and around 11% by 2035. See Study on access policy including review of the relevant markets recommendation, and review of access provisions of the EECC. Source: WIK based on FTTH Council (2025) and WIK market potential model.

[143] WIK's 2023 study for the EC on investments to meet the Digital Decade targets.

the national State Aid funding (which is substantial in countries such as Italy and Germany) – the funding gap seems to be minimal. Therefore, the size of the problem (i.e. the remaining gap) is not related to investment / availability of capital, but rather to the near universal persistence of parallel legacy infrastructure in rural areas.

According to WIK's forecast, under current conditions only 60% of households with access to fibre (FTTH) will subscribe to a fibre-based service by 2030 (FTTH take-up)[144]. This means that even if an FTTH network is available, 40% of households will continue to use copper networks or less future-proof technologies for different reasons mentioned above (high prices, inertia etc). Further, the share of households with fibre subscription among those with broadband connection (FTTH penetration) is expected to reach only 48% in 2030 and 59% in 2035. In countries where copper network is still widely used today, the take-up of Gigabit speeds will be below 20% in 2035[145]. By 2035, under the status quo, around 11% of broadband subscribers (roughly 50 million people) in the EU will still rely on copper-based internet connection[146]. In some Member States, the share is expected to be significantly higher, which would likely negatively impact national and regional discrepancies in terms of economic and social development. In absence of any action, more than two thirds of households will have connections with speed below 1 Gbit/s by 2035.[147.]

It is expected that 30% of customers will have access to Gigabit connection by 2035, while 40% of customers will demand Gigabit speeds in 2035.[148] In 2035 there will be a gap between demand and take-up of Gigabit services of 10 percentage points.

The following figure provides an overview of the expected bandwidth demand in 2035[149].

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[144] Study on access policy including review of the relevant markets recommendation, and review of access provisions of the EECC.

[145] Study on access policy including review of the relevant markets recommendation, and review of access provisions of the EECC.

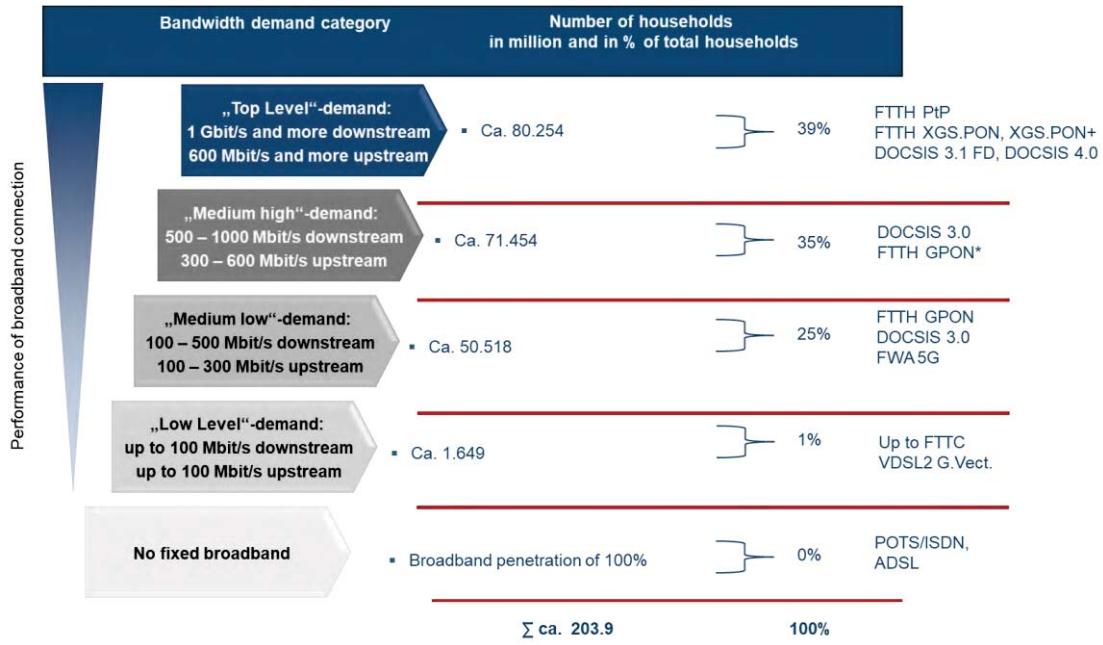
[146] Study on access policy including review of the relevant markets recommendation, and review of access provisions of the EECC.

[147] Some of the end-users with below 1 Gbit/s speed connections will have higher speeds available but will not choose to subscribe due to higher prices. Others will have no above 1 Gbit/s speed connection available to them. Study on access policy including review of the relevant markets recommendation, and review of access provisions of the EECC.

[148] WIK study.

[149] The estimates were derived by updating WIK's peer-reviewed market potential model, and are based on projections regarding the propensity of consumers to use given applications, bandwidth requirements of those applications, household composition and simultaneous device use by individuals and objects within households.

Figure 14: Bandwidth demand of EU27 in 2035 in the absence of constraints



Source: Study on Access Regulation.

In the near future, higher bandwidth is needed for households and businesses to support moving to online Government and commercial applications as well as entertainment. It is expected that nearly 40% of households will need downstream bandwidths of at least 1 Gbit/s and upstream bandwidths of 600 Mbit/s or more by 2035.[150] The connectivity needs for small businesses are likely to be even greater and will require more symmetric bandwidth (equal upstream and downstream speeds) to accommodate the use of advanced technologies such as cloud computing, big data and artificial intelligence as envisaged in the DDPP.[151]

Copper networks are unable to satisfy the future requirements for fixed internet access, regarding upload and download speeds, latency and reliability. In that regard, the average download speeds in countries with high share of VDSL is around 150 Mbit/s (30% lower than in countries with high share of fibre or coax).[152]

Overall, the presence and use of copper networks will continue to disincentivise and delay the deployment and adoption of fibre networks and services.

2.3.2. Mobile networks: lack of investment in high quality mobile connectivity

Without policy intervention, the underlying drivers of insufficient investment in high-quality mobile connectivity are bound to persist. Additionally, demand for spectrum is likely to

[150] Study on access policy including review of the relevant markets recommendation, and review of access provisions of the EECC.
[151] SME take-up of Gigabit broadband expected to increase by 3.6 times from 2024 to 2035. See Study on access policy including review of the relevant markets recommendation, and review of access provisions of the EECC.
[152] Study on access policy including review of the relevant markets recommendation, and review of access provisions of the EECC.

increase, as data consumption is projected to rise.[153] **With growing spectrum needs**, the cost of acquiring spectrum is expected to place increasing pressure on operators' balance sheets, particularly in view of their declining revenues.[154] Spectrum costs may represent a larger share of operator revenues than today. Even if unit prices were to fall over time, the need to acquire larger volumes of spectrum means that **the overall spectrum cost burden is likely to increase**, especially in Member States whose auction conditions prioritise revenue generation over investment.[155] This would reduce the attractiveness of mobile operators and mobile deployment projects for financial markets and further weaken operators' capacity to fund high-quality 5G and future 6G deployment.[156]

Growing spectrum scarcity will also increase the importance of efficient sharing arrangements in the 6G era. However, without a coherent EU-level framework, spectrum sharing and its advantages are likely to remain dependent on uncoordinated national decisions, limiting its potential to ease scarcity or support innovation.[157] In addition, market-shaping measures that create **artificial scarcity**, such as disproportionate set-asides or reservations, could continue to push up spectrum prices and reduce investment headroom. Due to its voluntary nature, the current peer-review process is unlikely to detect and address such investment-constraining auction designs, failing to deliver robust spectrum assignment that is predictable, well-justified, and consistently applied.[158] Furthermore, while legal deadlines for the release of harmonised bands will continue to apply, **predictability** regarding the timing of 6G spectrum availability would remain **insufficient**.

Under these conditions, 5G and later 6G deployment would progress but not at a pace sufficient for the EU to close the **gap with global peers** such as the USA, China and South Korea.[159] Limited predictability, insufficiently investment-oriented award conditions and high spectrum costs would continue to constrain operators' investment capacity, resulting in persistent gaps in **coverage, service quality** and the availability of advanced, quality-assured services for verticals and SMEs.[160] Without adequate spectrum access and sufficient investment, reduced speeds and higher congestion are likely, **restricting consumers'** ability to **use** bandwidth-intensive or latency-sensitive applications, such as video streaming and emerging AR-based services, particularly when not off-loaded to Wi-Fi.

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[153] The *Ericsson Mobility Report* (November 2024, p. 10) forecasts that European mobile data consumption will increase substantially between 2025 and 2035 across all traffic types (downloads, messaging, app usage, audio and video streaming), with heavy users expected to exceed 110 GB per month. Mobile data usage per active smartphone in Western Europe is projected to rise from 23 GB to 49 GB per month, placing Europe above global average. Some studies, however, argue that data consumption is approaching a plateau of 15–20 GB per user per month (William Webb, *The End of the Telecoms History*, 2025). Others rebut this claim and provide evidence of significantly higher consumption levels already observed in several countries (Stefan Zehle, Coleago Consulting, *The End of Telecoms History? Not Really*).

[154] See evaluation Annex 11, section on cost of spectrum and on mobile market ARPU profitability.

[155] GSMA, "Global Spectrum Pricing report," Global Spectrum Pricing, GSMA, London, 2025 (2025), p. 14.

[156] See section 2.2.2.2. ad 2.1.2 and Annex 9.

[157] In this regard, the RSPG Report on spectrum sharing (RSPG21-016) refers only to a limited number of shared-use cases in EU Member States, in particular between different technologies (and services).

[158] See section 2.2.2 and evaluation findings Annex 11, section 5.5.1. & 5.6.2.

[159] See EC study Single Market enablers.

[160] Based on GSMA econometric estimates historically a 10 p.p. higher spectrum cost to recurring revenue ratio decreased coverage by up to 6 p.p. and decreased average speeds by up to 8%, *Ibid*, p. 10.

2.3.3. Lack of pan-European networks and services

2.3.3.1.Barriers and limited development of innovative services

Without greater harmonisation of general authorisation conditions, procedures, and security-related rules, wherever possible and justified, the European electronic communications market will remain fragmented. This lack of regulatory consistency will hinder market integration, increase compliance costs, and create uncertainty for service providers, ultimately slowing down innovation and investment in the sector. Similarly, without encouraging cooperation between actors in this extended connectivity ecosystem and, when needed, providing more guidance to ensure regulatory predictability across the EU, delivery of such innovative services could be hampered. The persistence of the problem also impacts negatively the EU's economic security.

2.3.3.2.Barriers to pan-European sovereign satellite services

The EU's strategic initiatives in the space domain — including the EU Vision for a Space Economy, the financial support for the IRIS² constellation, and the forthcoming Space Act — are designed to stimulate investment and enhance Europe's competitiveness and strategic autonomy in space. While these initiatives address investment-related challenges as well as safety, resilience and environmental aspects of space activities[161], they do not tackle the underlying fragmentation of spectrum regulation and authorisation frameworks, the absence of a harmonised mechanism for accessing satellite spectrum for the provision of satellite communication services in the EU.

Without a regulatory intervention at Union level, this fragmentation is likely to persist, reducing the overall effectiveness of these initiatives and limiting progress towards the EU's broader policy objectives in the space sector. Satellite operators will continue to be obliged to request authorisation for the use of spectrum individually at every Member State without any guarantee of getting it everywhere, potentially facing 27 different conditions, duration, fees, conditions which act as barriers to economies of scale as described in section 2.1 and 2.2.

Further, the evolving geopolitical context as well as the growing demand for satellite systems will increasingly lack[162] a coordinated authorisation framework to strategically and effectively provide satellite services that protect EU's interests by prioritising security, resilience, technological leadership, and digital sovereignty.

Inefficiencies caused by regulatory barriers are expected to worsen in a context of integrated satellite and mobile communication services enabled by 6G technologies. Traditional

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[161] The Space Act establishes the conditions that Union space operators must meet to obtain authorisation for conducting space activities, particularly regarding safety, resilience, and environmental sustainability. These rules cover the authorisation, registration and supervision of space activities in the Union, orbit traffic management, governance and enforcement aspects and capacity-building measures, including the establishment of a Union space label.

[162] In the in June 2025targeted consultation on the use of the 2 GHz spectrum band — considered the sweet spot for the provision of innovative mobile satellite services (MSS) — respondents highlighted two main future needs. First, stakeholders emphasised the importance of addressing issues related to security, strategic autonomy in the digital supply chain, and the preservation of EU sovereignty. Second, several respondents noted the current lack of EU-wide spectrum resources dedicated to modern European satellite systems capable of providing secure and reliable communications for public safety and public security services across all Member States.

boundaries between terrestrial and satellite networks are becoming blurred, requiring a coordinated and forward-looking regulatory framework to prevent market fragmentation and spectrum interference, particularly in frequency bands that will be jointly used by both terrestrial-mobile and satellite operators[163] (see Annex 7, section 1.3). Without further action, the EU risks missing the opportunity for the timely development of autonomous, resilient and sovereign D2D mobile and IoT connectivity[164]. No Member State on its own has sufficient strength and dissuasive enforcement mechanisms to enforce the ITU obligations related to the avoidance of harmful interference, especially on large operators, and the strength of the single market remains unexploited[165]. Member States on their own are not unequipped to efficiently enforce ITU rules but also, they are not able to ensure an equitable use of spectrum and orbits by all space actors in the world, be they commercial, scientific or governmental[166].

Forum shopping and fragmentation could become a serious liability in terms of national security capabilities, including lawful interception. It is therefore essential to ensure that international law is respected effectively and Union interests not only for communications but also for other satellite applications are protected.

2.3.3.3. Governance structure not fully suited to serve the requirements of the single market

There are currently many issues which contribute to regulatory fragmentation and stand in the way of coherent and effective EU-wide governance framework for electronic communications, as mentioned in the problem drivers' section (2.2.4).

In the current setup, BEREC will in the coming years face significant and persistent challenges in functioning as a unifying regulatory body, which may weaken its ability to drive harmonisation across the European digital and electronic communications markets, while the BEREC Office will continue to struggle with limited resources and tasks, failing to fully leverage its potential.

Regarding the RSPG, identified problems in relation to the peer review and Good Offices will also persist. Even with the current amount of workload, the RSPG effectiveness is reaching its limits; this would affect its ability to take new tasks needed for further alignment of spectrum management in the EU, inter alia those linked to the satellite spectrum management. The issue will become more acute if the RSPG secretariat is not enhanced to provide it with administrative and preparatory support.

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[163] Annex 7, section 1.3. Barriers to the development of resilient satellite connectivity.

[164] See section 2.1.3. for its socio economic potential and Figure 2 Broadband satellite constellations.

[165] Interference from large LEO constellations has been evidenced to affect radioastronomy, both in ground-based and space-based observations: cf. Unintended electromagnetic radiation from Starlink satellites detected with LOFAR between 110 and 188 MHz | Astronomy & Astrophysics (A&A) and Draft_IAU_CPS_position_statement_9Z8xEO1.pdf. In addition, the CEPT/ECC has investigated the effect of harmful interference from the Iridium 2nd generation LEO satellite system on radioastronomy in the ECC Report 349.

[166] A few non-EU large satellite constellations with evolving (still partly pending) ITU filings might soon secure a dominant part of the available satellite spectrum and orbits due to the ITU's first-come-first. In this regard, the FCC has been examining or approving authorisations of Starlink's mobile satellite service across a wide range of both terrestrial spectrum below 3 GHz (within its "Supplementary Coverage from Space" ruling), and internationally harmonised satellite spectrum (at ITU level) in the so-called Ku, Ka, V, E, and W bands. Furthermore, at this stage, Amazon's Kuiper plans to use spectrum in the Ka and Q/V bands.

3. WHY SHOULD THE EU ACT?

3.1. Subsidiarity: Necessity of EU action

Services remain less and less national and increasingly have a significance that transcends Europe as a whole. As availability and take-up of connectivity provides a key input to European industry and is vital to enable societal participation in the digital economy as well as to drive European competitiveness, there is a strong case for the EU to establish ambitions regarding connectivity EU wide, as well as providing tools that will support the achievement of this goal.

In addition, communications networks are essential in supporting cross-border trade in digital services. Moreover, some of the problems involve cross-border services specifically. These include the provision of services to multi-national businesses. A common framework for competition should also enable cross-border entry. It is notable in this regard that a number of telecom providers and infrastructure companies operate in multiple countries.

The EU connectivity sector is still fragmented along national borders, so that end-users and EU operators cannot reap the full potential of the single market. The EECC as a Directive has shown limits regarding time-to-market (with a transposition delay up to 4 years) and level of harmonisation (primary focus on national markets). The achievement of the single market has been also hampered by practices of some Member States going beyond EU rules, deepening market fragmentation and increasing overall regulatory burden.

3.2. Legal basis

The legal basis for the review of the regulatory framework remains Article 114 of the Treaty on the Functioning of the European Union (TFEU)[167]. This Article confers on the EU legislature discretion, depending on the general context and the specific circumstances of the matter to be harmonised, as regards the harmonisation technique most appropriate for achieving the desired result, in particular in fields which are characterised by complex technical features.

Despite improvements since the regulation of electronic communications started the establishment of a single telecoms market in the Union, electronic communications markets remain national (see merger control decisions in which the Commission found that markets are national on the basis of, amongst others, the current regulatory environment)[168], with different supply and demand conditions, different spectrum licences awarded on a national basis, and different (albeit partially harmonised) regulatory regimes. Telecom operators must adapt their strategies to national constraints and differences even when they form part of larger multinational groups. This fragmentation of the EU market alongside national borders prevents the EU from reaping the full potential of an EU-wide telecoms market. While there are many operators in the EU, the level of concentration is high. Electronic communication network operators are not able to realise scale effects because differences in national rules keep telecom markets mainly national.

Therefore, in view of the objective of improving the conditions for the establishment and functioning of the internal market, Article 114 of the TFEU remains the appropriate legal basis also for this initiative.

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[167] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A12016ME%2FTXT.

[168] See for instance M.10896 - Orange/MasMovil/JV and M.8792 - T-Mobile NL/Tele2 NL.

3.3. Subsidiarity: Added value of EU action

The initiative will have significant added value compared to action taken at Member States level. Strengthening European competitiveness requires access to fast, secure, and resilient digital infrastructure. In a context where the digital connectivity landscape is changing rapidly with convergence of telecom, satellite, cloud and edge technology, driven by virtualisation and AI, the EU will only be able to achieve those objectives through a more harmonised legal environment across the EU that avoids inconsistent national administrative practices or implementation conditions that limit the opportunities of the single market.

Experience with the EECC shows that Member States have not been able to address the sectoral challenges in a timely way, due to the long time needed for transposition of the Code into national law. In addition, the transposition of Directives into national law has been often accompanied by additional layers of rules resulting in overregulation.

Overall, the scale of the problems in the digital ecosystem requires a legislative initiative at EU level because they have increasingly an EU dimension, and can be more efficiently resolved at Union level, leading to overall greater benefits, more accelerated and harmonised implementation, and lower costs than if Member States acted alone.

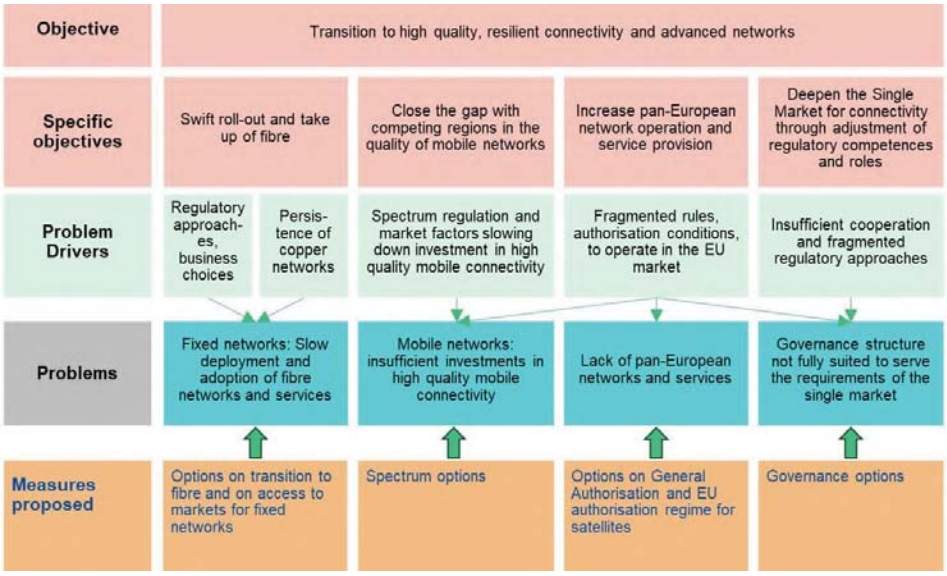
4. OBJECTIVES: WHAT IS TO BE ACHIEVED?

To support the Union's policy objectives of consumer welfare, industrial competitiveness, security and resilience and environmental sustainability, the DNA aims to incentivise market players to innovate and invest in advanced connectivity and computing infrastructures enabling the AI Continent.

4.1. General objective

The main objective of the proposed intervention is deeply rooted in the main findings of the Draghi, Letta and Niinistö reports, namely competitiveness, single market and preparedness. The general objective to which the initiative should ultimately contribute is the: preparation of the transition to high quality and resilient networks of the future.

Figure 15: Digital Networks Act high level intervention logic



High-quality, reliable and resilient connectivity for all, including in rural and remote areas, is essential for the EU to maintain its competitive edge and social standards. Achieving this requires reducing technological dependencies across the value chain and securing substantial investments, which in turn depends on a modern regulatory framework that supports the transition from copper networks to fibre networks; the roll-out of high-quality 5G and - in future - 6G, other wireless networks and cloud-based infrastructure; and scaling-up of businesses while keeping pace with emerging technologies such as quantum communication.

Cutting-edge digital network infrastructure – one of the cardinal points of the EU's Digital Decade Policy Programme 2030 and a goal under the AI Continent Strategy - is essential for a competitive EU industry and a thriving (digital) economy. Without it, the consumers will miss out on the benefits of advanced technologies while industry - in particular vertical sectors - will fail to exploit innovation potential. Enterprises need advanced connectivity and computing infrastructures to process data closer to their operations and customers, enabling to enhance innovative applications and services including those that require real-time data and AI processing, such as Internet of Things (IoT) devices, autonomous vehicles, smart grids, predictive maintenance, real-time monitoring and automation. This links strongly with competitiveness call in Draghi report.

Creating a genuine digital innovation in turn will allow for the deepening of the Single Market for connectivity as called for in Letta report, with conditions boosting investments and competitiveness. This is enabled by the removal of remaining obstacles and by facilitating a convergent, predictable and fair regulatory framework for investment in electronic communications networks, services, associated facilities and associated services, which can consequently be provider easier cross-border.

Finally, as stressed out in the Niinistö report, the importance of electronic communications, including satellite-based services, critical communication and digital services in the context of security, resilience and preparedness should be clearly reflected.

4.2. Specific objectives

For each of the below specific objectives, we have already identified quantifiable and traceable indicators, which are described in section 9, having a basis for an operational performance monitoring framework.

4.2.1. Swift roll-out and take-up of fibre

The specific objectives in relation to transition to fibre and access regulation are to: (i) foster the deployment of fibre networks, and (ii) the adoption of fibre-based services (take-up), which is crucial for providing high-speed and high-quality digital services to the European society and economy. This, in turn, will require preserving and promoting sustainable competition in a full fibre environment, allowing consumers to benefit from the full capabilities of the infrastructure while supporting efficient investments. The goal is also to support the single market in the electronic communications markets by facilitating the provision of services across the EU and by streamlining the regulatory framework, making it more efficient for all stakeholders involved.

As explained in section 9, this does not necessarily translate into 100% coverage and take up of fibre everywhere in the EU. Looking at the experience of countries where the fibre roll out is most advanced, it seems that the maximum fibre coverage that can be achieved is between 95% and 98% as there are always some areas (2-5%) of the territory where the deployment of fibre is not economically viable.

4.2.2. Close the gap with competing regions in the quality of mobile networks

Investments in high quality mobile networks will need to increase to ensure that the EU economy remains competitive. The EU will need to catch up with global leaders on deployment of wireless high quality networks (5G SA based on mid-band spectrum, network densification and 6G in the future) to better serve end-users and enable quality-assured services, that require high bandwidths, high speeds and/or low latency and realise full 5G and 6G innovation potential throughout the Single Market and in very different sectors[169].

This objective can be measured in terms of improved quality of mobile connectivity for consumers and businesses in terms of higher download and upload speeds, lower latency and in general better end user quality of experience as explained in section 9.

4.2.3. Increase pan-European network operation and service provision

Advanced digital network infrastructures and services, including LEO satellite constellations, will become a key enabler for transformative digital technologies and services such as Artificial Intelligence (AI). It is increasingly likely that many AI's breakthroughs will come not just from algorithms alone, but also from enhancing the infrastructure and connections that support them. Instead of relying solely on fibre and terrestrial 5G/6G networks, AI systems are beginning to leverage constellations of LEO satellites capable of delivering ubiquitous, reliable and high-capacity connectivity anywhere[170].

Removing regulatory barriers to facilitate the deployment of innovative pan-European satellite communication services and promote the integration of terrestrial and satellite D2D sovereign technologies within the new space ecosystem is essential to reinforce the Union’s industrial and scientific capacities, better serve end-users with connectivity services and consolidate Europe’s strategic autonomy, including supply chains, in the space sector. To strengthen EU competitiveness and strategic autonomy across the value chain, this initiative focuses on enabling scale, innovation, and fair competition, including the space sector and facilitates provision of satellite services also increasing reliability and security of EU connectivity.

This objective can be measured in terms of number of providers using the cross-border general authorisation regime, number of new EU-wide spectrum authorisations for satellite services completed within a reasonable timeline and number of satellite interference issues in the EU which have been timely and effectively addressed, as explained in section 9.

4.2.4. Deepen the Single Market for connectivity through adjustment of regulatory competences and roles

In line with the Digital Decade targets of Gigabit connectivity for all and 5G in all populated areas, the objective of the initiative is a transition to high quality, resilient connectivity and advanced networks. In this context it is important that the rules as well as the governance framework continue supporting the Single Market development. The specific objective is

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[169] See for example Annex 9 Section 3.1.1 on economic benefits of 5G by sector.

[170] As LEO satellites reduce latency and constellations with inter-satellite links create global mesh networks, satellites act as both data pipes and data sources, feeding AI models with vast datasets from Earth observation, IoT devices, and other satellite operations. Thanks to satellite networks, devices operating in remote areas—for example sensors for agriculture, energy or logistics—can stay connected to powerful AI systems. In the era of ubiquitous and reliable satellite connectivity, remote devices will no longer run in isolation, they will become part of a coordinated, real-time AI network, which shares data, updates, and makes decisions across vast distances.

therefore to deepen the Single Market for connectivity through adjustment of regulatory competences and roles. The governance structure must correspond to the needs of the developing market and all governance levels must be able to effectively cooperate to ensure that decisions are taken in line with subsidiarity rules and that as a result vulnerable end-users are protected, while connectivity is further enhanced, ensuring resilience, security and preparedness including through harmonisation of spectrum authorisation conditions. The initiative therefore focuses on strengthening the well-functioning aspects of the current governance set up while striving to rectify the identified shortcomings and improving the governance set up to make it future proof.

This objective can be measures through the number of high-quality outputs that have a direct link to Single Market objectives, i.e., strengthening harmonisation, supporting consistent regulatory implementation, and facilitating the completion of the EU Single Market for electronic communications, as explained in section 9.

5. WHAT ARE THE AVAILABLE POLICY OPTIONS?

5.1. What is the baseline from which options are assessed?

5.1.1. Transition to fibre

The EECC introduced the promotion of connectivity through access to and take-up of VHCN as a new objective of the regulatory framework, alongside the promotion of competition, the development of the internal market and the interests of Union citizens. The framework delivered as regards promotion of competition and protection of end users. The market environment changed as a consequence of infrastructure-based competition in many geographic areas, in particular through the emergence of players (other than the historic telecom incumbents) deploying FTTH networks in certain geographic areas. Despite the overall effectiveness of the ex-ante regulation which removed part of high entry barriers and in many areas allowed greater tendency towards effective competition, the objectives of the deployment and take up of fibre networks cannot be fully achieved by the current framework. The current framework, under the baseline scenario, cannot secure the ambitious EU-level connectivity targets[171]. The patchy approach to supporting fibre deployment and competition on quality in different countries lead to lack of predictability which is crucial to foster investment thus contributing to gaps in coverage and broadband speed.[172]

Under the baseline, there is no legal provision actively supporting or accelerating the copper switch-off. The conditions for copper switch-off are set by Article 81 EECC. This provision requires operators with Significant Market Power (SMP) subject to network access obligations to notify national regulatory authorities when they plan to decommission or replace their copper networks. The aim of this provision is to ensure that migrations from regulated networks are transparent with a clear timetable and adequate notice periods, do not harm competition or end-users' rights and that alternative access products of comparable quality are available. The

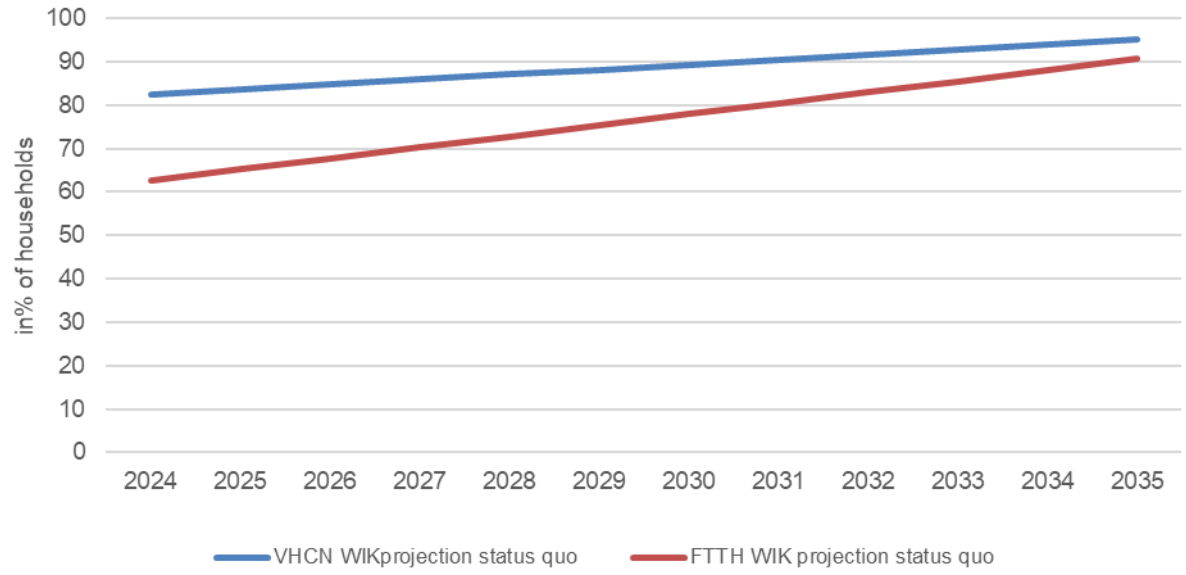
[171] Digital Decade Policy Programme https://eur-lex.europa.eu/EN/legal-content/summary/2030-digital-decade-policy-programme.html.

[172] Wide gaps exist between Member States in high performance FTTH infrastructure with coverage of more than 80% in some countries such as ES and PT and less than 50% in others, such as EL, BE and DE. There is also a significant urban rural digital divide, with rural coverage of FTTH lying around or below 10% in a number of countries (CZ, EL, BE).

provision is not intended to accelerate migration to fibre. In fact, Article 81 EECC may sometimes slow down the migration to fibre because it allows NRAs to impose conditions on how the copper switch-off process is implemented by SMP operators. According to the BEREC progress report on managing copper network switch-off and the NRA surveys conducted for the 'Study on Access Regulation', 9 countries[173] are planning to switch-off copper by 2030 or earlier. 16 countries[174] have not set a target date and 7 countries[175] are lagging behind in fibre roll-out and FTTH penetration (in % of broadband subscriptions).

As regard the evolution of the fibre coverage in the baseline scenario, there are particular difficulties in stimulating FTTH deployment (from any provider) when the incumbent has upgraded copper to provide higher levels of quality over FTTC (which often can provide a decent quality of 250 Mbps upstream). In this situation, as it is still making a return from its upgraded legacy copper network which may have been fully depreciated, the copper network owner has no incentive to deploy FTTH itself or to switch-off copper and transition its customers to another FTTH network, even if one exists. Taking into account the countries that are affected by this problem, WIK expects that under the status quo, FTTH coverage[176] will reach only 77.9% in 2030 and 90.6% in 2035.[177] Furthermore, the experience of countries which are more advanced in fibre roll-out shows that around 2-5% of households, normally located in very remote areas, will not be covered with FTTH networks in the long term and may only be served by alternative technologies.

Figure 16: EU VHCN and FTTH coverage (% households), Actual data to 2024 and Forecasts



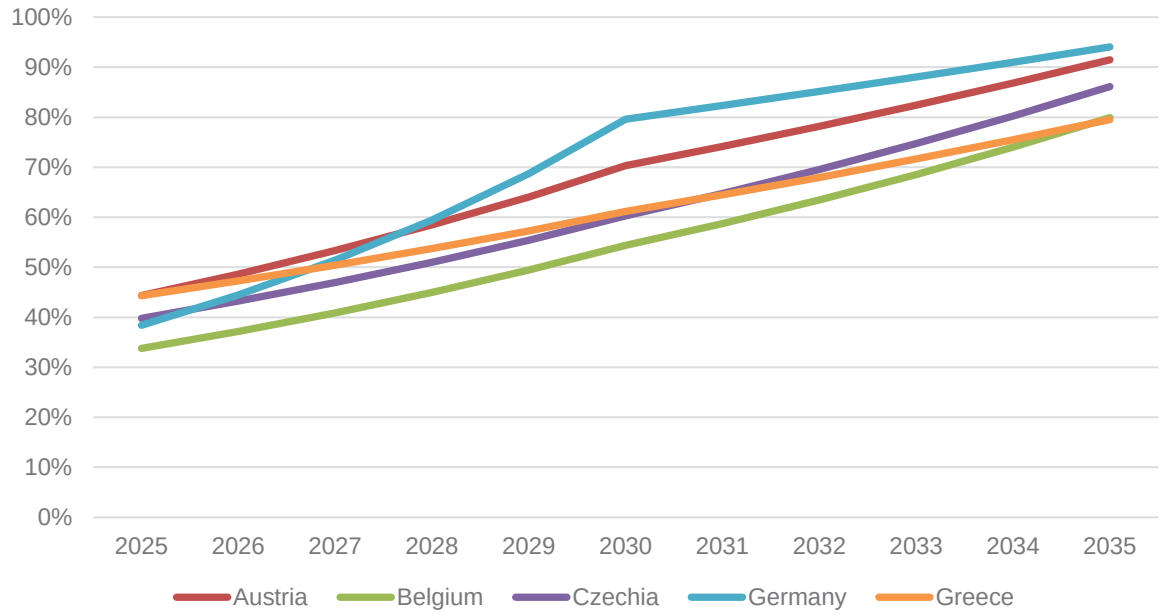
Source: WIK-Consult based on EC Broadband Coverage in Europe, Analysys Mason and FTTH Council Europe

Meanwhile, while countries with a lower FTTH coverage such as Austria, Belgium, Chechia, Germany and Greece can be expected to have a higher growth-rate in fibre roll-out than those

[173] DK, FR, LU, MT, PT, RO, SE, ES and CY.
[174] AT, BU, CZ, DE, EE, EL, FI, HR, HU, IE, LV, LT, the NL, PL, SK and SI.
[175] Austria, Belgium, Czechia, Germany, Greece, Latvia and Slovakia.
[176] Fibre coverage refers to the share of households passed by a fibre network.
[177] WIK study.

which are more advanced, it is unlikely that they will reach high FTTH coverage by 2035. As can be seen in the following chart, the coverage gap in some cases will be significant.

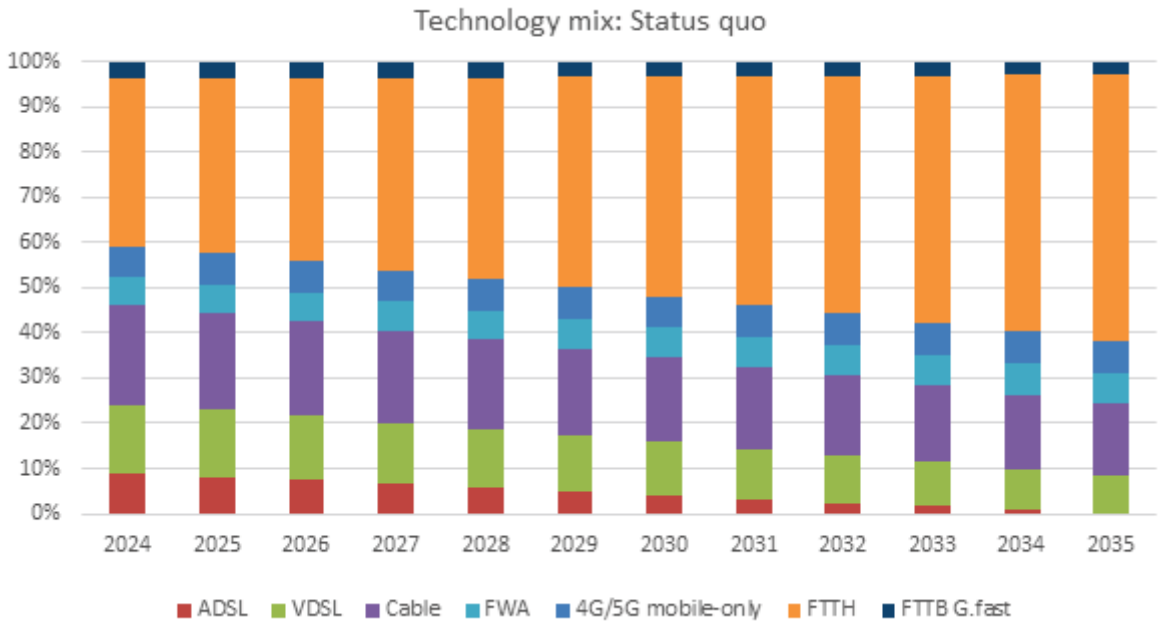
Figure 17: Estimated FTTH coverage (excl. FTTB) in Austria, Belgium, Czechia, Germany and Greece in 2035 under the status quo (in % of HH)



Source: WIK based on development of FTTP coverage in EU27 Member States from 2017-2024, own estimates, FTTH Council (2025).

Regarding the remaining technologies, WIK projects that under the status quo, in 2035 there will remain 8% broadband subscribers on VDSL as the EU Member States lagging in fibre roll-out will not have switched-off their copper networks by 2035. Because the prevailing DOCSIS 3.1 technology is capable of Gigabit download speeds, WIK expects cable take-up to remain more stable in the near term, but with declines to come, as customers transition (or are upgraded by their existing operators) to more performant and energy efficient FTTH. Meanwhile FWA take-up is expected to expand from a low base as 5G FWA offers are launched and as this service starts to replace DSL, in particular in less dense areas or in countries where FTTH/B is less widespread. The resulting projections concerning the technology mix under the status quo are shown below. As some countries in the EU allow copper switch-off with customers being migrated to mobile networks or FWA when the copper network operator does not have fibre coverage, WIK expects a share of 7% 4G/5G mobile-only broadband customers and a share of 7% for FWA connections. FTTB G.fast is expected to have a share of 3.4% in 2030 which will decrease to 2.9% in 2035.

Figure 18: Projected EU technology mix to 2035: status quo (in % of broadband subscriptions)



Source: WIK based on FTTH Council (2025) and WIK market potential model.

Concerning the expectations related to FTTH investment under the status quo, the expected persistence of copper and cable networks until 2035 and beyond has important implications for the evolution of the investment gap (i.e. the difference between Capex required to achieve full coverage and the capex that is likely to be invested). According to the WIK study prepared for the Commission published in 2023[178] based on data from 2021, there was a remaining Capex requirement of approximately EUR 114 billion to achieve 100% coverage of Fibre-to-the-Premise (FTTP) EU-wide, of which EUR 74 billion was estimated to be economically viable without subsidies in a situation **of no network duplication (i.e. an operator resulting in take-up of around 75% or more),** resulting in an 'investment gap'(i.e. here defined as a difference between total investments needed and private funding) under this assumption of EUR 40 billion. If a combination of FTTP and FWA is used (i.e. no full fibre coverage), the total investment figure would be reduced to around EUR 108 billion, of which around EUR 29 billion would be needed in public investments, if 5G FWA is used for the most remote households. Based on the most recent Digital Decade data, since 2021, FTTP coverage has increased from 50% to 69% (in 2024). The remaining investment (Capex) needed to achieve full FTTH coverage would therefore be significantly less than estimated in 2023. However, the shortfall cannot be calculated with precision. This is because the Capex required to deploy FTTH varies widely depending on a variety of factors, while economic viability further depends on ARPU and take-up.

Access regulation is currently based on SMP and on symmetric regulation[179]. Under the SMP regime, regulatory intervention on a specific product and geographic market can be justified if

178 https://digital-strategy.ec.europa.eu/en/library/investment-and-funding-needs-digital-decade-connectivity-targets.

179 In particular, Article 61(3) EECC provides that access obligations can be imposed, upon reasonable request, with respect to wiring and associated facilities inside buildings or up to the first concentration or distribution point

proven that these markets are characterised by high barriers to entry, do not tend towards effective competition, and that competition law instruments are insufficient to tackle the identified competition problems (so called 'three criteria test')[180]. An undertaking is deemed to have SMP, if, either individually or jointly with others, it enjoys a position equivalent to dominance, i.e. a position of economic strength, which gives it the power to behave to an appreciable extent independently of competitors, customers and ultimately consumers. Guidance on market definition and SMP assessment has been provided in the 2018 SMP Guidelines[181] and in the 2020 Recommendation on Relevant Markets (RRM)[182]. Under the RRM two markets are currently recommended as susceptible for ex ante regulation (i.e. the wholesale local access market and the market for wholesale dedicated capacity). Additionally, guidelines on the imposition of remedies were provided in 2024 in the Gigabit Recommendation[183].

As explained above, given the differentiated pace of deployment of fibre network at national and sub-national level and the need to adapt the regulation to the competitive situation at regional/local areas, evidence gathering by NRAs is key to inform their decisions and recommend policy interventions to support the deployment and take up of fibre. The current means of evidence gathering (Article 22 EECC) would remain limited in the baseline scenario and insufficient for the scope. Furthermore, the baseline scenario, despite its objective to ensure a consistent regulatory approach, cannot prevent patchy implementation of access remedies, which constitutes *per se* a barrier to the provision of services across different Member States, undermining the single market objective.

In conclusion, under the base line scenario, the timeline for fibre deployment and switch-off of copper would be entirely in the hands of operators with the shortcomings identified above. NRAs could only intervene to preserve competition at Member State level and end-users' rights without being able to ensure to the latter the high level of connectivity services they may require. This leads to market fragmentation and regulatory unpredictability, and it is not contributing to the development of the internal market for electronic communications.

5.1.2. Spectrum

The current framework leaves Member States **substantial discretion in designing assignment procedures, authorisation conditions, and pricing approaches.** This has resulted in a

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where the replication of these network elements would be economically inefficient or physically impracticable; under strict conditions such obligations can be extended up to a point beyond. These provisions are applicable outside of the context of a market analysis, and irrespective of whether the undertaking concerned has been designated as having significant market power.

[180] The decision to define a market as susceptible to ex ante regulation should also (alongside the first two criteria) depend on an assessment of the sufficiency of competition law to address adequately the market failures identified. This third criterion aims to assess the adequacy of competition law to tackle identified persistent market failure(s). Competition law-based interventions are likely to be insufficient where frequent and/or timely intervention is indispensable to redress persistent market failure(s). In such circumstances, ex ante regulation should be considered an appropriate complement to competition law.

[181] Guidelines on market analysis and the assessment of significant market power under the EU regulatory framework for electronic communications networks and services (2018/C 159/01).

[182] Commission Recommendation (EU) 2020/2245 of 18 December 2020 on relevant product and service markets within the electronic communications sector susceptible to ex ante regulation in accordance with the Code (2020 Recommendation on Relevant Markets) (OJ L 439, 29.12.2020, p. 23-31).

[183] Commission Recommendation (EU) 2024/539 of 6 February 2024 on the regulatory promotion of gigabit connectivity (C/2024/523) (OJ L, 2024/539, 19.2.2024).

heterogeneous regulatory landscape and the absence of a coherent Single Market approach. This fragmentation was particularly evident in the assignment of the 5G pioneer bands, a process that unfolded over more than ten years and far beyond the planned schedule, delaying the availability of the corresponding services in many markets. Fragmentation is also illustrated by the variety of approaches to reserve prices. In a subset of auctions analysed in the Commission study, 6 out of 37 closed at the reserve price, suggesting that minimum prices may have been set too high to attract competitive bidding. Significant differences have also been observed in spectrum prices, coverage obligations and market-shaping measures[184].

The current regime has **delivered competitive prices** for mobile connectivity for consumers across the EU, albeit with different levels and some exceptions.[185] While it has ensured spectrum availability and led to quasi-ubiquitous **basic 5G coverage**, it has **not generated sufficient investment in high-quality 5G networks.** As a result, performance outcomes in terms of speeds and quality are suboptimal in several Member States.[186] The **weak outcomes** are linked to persistent gaps in mid-band 5G coverage, the slow rollout of 5G SA and insufficient network densification, which is likely to persist, as indicated by interviews with major operators on their deployment plans.[187]

Under the status quo, **spectrum represents a significant cost component** for mobile operators[188]. While spectrum needs have increased over the last decade, average revenue per MHz in Europe has declined by 58% between 2014 and 2024.[189] This reduction has not been fully mirrored in spectrum prices, which have declined overall but not at a comparable pace. The discrepancy was suggested to reflect regulatory interventions, such as reserve prices or measures artificially increasing spectrum scarcity, which are likely to persist under the baseline. At the same time, across the EU, fragmented national approaches have resulted in significant differences in prices per MHz per population.[190] Divergent national pricing policies and high spectrum fees have been found to contribute to substantial opportunity costs.[191] Mid-band spectrum in Europe remains relatively expensive: its price level corresponds on average to around 14.5% of operator revenues, almost three times the level in North America, and may reach up to 20% in some Member States.[192]

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[184] See section 2.2.2.3 for an assessment of their impact on market outcomes. Further explained in Annex 4, section 3.

[185] See consumer price market outcomes high heterogeneity as presented in section 2.2.2.3.

[186] See Quality of service market outcomes as presented in section 2.2.2.3 and Annex 4.

[187] The majority of MNOs responding to a questionnaire distributed for the 'Study on Finance and USO' did not report any concrete plans to densify their networks with the deployment of small cells, at least in the short term. As regards the 2030-2035 horizon it is unlikely that MNOs would have internal investment plans that extend beyond the next 5 years, also noting that future plans will also depend on the external factors which are hard to predict, such as the evolution of demand, and potentially changes to current approaches towards spectrum licencing and any associated conditions.

[188] Across Europe, spectrum costs account for around 7% of mobile service revenues and about 35-40% of capital expenditure Ingravallo, R., & Solomon, G. (2022). Spectrum Licence Renewals and Europe's Digital Future.

[189] GSMA Global Spectrum Pricing 2025.

[190] See section 2.2.2.3. and Average spectrum prices from Completing the Digital Single Market (DSM): Regulatory enablers for cross-border networks.

[191] See section Completing the Digital Single Market (DSM): Regulatory enablers for cross-border networks".

[192] Completing the Digital Single Market (DSM): Regulatory enablers for cross-border networks" reporting GSMA data.

Cost pressures may intensify with future rollouts of advanced technologies. Forecasts of substantial growth of mobile data consumption in the coming decade and larger spectrum volumes required for high-quality networks and new use cases imply an increase in spectrum cost even if unit prices were to decline. Beyond spectrum acquisition, investment needs include network densification, identified by stakeholders as the costliest aspect of 5G deployment. Based on stakeholder input, this is estimated to require some EUR 33.5 billion and expected to persist at least until 2030, as operators currently do not plan large-scale densification. Additionally, the **attractiveness of mobile network projects for investors is likely to remain limited** due to risks arising from regular technology shifts, volatility in the consumer base, the finite nature of spectrum rights as well as uncertainty regarding the timing of 6G spectrum availability.[193] Under these circumstances, operators' willingness and ability to secure financing for high-quality deployment is expected to remain constrained. Overall, **the investment headroom for high-quality mobile networks would remain limited.**

Under the baseline, the many divergences across Member States are expected to persist. Fragmented award practices and heterogeneous authorisation conditions would continue to create uneven spectrum availability and inconsistent investment incentives, while also complicating activities for operators present in multiple Member States. Certain market-shaping measures could continue to be applied in uncoordinated ways that maximise spectrum fees or maintain low retail prices at the expense of investment incentives. If the peer review mechanism remained voluntary and without binding effect, it would offer no assurance that investment-constraining award designs are detected in time for the Commission to intervene ex ante.[194] The application of mechanisms intended to promote more efficient spectrum use, such as sharing, secondary trading, leasing and local licensing, would remain occasional and insufficient, limiting their capacity to alleviate scarcity or support industrial 5G deployment. Cross-border interference coordination with third countries would continue to be inefficient, as the Commission would remain able to resolve interference only in harmonised bands, leaving Member States to address issues in non-harmonised spectrum. The harmonisation process would continue to rely exclusively on Member States contribution through CEPT, where participation of non-EU countries may influence timelines and predictability. The procedure which allows several Member States to jointly establish common aspects of an authorisation process and jointly conduct a selection process will remain largely unused, limited by the fact that it can only be initiated by the Member States.[195]

The direction of the patterns of spectrum regulatory approaches and market outcomes identified in our analysis indicates how these performance indicators may evolve under the baseline.[196] Member States applying more restrictive award conditions, such as considerable spectrum reservations or set-asides, could continue to increase spectrum costs, consumer prices and to lower the download speeds. Reliance on access obligations may continue to involve trade-offs between consumer prices and 5G coverage. Persistently high spectrum prices could carry a risk

[193] Study on Finance and USO.

[194] See summary tables with evaluation findings in section 1.2.1 ad 1.2.2.

[195] See summary tables with evaluation findings in section 1.2.1 ad 1.2.2.

[196] Controlling for non-regulatory factors, the analysis presented in section 2.2.2.3 suggests that certain auction and award conditions correlate with differences in prices, coverage and service quality across Member States. If existing regulatory practices were maintained, these patterns could persist, even though the analysis does not claim to reveal causal relations.

of lower overall download speeds[197]. At the same time, Member States with more investment-oriented assignment frameworks may continue to achieve relatively stronger results in mid-band coverage and quality of service. As a result, the availability of advanced, quality-assured services requiring reliable high-speed, low-latency performance would progress slowly, selectively, remaining constrained in parts of the EU.[198]

Overall, under the baseline, the spectrum framework is likely to remain of **limited effectiveness and efficiency in supporting high-quality mobile connectivity and a functioning Single Market**.[199] The persistence of fragmented award practices, investment-impeding assignment conditions and limited predictability would continue to constrain operators' incentives and ability to plan and finance high quality 5G deployment and would slow the transition towards 6G. As a result, the delivery of anticipated economic and societal benefits from advanced mobile connectivity would be delayed.

5.1.3. Authorisation

The baseline focusses on better enforcement of the existing **authorisation regime** i.e.:

- general authorisation at the Member State of the provision of the network or service (TN or NTN), using a template of authorisation conditions developed by BEREC[200] and a General Authorisation Data Base (GADB) [201] maintained by the BEREC Office;

- and assignment of spectrum for satellites at national level, while voluntarily addressing divergences via BEREC/RSPG.

The Commission may use its powers to adopt implementing acts to facilitate compliance with cybersecurity requirements by public ECN/ECS providers under NIS 2. Taking into utmost account the BEREC Opinion, the Commission may publish a report on the functioning of the general authorisation and outline areas where BEREC could further address obstacles to the proper functioning of the internal market (Article 122 (3) EECC, non-legislative initiative).

Under this baseline scenario identified shortcomings would remain; it would not effectively foster innovative, resilient pan-European networks and services, as the current general authorisation regime remains fragmented and unevenly implemented across the Member States. It would also do little to increase the number of pan-European services, since the existing

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[197] While the last association does not reach conventional levels of statistical significance in our regressions, it is consistent with econometric estimates presented in the WIK Study that historically a 10 p.p. higher spectrum cost to recurring revenue ratio decreased average speeds by up to 8% (and coverage by up to 6 p.p.). Zagdanski, Jakub; Castells, Pau; Bahia, Kalvin: The Dynamics of Spectrum Cost in the Era of 4G and 5G and Its Impact on Mobile Network Development and GSMA, "Global Spectrum Pricing report," GSMA, London (2025), p. 10.

[198] Analysis by Mason shows that capex in 5G mobile plateaued at 20% of total European telecom capex in 2023, with capex in FTTH networks more than double this value. Lower numbers of small cells in Europe compared with the US and Asia are reported in surveys conducted by the Small Cell Forum (SCF) - SCF (2024). SCF Market forecast report.

[199] See section 2.3.2 on how the problem would evolve and the more detailed findings of the evaluation report in section 2.2.1 and 2.2.2 that further describe the baseline with supporting evidence.

[200] https://www.berec.europa.eu/en/document-categories/berec/regulatory-best-practices/guidelines/berec-guidelines-for-the-notification-template-pursuant-to-article-12-paragraph-4-of-directive-20181972-of-the-european-parliament-and-of-the-council.

[201] https://www.berec.europa.eu/en/tools/general-authorization-database.

national authorisation frameworks continue to create administrative burdens for cross-border operations; these are especially severe for satellite services, which are inherently cross-border.

Barriers to the development of pan-European satellite networks and services will persist since the authorisation of satellite networks and services will not be coordinated and will continue to be entrusted to 27 national authorities, even for pan-European services. Continuing with the current complex division of national regulatory competences for satellite authorisations – many of which differ substantially in application procedures (including costly testing requirements), licence conditions and fee structures – will limit the deployment of innovative satellite D2D services in an increasingly competitive global market, significantly undermining EU competitiveness.

Such a fragmented authorisation regime will lack predictability, legal certainty, transparency and raise market access barriers due to complexity, increased compliance and scale-up cost, and prolonged time to market[202], which could eventually undermine investor confidence and, ultimately, increase the cost of capital for new satellite projects[203]. According to a study, a 4-month delay in authorisation for the deployment of D2D services in a major LEO constellation with a global average number of subscribers of around 300 000, could cost a company in terms of lost revenue EUR 18.3 million[204]. Looking at potential future impacts on another EU constellation, a complete inability to deliver IRIS² services across the EU for one month in 2030 would lead to an estimated loss of about EUR 50 million in potential revenue. A one-month loss of service in a single Member State would reduce revenue in proportion to that State's share of total EU revenue.

Barriers to pan-European satellite services will also be driven by inconsistent interpretation of compliance and reporting obligations (in terms of format, frequency and requirements) increasing administrative costs. For instance, as part of the authorisation process, operators are asked to conduct in-country testing in each MS which would indicatively cost EUR 3.2 million across all Member States (see section 6.3.2 for a more detailed analysis).

In a context of exponential increase of the number of satellites and satellite constellations in the following years[205], access to EU markets will remain uncoordinated, to the detriment of late-comer satellite systems which will face limited access to spectrum, increased risk of interference and high costs. Selection of providers of pan-European services is possible only for the limited spectrum available in the 2 GHz band (2x30 MHz), while for other bands relevant for pan-European provision of services, satellite operators need to be awarded spectrum rights in every Member State, with the risk of gaps in their coverage. Finally, uncoordinated enforcement does not allow Member States to act effectively against harmful interferences that will be increasingly problematic with exponential uptake of LEO constellations. Where satellite operators do not respect international law, a lengthy bilateral process at the ITU level would need to be followed to ensure compliance, without the possibility

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[202] Opinion on Assessment of Different Possible Scenarios for the Use of the Frequency Bands 1980–2010 MHz and 2170–2200 MHz by the Mobile Satellite Services Beyond 2027 (RSPG24-007 FINAL).

[203] Detecon (2025). Study on Mobile Satellite Services (MSS) in the 2 GHz band in the EU: Implementation of the current regulatory framework and an overview of the satellite connectivity market, study for the European Commission.

[204] Study on Digital Single Market.

[205] See Detecon data presented in section 2.1.3.2. on number of launched and planned satellite constellations per country/region.

to leverage the strength of the internal market against very strong operators, limiting EU's competitiveness and sovereignty.

Under the baseline scenario, fragmented and uneven implementation of the authorisation regime is expected to persist, limiting the effects of the technical harmonisation of spectrum and slowing the effective deployment of pan-European networks and services, drawing on lessons learnt in the 2GHz MSS band. The growth of pan-European electronic communications services is projected to remain modest, constrained by administrative burdens and delays in cross-border authorisations, which could plausibly reduce sectoral investment in R&D[206] and innovation[207].

Comparative benchmarking indicates that countries with unified regulatory frameworks, such as the United States (FCC) and South Korea (where the Ministry of Science and ICT established a "5G+ Spectrum Plan"), achieve faster spectrum allocation and more uniform deployment of innovative services[208], highlighting that the EU baseline scenario is likely to lag behind international peers in promoting pan-European connectivity and digital innovation, thereby undermining EU`s global competitiveness.

5.1.4. Governance

The baseline scenario assumes that the governance set up remains unchanged. The current division of competences and roles between the Commission, NRAs and other CAs, BEREC, and RSPG will remain. BEREC continues to be a network of NRAs, assisted by the BEREC Office, an EU decentralised agency with legal personality. RSPG remains a Commission expert group composed of high-level representatives of Member States and the Commission. The tasks, including any additional tasks stemming from DNA, would continue to be allocated to the Commission or the Member States' authorities.

Under the baseline scenario the RSPG Secretariat provided by the Commission would use their current resources to support RSPG on administrative issues. For performing the new tasks on spectrum, the Commission would need to be strengthened with 12 FTEs, equivalent to EUR 1.83 million. The BEREC Office would also need to be strengthened to ensure proper support for BEREC in performance of its tasks stemming from the DNA. It would necessitate an additional 2.5 FTEs corresponding to approximately EUR 262 348. Assuming operational,

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[206] A 2025 report by PEI (Polish Economic Institute) on the EU telecommunications market states: 'the low level of R&D and innovation spending (…) translates into the attractiveness of telcos as workplaces (…)' and notes that weak innovation may hinder entry into new business areas. The report links fragmentation to this problem by explaining how the sector's structural issues lower returns and reduce funds available for innovative activities. https://pie.net.pl/wp-content/uploads/2025/01/PEI_Report_European_telecommunicatios_market.pdf.

[207] According to ECIPE, 2025 report 'Strengthening the Supply-Side Innovation in the EU Telecommunications' EU-based telecom companies spent €81 billion on R&D in 2023, but their share in global telecom R&D has dropped significantly: from 44% in 2003 to just 16% in 2023. This decline suggests that EU telecom firms' ability to scale R&D is being outpaced by non- EU competitors, which could be linked to fragmentation (less scale, less efficient investment).

[208] See Australian Communications and Media Authority 2024 report on 'International benchmarking study of spectrum utilisation requirements in wireless broadband licences' https://www.acma.gov.au/publications/2024-12/report/policy-tracker-report-international-benchmarking-study-spectrum-utilisation-requirements-wireless-broadband-licences and Korean"5G+ Spectrum Plan" by the Ministry of Science and ICT adopted in 2019 : https://smartcity.go.kr/en/2019/12/05.

building and equipment costs increase by ~5%, the annual costs for the BEREC Office would increase by approximately EUR 0.5 million.

Identified shortcomings would remain. BEREC and RSPG will continue to play purely advisory role on narrow set of tasks with limited scope of cooperation, with further synergies unexploited. BEREC would take on the new tasks such as preparing guidelines and best practices within its remit. Considering that the functions of the BEREC Office would remain the same as currently, its support to BEREC would be equally limited mostly to administrative and data base handling tasks. The RSPG secretariat provided by the Commission will not be able to provide to RSPG more support on substance (in this option such support would still need to be provided by the Commission itself). Furthermore, it is questionable whether all new measures foreseen by DNA could be implemented under the baseline scenario governance structure, such as spectrum single market procedure. Complexity will keep increasing by the proliferation of different bodies to which BEREC participates or cooperates within the digital sphere[209].

5.2. Description of the policy options

Each option block is built from a set of concrete policy measures that directly address the problem drivers identified in section 2. Recognising that problem drivers vary in nature and impact; the options are designed with increasing levels of regulatory ambition. The packaging process therefore moves from relatively light adjustments to more structural reforms, ensuring that each option block represents a coherent and internally consistent response to the four blocks of problems and their drivers. Presentation of each option block is accompanied by a table mapping the measures under each block against the specific problem drivers. Measures within each option block are selected to complement each other.

5.2.1. Transition to fibre

To fill the gaps in terms of fibre deployment and take-up, the options cover:

1. measures to foster the deployment and take up of fibre, including measures to expedite the copper switch-off, given the negative effects that the persistence of legacy copper networks has on deployment and take-up, and
2. Updates to access regulation to align it with the future full fibre landscape, to ensure that, during the copper switch-off phase and following it, end-users continue to benefit from choices of services at affordable conditions and that competition is preserved. This will enable operators to design more flexible offers to ensure consumers can choose among different services at affordable prices and, thus further push take up of fibre.

All the options include some simplifications by removing the Code provisions related to remedies that have not been used (e.g. co-investments), in line with the findings of the Code evaluation report (Annex 11). To protect end-users following the copper switch-off, under all options presented below, the Universal Service obligations will be kept ensuring that affordable and adequate internet access is available, irrespective of location and income. The key elements of the options are shown in the table below, followed by a more detailed description of the measures under each of the option and in Annex 8. The matrix of all combinations of options and choice of the ones described below is done under discarded options.

[209] e.g. RSPG, ENISA, NIS Cooperation Group, EDIB, DMA High Level Group.

Table 14: Transition to fibre options and links to the problem driver and specific objective

Problem driver	Specific Objective	Policy options			
		P01 Non-binding CSO and updated access regulation	**P02** Conditional CSO and updated access regulation	**P03** Market driven CSO and bottleneck-based access regulation	**P04** Mandatory CSO and symmetric regulation
Factors slowing down the deployment and adoption of fibre networks/ services (persistence of copper and some regulatory approaches)	SP01: Swift fibre deployment and take-up in all MSs	Transition to Fibre Plan with non-binding date for copper switch-off	MS to prepare a Transition to Fibre Plan and communicate it to the Commission; Mandatory date for copper switch off by 2030, subject to sustainability conditions Obligation on MSs to ensure that copper switch-off starts by 2030 in all areas with at least 95% fibre coverage and comparable prices for fibre-based broadband. Vulnerable consumers to be protected. If the above coverage and affordability conditions are not met, Member States should set out the measures to transition to fibre by 2035. Review of the Transition to Fibre Plan by 2035. This process will be subject to the Commission's scrutiny. Introduce some changes to the access regime to make it effective also during and after the copper-switch off phase: Increased focus on regional markets through geographic surveys (strengthening of Art. 22); Complement SMP regulation (which is maintained) with tools that NRAs could use where needed, in particular in relation to sub-national markets: Update existing "symmetric regulation" under article 61.3 to enable NRAs to apply it for access to in-house wires (upon request) and beyond the first distribution point on their own initiative where warranted. Strengthening the provisions on in-building wiring to facilitate deployment.	Market driven fibre deployment and copper switch-off process managed by operators (Art.81 is removed, and no condition to the switch off apply); Bottleneck approach applied on areas with a single fibre network;	Transition to Fibre Plan with binding date for copper switch-off No sustainability conditions or additional safeguards.
		Very limited changes to access regulation Guidelines on EU wholesale access products	Updates to access regulation in particular symmetric rules EU wholesale access products	Bottleneck approach applied on areas with a single fibre network; Only symmetric access to passive networks (ducts and poles)	Regulated access to all fixed networks Regulated access to ducts and poles List of EU wholesale access products

Option 1: Non-binding copper switch-off and limited updates to access regulation

Member States will prepare plans for FTTH coverage, including proposed measures to foster fibre deployment, and communicate those to the Commission [by 2029].

For copper switch-off, this option sets a non-binding target date of 2030. The obligation existing in the Code to notify NRAs of the network switch-off will be extended to cover all copper network operators, not only those with SMPs. Operators will be required, where appropriate, to submit a copper switch-off plan to the NRAs. New conditions for migrating to alternative fibre networks will be defined in Article 81. BEREC will be mandated to publish guidance on best practices for copper switch-off and geographic surveys. The references to 100 Mbps in Article 22 of the EECC regarding geographic surveys will be changed to VHCN as defined in the EECC.

For access regulation, the market analysis framework will be retained, subject to the prior assessment whether the measures already in place (e.g. GIA) are sufficient to remedy the problems identified. As it is currently the case, with respect to the markets that are recommended for ex ante regulation, there is a presumption that the three criteria test (i.e. existence of high entry barriers, lack of tendency towards effective competition and insufficiency of competition law) is met. For other markets, the three criteria test applies (to facilitate fibre deployment and address the issues related to access to in-building wiring, NRAs will be also able to impose (upon request) access to in-building wiring and access beyond in-building wiring could be imposed ex-officio (and not only upon request as currently the case). Article 61(3) will be amended accordingly. NRAs would be able to require operators deploying FTTH to provide a connection (drop cable) to households which are passed by fibre within a given distance.

To ensure more consistency in NRAs' regulatory practices across the EU and address the single market fragmentation, the EU wholesale access products will be introduced. BEREC will be mandated to establish guidelines on the EU wholesale access products. NRAs could impose other remedies but would need to justify the reasons for such differentiation.

Option 2: Conditional copper switch-off and updated access regulation

This option contains a combination of measures geared at fostering fibre deployment and take-up, including via an EU-wide copper switch off date by 2030, subject to certain conditions. It aims at increasing accountability of Member States, who should adopt a coordinated strategy at national level and concrete measures to support fibre deployment (which would, in turn, facilitate meeting the conditions for the switch-off of copper and increase take up). It includes a review date in 2035 and very strong safeguards for end-users.

As regards copper switch-off, by 2029 Member States should submit to the Commission's scrutiny a "Transition to Fibre Plan" setting out their strategy for the entire country. The plan will include:

- the identification of the areas where transition to fibre is feasible and the copper switch off process will start as soon as possible and at the latest in 2030;
- for the areas where copper switch off cannot start by 2030, set out the measures to transition to fibre at the latest in 2035.

In assessing whether the copper switch-off should start the following aspects should be considered by Member States:

1. Sufficient coverage by fibre networks in a given area [indicative 95%]
2. Ensuring affordability through comparable prices for comparable services

3. Ensuring that appropriate safeguards, including alternative solutions, for vulnerable customers are in place.

The first two aspects are addressed via the conditions ("sustainability conditions"), that are requirements for the copper switch off to start. The third aspect will be addressed via additional safeguards and measures that will be set by NRAs or other national authorities.

By 2035 Member States should review the fulfilment of the Transition to Fibre Plan and transmit it for Commission's scrutiny. In the review Member States should, in particular:

- ensure that in all the areas of the country where the copper switch off started, it is completed asap, and
- for all remaining areas where fibre deployment is not viable (e.g. remote areas geographically difficult to reach), explain the reasons for the exceptions and provide alternative connectivity solutions for customers in these areas.

NRAs will also be required to contribute to the process by (i) gathering data on network coverage that will be the input for the Transition to Fibre Plan; (ii) producing the lists of areas for CSO, based on Commission's guidance on the definition of these areas to be issued shortly after adoption of the DNA; (iii) advising national authorities for the preparation of the Fibre Transition Plan; (iv) conducting market reviews, in the context of the national authorities' decision to order the switch off of copper networks, and adopting remedies as needed, and (v) review the switch off plans of the operators and oversee the migration process.

For access regulation, this option provides greater flexibility in the application of ex ante regulation by providing NRAs with more tools to be used depending on the features of the market.

The NRAs should first analyse whether the existing symmetric regulation (GIA) would be sufficient to address the identified problems. In the next step, if GIA is not sufficient, the NRAs could decide to apply SMP regulation or the symmetric rules under Article 61(3), depending on what is most appropriate to address the identified competition problems in a given area. In this option the application of the symmetric rules is broader than in option 1 as it covers not only the possibility to impose access to in-building wiring but also access beyond the building if the criteria of Article 61(3) EECC (high and non-transitory barriers to replicability) are met. Access to the in-building wiring part would be imposed upon request whereas access provided beyond in- building wiring could be imposed ex-officio (and not by request as it is currently the case) to facilitate deployment and to tackle more localised competition concerns.

The approach to geographic surveys would be expanded, requiring NRAs to gather data on retail markets and the underlying infrastructure periodically. This data will be important for NRAs to assess the market conditions and decide whether ex ante intervention is required.

To support the standardisation of wholesale offers, a list of essential wholesale products will be included in the DNA, and the Commission would have to adopt an Implementing Act to establish best practice specifications and/or to amend the list, following consultation with BEREC.

Option 3: Market driven copper switch-off and bottleneck-based access regulation

For copper switch-off, this option removes NRAs' oversight over the copper switch-off process and give operators full discretion over the timing and conditions of the copper switch-off (i.e. remove Article 81).

For access regulation, this option focuses on deregulation by removing: (i) SMP-based regulation, and (ii) regulation on in-building wiring (Article 61(3)).

SMP-based regulation would be replaced by a "bottleneck" approach mandating wholesale access only in areas with a single fibre network. EU wholesale products will be provided.

Access to civil engineering infrastructure is handled via the GIA exclusively.

The option supports coherent access regulation across the EU by giving the Commission veto right on imposing regulation. Further, it eliminates the provision on geographic surveys and data gathering regarding infrastructure deployment (Article 22 of EECC). This option would be a significant shift from the current ex ante approach as it would rely mainly on ex post competition enforcement and would limit the ex ante regulation to quite exceptional cases where there are no means to create any form of competition. As a consequence, many markets that are characterised by non-competitive characteristics would not be regulated anymore, as some access products would be often available on commercial basis, but would not necessarily allow effective replicability of the local market leader's services and hence service competition.

Option 4: Mandatory copper switch-off and symmetric regulation

For copper switch-off, this option mandates ECN operators to switch off their copper networks by 2030. No conditionality or other form of sustainability checks or safeguards is envisaged. NRAs are tasked with gathering and publishing relevant data on copper switch-off, including geographic surveys of FTTH, cable, and Gigabit-capable fixed wireless networks, along with the status of copper to fibre migration.

For access regulation, this option replaces SMP-based regulation and Article 61(3) with a requirement for all fixed operators to provide wholesale local access on fair terms, enabling dispute resolution by NRAs if no agreement is reached within two months. It requires operators of copper networks, or those previously deemed to have SMP, to provide access to ducts and poles based on cost-orientation and non-discrimination, with guidelines from the EC or BEREC. To support harmonisation, an initial list of basic wholesale products will be included in the Annex to the DNA for NRAs to consider during the resolution of access disputes.

For a more detailed description of the policy options, see Section 1 of Annex 8.

5.2.2. Spectrum

Spectrum options have been designed with the objective to ensure very high quality 5G and future 6G mobile connectivity for European businesses and citizens with the view to closing the gap with competing regions in high quality wireless networks by 2040. By creating a pro-investment predictable spectrum authorisation framework and enabling efficient use of spectrum and innovation, spectrum measures can decisively contribute to boost investment in wireless networks by 2035 and ensure quality of service needs are fulfilled, also for quality-assured services. The policy intervention will pave the way for early 6G deployment, including 6G-NTN in synergy with satellite authorisation measures described in the relevant section. The options therefore propose solutions to increase predictability, reduce fragmentation, incentivise investments in high quality mobile networks and ensure more efficient use of spectrum.

Each option progressively increases the intensity of intervention in six groups of measures that are linked with the problem drivers illustrated in Section 2.2.2, and are echoing measures which have been proposed in the Draghi report on EU competitiveness:

(i) longer **licence duration** (causal link with the driver of lack of predictability and financial attractiveness)
(ii) **harmonisation of spectrum authorisation conditions** and **consistent use of market shaping measures** (causal link with the driver of regulatory fragmentation insufficiently incentivising investments, excessive cost of spectrum, lack of predictability)
(iii) **roadmaps to ensure availability of spectrum**, including for the coordinated launch of 6G (causal link with the driver of lack of predictability and regulatory fragmentation)
(iv) **enhancing spectrum sharing** in compliance with competition law causal effect with the driver of regulatory fragmentation not ensuring efficient use of spectrum)
(v) **facilitating spectrum harmonisation for innovators** (driver of regulatory fragmentation not ensuring efficient use of spectrum), and
(vi) **ensuring sovereignty/security**, including by addressing harmful interferences (causal effect with the driver of lack of predictability and inefficient use of spectrum).

The Draghi Report proposed similar measures which have to a certain extent inspired and informed the proposed measures. More specifically, the report suggested:

1) harmonising EU-wide spectrum licensing rules and processes, including for satellite uses, and orchestrate EU-wide auction design features to create scale benefits and incentivise the consolidation of continental digital networks, a measure which is echoed in the proposed harmonisation of spectrum authorisation and award conditions and in the EU satellite authorisation;
2) harmonising the release of new frequency bands to allow investment across Member States by EU players, guarantee the timing of harmonisation and include the release of additional WiFi-dedicated bands into the spectrum guidelines, to allocate enough spectrum to 5G and 6G, which is echoed in the proposals related with the spectrum roadmap and in the proposal relevant for the petition for rule making;
3) introducing a Commission veto on auctions not following harmonised guidelines which is echoed in the proposal for mandatory spectrum single market procedure and veto on market shaping measures;
4) at least doubling the duration of frequency licences, with the possibility of reselling during their lifespan, which is echoed in the proposal for unlimited license duration by default, quasi automatic renewal and facilitation of spectrum trading and leasing;
5) banning reservations in spectrum allocation and restrict the imposition of caps for spectrum holdings only to cases of dominant position, which are echoed in the proposal with the reinforcement of the robustness of the competition assessment before imposing such remedies.

Table 15: Spectrum options and links to the problem driver and specific objective

Problem drivers	**Specific policy objectives**	**Policy options - Spectrum**		
		PO1 soft harmonisation	**PO2 more single market to enhance investment, innovation**	**PO3 strong harmonisation and EU level awards**
PD2: Spectrum regulation and market factors slowing down investment in very high-capacity mobile services	**SPO2: Close the gap with competing regions in high quality wireless networks**	**Duration: Longer licence duration** (min 25 years)	**Duration: Unlimited licence duration by default**, with safeguards for revocation and strong renewal guarantees. (For details see below)	**Duration: Indefinite licence duration**
		Assignment conditions: Toolbox of **best pro-investment /pro-efficient use authorisation practices**, developed by EC with RSPG	**Assignment conditions: Mandatory application of pro-investment** auction designs with common set of criteria to promote effective competition For **public networks,** possibility for EC to recommend pro-investment **authorisation processes aspects and conditions[210];** any deviation thereof should be justified; possibility of EC decision, if deviations persist, or to promote pan-European provision of services or to incentivise scale (e.g. 6G). For **public/non-public networks**, on request, possibility of harmonising authorisation conditions in through RSPG; possibility to establish award procedure and conditions on EU level with involvement of RSPG; possibility of one-stop-shop procedure	**Assignment conditions:** **Full harmonisation of authorisation processes aspects and conditions** (e.g. auction design, reserve prices, award fees, annual fees, coverage obligations, QoS). **Mandatory deadlines for assignments** set for every band, with **auction on standard pre-established condition** if a deadline is **passed.**
		Authorisation regime: Possibility for EC to **recommended authorisation regime** for EU harmonised bands, and promotion of **flexible licencing.**	**Authorisation regime:** Possibility for EC to **decide on authorisation regime.**	**Authorisation regime:** **EU level award** of **harmonised spectrum** for certain services. **Mandatory authorisation regime** for nationally assigned spectrum, with a possibility to request **joint selection procedure.**

[210] This measure echoes the proposal in the Draghi report to harmonise EU-wide spectrum licensing rules and processes, including for satellite uses, and orchestrate EU-wide auction design features to create scale benefits and incentivise the consolidation of continental digital networks.

Problem drivers	Specific policy objectives	Policy options - Spectrum		
		PO1 soft harmonisation	**PO2 more single market to enhance investment, innovation**	**PO3 strong harmonisation and EU level awards**
		Ex ante control: **Ex ante single market procedure** by EC and RSPG/BEREC of spectrum assignment measures resulting in **non-binding EC opinion** on measures	**Ex ante control:** **Mandatory ex ante single market procedure** by EC and RSPG/BEREC of spectrum assignment measures resulting in **EC decision** on measures with possibility of **EC veto on market shaping measures**, if they are not justified	**Ex ante control:** **Mandatory ex ante single market procedure** by EC and RSPG/BEREC of national spectrum assignment measures resulting in EC opinion with possibility of **EC veto on market shaping measures,** if they are not addressing **only** the case of **dominance**
		Coordination of assignment timing: **Spectrum roadmap** for 6G developed by EC with RSPG and regularly updated	**Coordination of assignment timing:** **National roadmaps** based on spectrum strategy and spectrum roadmaps, with obligation to authorise spectrum within less than 24 months from harmonisation, scrutinised by the EC with the assistance of the RSPG, and consequences for not respecting the timelines.	
		International governance: Recommended coordination of positions at **CEPT** on issues related to security / technology sovereignty	**International governance:** Mandatory coordination of position at **CEPT** on issues related to security / technology sovereignty	**International governance:** In exceptional cases, harmonisation work carried out by ad hoc / high-level only MSs group instead of by **CEPT**
		Petition of rule-making mechanism with EC obligation to respond to request and justify eventual refusal	**Petition for rule making mechanism** to request spectrum harmonisation with procedures and obligations for competent authorities	**Petition for rule making mechanism** with an extended scope to also cover authorisation aspects and innovative approaches to improve spectrum efficiency
		Spectrum sharing: Soft Harmonisation – 1) removing legal / regulatory obstacle for **spectrum sharing / pooling,** especially in rural/ underserved areas & 2) promoting flexible spectrum licensing	**Spectrum sharing:** **More Single Market** – 1) stronger and more coordinated **EU approach** through **mandatory spectrum sharing (**subject to technically feasible and not distort competition), including "use it or share/lose it" conditions and dynamic geolocation databases & 2)	**Spectrum sharing:** **Hard Harmonisation - Mandatory EU framework** for spectrum sharing across all EU-harmonised bands and generalise use of dynamic geolocation database systems to all bands.

Problem drivers	**Specific policy objectives**	**Policy options - Spectrum**		
		PO1 soft harmonisation	**PO2 more single market to enhance investment, innovation**	**PO3 strong harmonisation and EU level awards**
			address barriers to assigning spectrum to wholesale network operators	
		Cross-border harmful interference issues: - **deadlines** introduced in current mechanism for solving issues **between Member States** - **enhance solidarity** in case of issues with **third countries**	**Cross-border harmful interference issues:** - mechanism for solving **issues between Member States** with deadlines extended to **non harmonised spectrum** - **enhance solidarity** in case of issues with **third countries**	**Cross-border harmful interference issues:** - mechanism for solving **issues between Member States coupled** with **private enforcement** - **mechanism** for **coordinating Member States response** under RSPG to **issues with third countries**

Safeguards for indefinite duration of licenses

While unlimited duration of licenses provides regulatory predictability for spectrum users and allows the development of a functioning secondary market for spectrum trading and leasing, it could have negative effects on competition, if it is not subject to strict conditions. The risk that indefinite duration of licenses would prevent market entry and reduce competition, availability, quality of services, and investment incentives[211] could however be addressed through **regulatory safeguards** that protect competition and prevent spectrum hoarding, a number of which have already been integrated into various licensing regimes, such as obligations to provide wholesale access or enable spectrum sharing. Such measures will be subject to *ex ante* single market procedure under the new rules.

By choosing appropriate authorisation conditions - such as "use-it-or-share-it or lose-it" conditions and rollout obligations - and by enforcing them, the regulators would ensure spectrum would not be left idle or blocked and would be made available to more efficient or innovative competitors. They can also combine long or indefinite durations with periodic checkpoints, conditional renewal regimes or revocation powers that allow rights to be reviewed, adjusted, or withdrawn, if needed for spectrum management or public interest objectives. For example, such licences could be revoked in case of technical or market developments justifying new assignment (such as reduced interest of customers for a service provided by certain technology or lack of competition).

Indefinite duration of rights of use does not hinder the deployment of up-to-date technologies as rights of use are granted under the principle of technology neutrality. This facilitates a smooth transition between successive technology generations (e.g. from 4G via 5G to 6G). The combination of indefinite duration and technology neutrality enables operators to adopt the latest and most efficient technologies as soon as they emerge, ensuring flexibility and continuity in network evolution. Since mobile markets are largely competitive, market pressure is forcing operators to constantly invest to retain the competitive edge.

Overall, while long or indefinite licences raise valid concerns, these can be addressed through well-established policy tools that balance the need for long-term investment certainty with the preservation of a dynamic, competitive, and efficient spectrum market. There is already experience with long or indefinite duration licenses and simplified renewals already in other jurisdictions, such as in the UK or the US[212], from which lessons are drawn. In any case as indicated in Section 2.2.2. with full 5G there are limitations to the economically viable duplication of networks given high investment costs.

Feasibility of spectrum sharing options

Spectrum sharing has been already used by several jurisdictions to open previously underutilised spectrum to a wide range of applications, including private enterprise networks, industrial sites, and rural broadband, as indicate the examples from the UK, where sharing is enabled in several bands, and the US, where dynamic spectrum sharing is increasingly used.

Spectrum sharing arrangements should be in compliance with competition law and agreements will be subject to the competition law single market procedure by the national competent authority. In particular, sharing would primarily apply between services which are not in direct competition (e.g. between mobile and Wi-Fi or between mobile and PMSE). Intra service sharing would be feasible provided that it would not distort competition, for example by ensuring that commercially sensitive

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[211] See BEREC input.

[212] See section 2.2.2.3 for FCC streamlined and harmonised license renewal and service continuity rules.

information is not made transparent or exchanged between the competing parties. The technical feasibility and economic viability of spectrum sharing would be determined on a case-by-case basis, taking into account technological development, implementation costs, and stakeholders' market strategies. Technical feasibility and related risks will be assessed through CEPT studies and taken into account in Commission implementing decisions on spectrum harmonisation. The authorisation of specific spectrum sharing arrangements by Member States (or the Commission in relevant scenarios) should be informed by EU-level opinions of the Radio Spectrum Policy Group and by extensive stakeholder consultations. The imposition of use-it-or-share-it conditions may entail the risk of inadequate assessment of technical and/or economic feasibility and therefore should be subject to single market procedure, e.g. in the peer review process. Duly justified spectrum sharing arrangements and/or obligations could also be considered as part of the evolving EU spectrum roadmap.

As regards spectrum sharing, the different options differ regarding the level of harmonisation.

Option 1 focuses on removing legal or regulatory barriers to spectrum sharing or pooling and promotion of flexible spectrum licensing, e.g. licences limited to a particular location or time period, especially for verticals, through non-binding measures (guidelines, best practices).

Option 2 introduces a stronger and more coordinated EU approach, through legally binding measures. Spectrum sharing would be mandated where technically feasible, and does not distort competition. It would be integrated into standard regulatory practice for selected harmonised bands. Generalised use of "use it or share it or lose it" condition would ensure the efficient spectrum use of spectrum and act as a safeguard against spectrum hoarding in the case of indefinite-duration licences. To move to dynamic ways of spectrum sharing that are already in use in other jurisdictions, the option includes also development of dynamic geolocation databases in frequency bands where sharing would be most beneficial. It would also address possible barriers to assigning spectrum to wholesale network operators.

Option 3 establishes a mandatory EU framework would be established to impose spectrum sharing across all EU-harmonised bands. Under this framework, the use of dynamic geolocation database systems would be generalised to all bands.

While spectrum sharing may contribute to a more efficient use of spectrum, it could also raise concerns with regards to its compliance with competition law. For this reason, all options involving spectrum sharing in this impact assessment are considered as involving spectrum sharing in compliance with competition law.

For detailed description of the policy options, see section 2 of Annex 8.

5.2.3. Authorisation

The key aim of the measures related to general authorisation and authorisation for satellite services is to simplify and harmonise the fragmented regulatory environment.

The three options aim to improve conditions for resilient and scalable pan-European digital networks and services, but with differing levels of harmonisation and market impact. option 1 partially harmonises authorisation and strengthens enforcement, reducing some fragmentation but leaving authorisations largely national, including for satellite spectrum. option 2 establishes a "single passport" for the general authorisation of all networks and services excluding satellite and an EU level simplified authorisation and, if relevant, EU-level selection for satellite spectrum, creating

coherent cross-border conditions and enabling market scale, and combined with coordinated enforcement at EU level to establish a level playing field in satellite. option 3 applies country-of-origin authorisation EU-wide, simplifying compliance and accelerating deployment, but risks regulatory arbitrage and uneven enforcement.

All options for simplified authorisation regimes work in complement with the simplification of other relevant DNA rules, which can represent barriers to cross-border operation and provision of innovative services. These include guidance for voluntary cooperation in the broader ecosystem to avoid litigation as well as more harmonised end-users rules, with less possibilities for Member States to derogate, while keeping strong protection for consumers.

Table 16: Authorisation options and links to the problem driver and specific objective

Problem drivers	**Specific policy objectives**	**Policy options - Authorisations** **General authorisation and authorisation for satellite services**		
		PO1 Partial harmonisation of authorisation	**PO2 "Single "passport" for other networks and services than satellite and an EU-level authorisation for satellite spectrum**	**PO3 Country-of-origin authorisation for cross-border and B2B services**
PD4 Fragmented authorisation conditions, not allowing to operate across the EU	SPO4**:** Increase pan- EU network operation and service provision General authorisation	Emphasis on enforcement of the EECC GA regime. National notification is still required in each MS. The notification process is simplified only for cross-border operators (BEREC Office not a MS is notified, and it informs the concerned NRAs/CA)). Focusing Commission on implementing acts for security of public ECNs and ECS to facilitate compliance with security requirements; Improvements to the non-mandatory notification template by BEREC Issuing a non-mandatory reporting template by BEREC Upgrading the BEREC Database on notifications	Notification in one Member State and "Single passport" issued by a Member State chosen by the provider (MS of notification). This MS triggers the coordination process for providers launching new networks or services, and for existing providers that choose to operate under the Single passport regime. It is optional for purely local providers, but once a cross-border provider requests it, the MS must issue it. BEREC issues Guidelines, in cooperation with the Commission and other competent authorities, on consistency, coherence and streamlined applicable further harmonised GA conditions (approximation of conditions). More coherent requirements, and esp., non-DNA related via a facilitating mechanism based on coordination between Member States to facilitate compliance. Enforcement remains at the country of destination level based on EU-wide pre-coordinated conditions and requirements	Limited to certain service providers only of cross-border nature; GA conditions of only one Member State apply while other should respect, mutually recognise and assist the country of origin in exercising enforcement powers. GA remain national i.e., of only one Member State.

Problem drivers	Specific policy objectives	Policy options - <u>Authorisations</u> General authorisation and authorisation for satellite services		
		PO1 Partial harmonisation of authorisation	**PO2 "Single "passport" for other networks and services than satellite and an EU-level authorisation for satellite spectrum**	**PO3 Country-of-origin authorisation for cross-border and B2B services**
			Unleashes cross-border provision of networks and services and is adjusted according to the technology evolution and transition to more software-based networks and more virtualised services.	
PD4 Fragmented rules, in particular in authorization, not allowing to operate across the EU	**SPO4: Increase** pan-EU network operation and service provision Satellite spectrum authorisation	**EC** empowered to conduct **selection procedure** for licencing **satellite spectrum** for **pan-EU services;** however, spectrum assigned at national level under **common template** for authorisation conditions	**Simplified authorisation at EU level for satellite spectrum**: EC empowered to **issue declarations** to provide satellite networks or services and **authorisations to use relevant spectrum** including individual rights of use of spectrum, in the relevant Member States or the entire EU **Full harmonisation of authorisation conditions** **Selection at EU level** in case of spectrum scarcity Binding **EU-level compliance and enforcement framework** for access to the EU market, with possibility of authorisation withdrawal for the entire Single Market	**EC** empowered to **conduct a selection procedure** for licensees of MSS satellite spectrum for the **provision of pan-European services** **EC** supported by RSPG and BEREC Office to set **common requirements** for access to EU satellite market and create a **coordinated compliance and common enforcement mechanism** **Country of origin** issues the **rights of use** following the common requirements and **imposes sanctions** in case of non-compliance

For detailed description of the policy options, see section 3 of Annex 8.

Other relevant DNA rules, which can represent barriers to cross-border operation, such as end-users rules would be streamlined, with less possibilities for Member States to derogate, while keeping strong protection for consumers.

5.2.4. Governance

Key aim of this intervention area is to create a governance system both for market regulation and spectrum management that is suitable for the new EU level tasks with Single Market dimension and allows for decision taking on the most efficient level. Apart from addressing the specific objective of adjusting regulatory competences and roles to deepen the Single Market for connectivity, the options aim to accommodate the tasks stemming from preferred options in other policy areas in the best way possible in line with the specific objective.

Table 17: Governance options and links to the problem driver and specific objective

Problem drivers	Specific policy objectives	Policy options		
		PO1: BEREC and RSPG as two separate bodies supported by the BEREC Office	**PO2: EU agency (BEREC and BEREC Office merged), providing an office to the RSPG**	**PO3: Two separate agencies – BEREC + BEREC Office & RSPG**
Insufficient cooperation and fragmented regulatory approaches	SPO4: Deepen the Single Market for connectivity through adjustment of regulatory competences and roles	Participation of Office's staff in BEREC and RSPG working groups, possibly taking over some co-chairs' workload, to increase BEREC and RSPG impact on harmonisation. Improved cooperation between BEREC and RSPG thanks to the common Office. Enhanced cooperation with other agencies, expert groups and bodies through the contacts at the BEREC Office level.	Merging BEREC and BEREC Office into an agency to increase its involvement in the substance work and facilitate harmonisation. Otherwise as in option 1.	BEREC & BEREC Office as in option 2. RSPG as an agency will take over some decision-making powers from the Commission. Enhancing cooperation between the two agencies would be ensured by regular check-point meetings; reaching out to other EU agencies, expert group and bodies.
		Mandating representation of other CAs each time a subject within their remit is discussed within BEREC. NRAs will perform a role of national contact points responsible for coordinating and presenting their positions at the BEREC level.	As in option 1.	As in option 1.
		Strengthening of the BEREC Office to enable it to support BEREC and RSPG both on administrative tasks and on substance. Thanks to links with both BEREC and RSPG, and cooperation with other relevant authorities, the Office with gain an overview of different aspects of market functioning.	EU agency merging BEREC and its Office will streamline its internal structure. It will be equipped with staff able to take on more tasks, including decision-making tasks in the future. This would improve the relevance and coherence of its outputs. Otherwise as in option 1.	Two fully fledged agencies equipped with staff able to take on more tasks, including some decision-making on spectrum and in the future other decision-making tasks. Having two separate agencies responsible for electronic communications and spectrum will strengthen the EU-level responsiveness. The coordination aspect will however be weakened due to separation between BEREC and RSPG.

For detailed description of the policy options, see section 4 of Annex 8.

5.2.5. Options discarded at an early stage

Fibre transition – discarded options and approach to choosing the best combinations of the options component

A wide range of policy combinations are available. For copper switch-off, options range from deregulatory to highly interventionist approaches along the following lines:

- Full deregulation: removal of existing CSO provisions (e.g. Article 81 EECC) and leaving switch-off entirely to the market. (
- Non-binding target date: a legislative recommendation without enforceability.
- Conditional CSO requirement: mandatory CSO only in areas meeting predefined conditions (FTTH availability and equivalent quality/price alternatives).
- Unconditional CSO requirement: mandatory switch-off by a fixed deadline regardless of alternative infrastructure conditions.

Similarly, access regulation could follow several pathways:

- Highly deregulatory: replace SMP framework with a narrower "bottleneck" approach focused on a single closed network.
- Maintain SMP framework with minimal amendments: simplification where possible (removal of unused and potentially incoherent measures) and limited adaptations to improve usability of measures that have proven to be valuable where applied such as Article 22 (geographic surveys) and Article 61(3)
- Maintain SMP framework with more substantial improvements: of the existing regime with simplification where possible (removal of unused and potentially incoherent measures) and more extensive adaptations to improve usability of measures that have proven to be valuable where applied such as Article 22 (geographic surveys) Article 61(3), as well as strong guidance regarding wholesale access specifications, requiring justification for departure.
- Symmetric regulation: replace the existing access regime with a broader set of access obligations for all operators

The combinations that were ultimately selected for full analysis are shown in the following table.

Table 18: Range of potential policy choices

	CSO deregulation	Non-binding CSO	Conditional CSO	Unconditional CSO
Access deregulation (bottleneck)	Option 3			
Access status quo with small amendments		Option 1		
Access status quo with more significant amendments			Option 2	
Symmetric access regulation – all players provide access				Option 4

These combinations (Options 1-4) combine policy choices with the same level of intervention for both components, copper switch-off and access regulation. Thus they are the most coherent combinations. They also cover a sufficiently wide range of approaches from market based to strong EU-level involvement. For example:

- Extensive deregulation of wholesale access on the assumption that the market would function better in the absence of intervention in delivering FTTH investment is compatible with a laissez faire approach to copper switch-off, as the market could be assumed in this context also to deliver CSO when appropriate for investors and end-users. Under such a scenario it would also be logical that the market would be assumed to deliver appropriate wholesale access products and thus no provision is made for EU-level standardisation. This is captured in option 3.

- An incremental approach to CSO, based on non-binding deadlines established in legislation, and therefore leaving discretion to Member States is coherent with an incremental approach to access regulation, where the existing regime is maintained but complemented with non-binding but legislatively backed guidelines on wholesale access product specifications, and minor amendments to address identified problems e.g. in data gathering and lack of attention to Article 61(3). This is captured in option 1.

- A mandatory, but conditional approach to CSO (to address concerns about the potential impact of an unconditional approach on end-user) is compatible with an approach which introduces a requirement for NRAs to gather data about CSO and to conduct market analyses relating to CSO to ensure that wholesale access regulation is fine-tuned to support the mandatory CSO process and to secure positive consumer outcomes (e.g. by ensuring that wholesale access regulation is adjusted as needed to reflect changes in market structure resulting from CSO). This approach, of setting binding requirements, but with some flexibility to deviate at national level based on national circumstances is also consistent with the policy pursued under option 2 of introducing a requirement for NRAs to follow best practice wholesale product specifications unless they can justify the alternative approach proposed.

- A mandatory and unconditional approach to CSO with a deadline of 2030 is unlikely to leave sufficient time for a market analysis process to address any issues resulting from the associated changes in market structure. A blanket obligation in this case for all operators owning access networks to offer wholesale access (without the need to assess an intervention threshold in this regard) would be needed to ensure that customers can be transitioned from the decommissioned copper networks to alternative networks. At the same time, if there is an obligation applying on all operators to offer wholesale access (rather than those with market power or control of an asset that is hard to duplicate), it would be disproportionate to mandate strict price control or require strict specifications regarding the wholesale products offered. Thus, under option 4, the symmetric obligation to offer access is associated with an obligation to do so under fair and reasonable terms and conditions, and is likely to apply to bitstream rather than physical or virtual unbundling.

Other combinations of policies relating to copper switch-off and wholesale access were considered but rejected on the basis that they were not internally coherent.

6. WHAT ARE THE IMPACTS OF THE POLICY OPTIONS?

6.1. Transition to fibre

The quantification of economic and environmental impacts associated with the different options for the transition to fibre is based on a 3-step process. First, the effects of the different policy options on FTTH coverage and take-up as well as their capability to promote competition in broadband quality (via infrastructure competition where viable or otherwise access regulation permitting full differentiation) are assessed. Then the projected increases in FTTH coverage and take-up is translated

into average speeds and per user consumption. Second, the effects of increased take-up of FTTH and increased speeds on GDP are estimated. Lastly, the effects of broadband speeds on data consumption are analysed to quantify the implications for electricity consumption and CO2 emissions. The relevant impacts are estimated for 2030 and 2035 to capture the short-term and mid-term impacts of the options. The complete methodology and results are described in detail in Annex 4.

Table 19: Quantitative and qualitative analyses performed

	Quantitative analysis	Qualitative analysis
Macroeconomic impacts (GDP)	✓	
Conduct of business (coverage, take-up and speed)	✓	
Position of SMEs	✓	✓
Administrative burdens on businesses	✓	✓
Sectoral competitiveness, trade and investment flow		✓
Functioning of the internal market and competition		✓
Public authorities	✓	✓
Technological development / digital economy	✓	✓
Territorial impacts (specific (types of) regions and sectors		✓
Innovation		✓
Resilience, technological sovereignty		✓

Gigabit broadband delivers direct benefits to citizens as well as indirect benefits to society. Examples of direct benefits include home care applications, quick and efficient emergency response, greater educational opportunities, support for teleworking and improved entertainment options.

In addition to boosting consumer welfare, these applications can also save money both for the individuals concerned and for the service provider. A quantitative model estimation[213] of the projected social impacts of faster broadband speeds (although not FTTH per se) shows that the increase in teleworking driven by faster broadband would save about 60 million hours of leisure time per annum in the UK between 2008 and 2024. In addition, by avoiding commuting costs, it estimated total household savings of GBP 270 million (EUR 310 million) per year. Furthermore, it projected that increased productivity from teleworking could reach GBP 1.8 billion (EUR 2.1 billion) by 2024.

Faster broadband can also support more efficient delivery of healthcare. A study assessing developments in Sweden[214] found significant savings in using digital FTTH-based homecare especially in rural areas. It concluded that even with limited adoption, these solutions could contribute to annual net cost reductions of USD 0.6 million (EUR 0.5 million) in a rural municipality with 8 000 residents by 2020. Overall, reliable and fast connectivity has a clear positive social impact, and its

[213] SQW (2013), UK Broadband Impact Study. The study looked at the impact of faster broadband speeds being available from 2008 onwards. 2008 was the launch date for Virgin's 50Mbit/s service.
[214] Forzati, M. and C. Mattson (2014), FTTH-enabled digital home care – A study of economic gains, Department for Networking and Transmission, Acreo AB.

future potential is likely to grow. However, a quantification of the social impact is not possible. Consequently, the social impact of options cannot be assessed in detail.

In addition to energy and CO2 savings, the copper switch-off may have other environmental benefits such as mitigation of water pollution. According to an investigation by the Wall Street Journal, cables covered in toxic lead laid decades ago by telecom companies pose a health hazard in the USA[215]. Lead-sheathed telecom cables may be also found in the EU[216] Replacing lead-sheathed cables with fibre optic ones reduces any actual or perceived environmental risks.

The primary impact of the copper switch-off and access measures are on FTTH coverage, FTTH take-up and download speed. The different options of the transition to fibre impact in different ways both the coverage and the take up of the FTTH network. Copper switch-off is expected to lead to increased FTTH coverage, by removing unviable network duplication from legacy copper networks. In doing so it reduces penetration risk (i.e. low take-up) on FTTH networks, improving the business case for FTTH deployment. Specifically, the mandatory copper switch-off date, with and without sustainability conditions respectively in options 2 and 4 is expected to accelerate the fibre deployment until 2030 compared to options 1 and 3. However, option 4 may lead to a deceleration of FTTH coverage afterwards, as many subscribers will be forced to switch to mobile/wireless technologies and their willingness to change to fibre afterwards remains to be seen, especially in the case where their new connections perform well. On the other hand, option 2 is expected to achieve similar FTTH coverage in a less intrusive and a more user-friendly way.

The numbers presented below are projected average values for the EU.[217] The underlying calculations assume that the sustainability conditions allow for the continued operation of copper networks in areas with insufficient FTTH coverage (below 95%) for a maximum of five years.

Table 20: FTTH coverage[218]

Year	Option 0	Option 1	Option 2	Option 3	Option 4
2030	78%	79%	83%	77%	84%
2035	91%	93%	98%	86%	98%

Source: WIK

Table 21: FTTH take-up[219]

Year	Option 0	Option 1	Option 2	Option 3	Option 4
2030	48%	51%	55%	47%	61%
2035	59%	67%	78%	53%	80%

Source: WIK

[215] The Wall Street Journal, America Is Wrapped in Miles of Toxic Lead Cables, 9 July 2023.
[216] FinanzNachrichten.de, RESEARCH/Berenberg: Altkabel-Blei geringeres Telekom-Problem in Europa, 17 July 2023.
[217] The projected values were calculated by WIK based on its own model.
[218] Fibre coverage figures refer to the share of households passed by a fibre network.
[219] Fibre take-up figures refer to the share of FTTH subscribers among all households.

The availability of fibre networks is anticipated to affect the mixture of access technologies in the access network after the CSO, which in turn impacts the average download speeds of the subscribers. Better results for FTTH take up in 2030 are anticipated for options 2 (55%) and 4 (61%). In addition, option 4 eliminates FTTB/G.Fast due to the mandatory nature of the CSO in 2030, but on the other hand it leads to an increased percentage of 4G/5G mobile only technologies (15%, while 7% for all other options in 2030). In the course of time until 2035, option 2 is expected to reach similar FTTH share (78% compared to 80.4% of option 4), but with a significantly higher penetration of cable networks (9% vs 3%). This impacts the expected download speeds in 2035: while option 4 has the best performance in 2030, in the longer term, the access network technology mixture of option 2 leads to a better outcome (7% better performance than the second best, reaching an average speed of 743 Mbps).

Table 22: Download speed (Mbps)

Year	Option 0	Option 1	Option 2	Option 3	Option 4
2030	293	301	314	288	328
2035	584	651	743	542	691

Source: WIK

The changes in coverage, take-up and speed translate into an impact on GDP over 10 years (2025-2035) for the entire EU. The GDP impact is estimated based on several econometric studies showing a positive causal relationship between adoption of high speeds and GDP growth.[220]

The coefficient used to reflect this relationship falls within the identified range of 0.01 to 0.08, reflecting the full span of values reported in recent studies[221] . This range is presented to illustrate the sensitivity of the results and to ensure that all plausible eventualities are covered. However, based on the weight of the empirical evidence and recent findings highlighting the gradual materialisation of economic benefits as households and firms adapt their behaviour and undertake complementary investments, a coefficient of 0.06 is considered the most robust and policy-relevant estimate. This value is therefore used as the central assumption throughout the Impact Assessment.

The monetized positive impacts on the GDP corresponding to different coefficient values are presented in the table below. In addition to the central coefficient (0.06), results are shown for the lower and upper bounds (0.01 and 0.08) and for one additional lower-range value (0.03), in order to illustrate the sensitivity of outcomes to alternative assumptions.

Table 23: Accumulated GDP impact (2025-2035) of options (EUR billion)

Coefficient	Option 0	Option 1	Option 2	Option 3	Option 4
0.08	**2 073**	**2 179**	**2 514**	**1 938**	**2 388**
0.06	**1 535**	**1 679**	**1 862**	**1 437**	**1 761**

[220] Study on Access Regulation, section 6.3.

[221] See: Briglauer, Wolfgang; Krämer, Jan; Palan, Nicole (2023): Socioeconomic benefits of high-speed broadband availability and service adoption: A survey, Research Paper, No. 24, EcoAustria - Institute for Economic Research, Vienna, available at: https://hdl.handle.net/10419/279416.

0.03	**753**	**822**	**910**	**706**	**862**
0.01	**248**	**270**	**299**	**233**	**238**

It should be mentioned that the upper part of the empirically supported range is considered as the most appropriate for the estimation of the impact, in a forward-looking context, given the currently limited gigabit take-up in the EU27. This value reflects the "speed → adoption → productivity → GDP" pathway and the cumulative nature of the associated economic effects.

Moreover, a linear relation was assumed for the estimation of the impact of the increase in download speed on the annual GDP growth. It is the simplest approach, and it lies in the midway between the more conservative degressive and the more optimistic progressive approaches. However, it should be stressed that irrespective of the approach, there is always a positive correlation, as the GDP is expected to benefit (i.e., increase) from the increase in the download speed.

The environmental impact of the transition to fibre, namely the CO2 emissions, result from the electricity consumption of the different options. More specifically, CO2 emissions are estimated by multiplying total electricity consumption by the corresponding year-specific emission intensity factor[222]. Energy consumption in fixed networks is closely tied to the number of active access lines, the type of technology used, and the capacity of network equipment installed. It is usually expressed in kWh per line per year, and the total consumption can be modeled as a function of subscriber migration between technologies with different per-line energy profiles. The emission intensity factor is declining due to the percentage increase of the renewable energy sources. Finally, to monetize the environmental impact of greenhouse gas emissions, a fixed damage cost set at EUR 800[223] per tonne of CO_2 e has been used.

The following table presents the monetary effect of the different options.

Table 24: Monetary effect of the environmental impact of the different options in EUR billion

	Option 0	**Option 1**	**Option 2**	**Option 3**	**Option 4**
Aggregate t CO2e (m)	13.7	13.6	13	13.7	12.5
EUR billion	10.96	10.88	10.4	10.96	10
Difference from baseline	0.00	-0.08	-0.56	0.00	-0.96
Difference (%)	0.0%	-0.7%	-5.1%	0.0%	-8.8%

[222] https://www.eea.europa.eu/en/datahub/datahubitem-view/3b7fe76c-524a-439a-bfd2-a6e4046302a2?activeAccordion=1091606.
[223] https://www.umweltbundesamt.de/daten/umwelt-wirtschaft/gesellschaftliche-kosten-von-umweltbelastungen#gesamtwirtschaftliche-bedeutung-der-umweltkosten.

It becomes thus obvious that the options envisaging a definite CSO date outperform the other options. The larger percentage of cable access network in option 2 than in option 4 has this time a negative impact, as the electricity consumption per subscriber in HFC networks is quite big.

It should be mentioned that options 2 and 4 would also be linked with more environmental benefits in terms of lower CO2 emissions per GB consumed than options 1 and 3 due to the higher share of FTTH in the technology mix. Under option 2, there is a reduction in electricity intensity for data traffic, from around 0.18 kWh per GB to 0.05 kWh/GB, a reduction of around 71% from 2025 to 2035. This value is 14% lower in option 2 compared to the status quo scenario.

The Universal Service Obligation (USO) option chosen and included under all options, maintains largely the status quo but would address potential gaps following copper switch-off and ensure that vulnerable groups have access to the services needed to enable social and economic participation in an environment where there is further reliance on online services. Based on the extrapolation of current data, USO would not have an impact on average speed and coverage.

6.1.1. Option 1: Non-binding copper switch-off and updated access regulation

Economic: This option results in a relatively low increase in GDP of EUR 144 billion (compared to baseline).

Environmental: This option results in a small decrease (0.7%), corresponding to EUR 0.08 billion, in CO2 emission (compared to baseline) over the period 2025-2035.

Societal: Due to the non-binding nature of the copper switch-off, this option interferes only minimally with copper network operators' commercial freedom to operate or to switch off their network. This option would achieve only incremental improvements to the technology mix but also avoid market disruptions thus it is unlikely to have negative societal impacts and, in particular, no impact on vulnerable consumer groups is expected.

6.1.2. Option 2: Conditional copper switch-off and updated access regulation

Economic: This option results in the highest GDP impact with an increase in accumulated GDP of EUR 327 billion (compared to baseline). It delivers the highest coverage (together with option 4) and the second highest take up in longer run.

Environmental: This option results in a 5.1% (EUR 0.56 billion) decrease in CO2 emission (compared to baseline) over the period 2025-2035.

Societal: The mandatory copper switch-off, subject to conditions, represents a restriction to the "freedom to conduct a business" enshrined in Article 16 of the EU Charter of Fundamental Rights. Limitations of this freedom are possible if they are found to be necessary to achieve a recognised objective of general interest, but they must be proportionate. Operators have been replacing parts of their copper networks with fibre based on their own business considerations. This indicates that copper switch-off is not contrary to their interests. Due to its positive social, economic and environmental impact, this option seems in line with the principle of necessity. In addition, the sustainability conditions and the possibility to allow the continuation of copper network on a longer timeframe ensure that this option respects the principle of proportionality.

Under this option, most end-users would migrate to FTTH, with associated improvements in service quality. Some end-users would need to migrate to wireless or mobile alternatives, but the sustainability conditions ensure that the overwhelming majority of end-users (at least 95%) will

benefit from improved services without (any significant) price increases. Further, Member States would remain responsible for ensuring that adequate broadband services are available, using USO provisions where needed, and including also other safeguards and coverage by alternative technologies in the areas where fibre deployment is not viable after 2035. The risks for vulnerable consumers are present but significantly mitigated by these protections.

6.1.3. Option 3: Market driven copper switch-off and bottleneck-based access regulation

Economic: This option results in a EUR 98 billion decrease in GDP (compared to baseline).

Environmental: Compared to the baseline scenario, this option results in an identical environmental impact over the period 2025-2035.

Societal: This option leaves the copper switch-off process to the operators. Thus, it does not restrict the freedom to conduct business. It would alter the technology mix in a way that removes existing safeguards supporting retail broadband competition. This would likely lead to market consolidation and reduced competition. The resulting higher prices would disproportionately affect vulnerable consumers, including low-income households and individuals in constrained market segments.

6.1.4. Option 4: Mandatory copper switch-off and symmetric regulation

Economic: This option results in a EUR 226 billion GDP increase (compared to baseline). It scores the highest in terms of FTTH coverage and take-up.

Environmental: This option results in the biggest decrease (9% - EUR 0.96 billion) in CO2 emission (compared to baseline) over the period 2025-2035.

Societal: This option mandates copper switch-off without sustainability conditions. Therefore, it intervenes strongly with the freedom to conduct business.

Option 4 could result in a large proportion of copper-dependent consumers—including the elderly, disabled, and those in remote locations—being disconnected and obliged to rely on mobile or wireless connectivity instead. These alternatives may not always match the quality or reliability of copper, potentially leading to deterioration in the consumer experience.

6.2. Spectrum

6.2.1. Option 1: Soft harmonisation

The main **economic impact** of spectrum option 1 is an increase in investments in high quality mobile networks driven by soft harmonisation measures. Part of the impact on GDP calculated over a period from 2025 to 2035 is estimated using a model linking changes in mid-band coverage, take-up and speed to GDP, based on econometric evidence of a positive relationship between increased adoption and internet speed and economic growth.[224] This option's overall indicative GDP impact for the EU over 2025 to 2035 is estimated at EUR 1 505 billion compared to EUR 1 480 billion under the

[224] Study on Access Regulation, section 6.3.

baseline. To account for potential uncertainties of the model,[225] a sensitivity analysis has been performed, assuming a smaller or larger impact of increased mobile broadband speeds on productivity and GDP and yielding an estimated GDP impact ranging from EUR 174 to EUR 2 049 billion.[226] Beyond the modelled effects, additional spillover effects on different sectors are expected from 5G, IoT and future 6G deployment. However, impacts related to accelerating the transition to 6G cannot yet be quantified, as commercial launch of 6G is still around five years away. These estimates are consistent with the literature on the global economic impact of 5G. For example, Oxford Economics estimates an impact of USD 2.1 trillion by 2030. PwC forecasts a total impact of USD 1.3 trillion until 2030[227] .

The **environmental footprint** of mobile networks under option 1 is estimated at 5 252 490 t CO_2 eq of mobile/wireless broadband network emissions which is less than the 5 257 074 t CO_2 eq under the baseline scenario.[228] Emissions are expected to be significantly lower in 2035 compared to 2025 even under the baseline, driven partly by lower electricity consumption per unit of data traffic resulting from the shift to a more performant 5G technology and partly by a reduction in the emissions intensity of electricity generation. Differences in total emissions between the options are negligible. When monetised, environmental impacts are very similar across options, at approximately EUR 4.63 billion under the baseline and around EUR 4.62 billion under options 1, 2 and 3, a marginal improvement.[229]

The proposed options are expected to have positive **societal impacts**, particularly for digital inclusion, social equity, and public service delivery. Higher coverage reduces geographic and socio-economic connectivity gaps by expanding individuals' effective access to digital communication, information, and public services. At the same time, high QoS, defined by reliable, high-speed and low-latency connections, determines whether users can meaningfully engage in digital activities such as online education, telehealth, mobile banking, remote work and other services with specific quality requirements. Together, these factors strengthen social and community ties, support participation in civil society, and promote economic integration, particularly in rural or underserved areas. However, their inclusive impact depends on complementary conditions such as affordability, digital literacy, and the existence of supportive institutional frameworks. option 1 is expected to deliver a moderate improvement in societal outcomes, as longer licence duration and improved roadmap coordination may help accelerate the reduction of disparities in network rollout between urban and rural areas.

The narrow scope and non-binding nature of measures entails low to moderate **costs** for competent authorities and operators, outweighed by benefits. In terms of direct compliance costs, the toolbox of good practices has low compliance burden and limited one-off adjustment costs. Longer licence

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[225] These uncertainties reflect, inter alia, the reliance of Briglauer et al. (2025) on pre-2019 evidence capturing 4G rather than 5G related improvements, and the fact that the estimate accounts for mobile broadband adoption rather than directly quantifying speed increases. See Annex 4, section 2 for further details on the model and the corresponding sensitivity analysis.

[226] These estimates are based on the application of the lower and higher extreme coefficient estimated by Briglauer et al. (2025), therefore 0.01 % and 0.113 % compared to 0.048%. For details see Annex 4, section 2.

[227] Oxford Economics (2023). The Global Economic Potential of 5G-Enabled Technology. PwC (2021).

[228] The reported CO_2 values are based on a model presented in Annex 4.2. They reflect a defined set of assumptions and should be interpreted as outputs of a scenario-based estimation rather than precise measurements. Potential uncertainties of the model are addressed through a sensitivity analysis of environmental impacts in Annex 4, section 2.2.6. Depending on the assumed annual energy-efficiency improvement factor (5%–30%), total emissions associated with Option 1 range approximately between 5,106,615 and 5,682,062 t CO_2 eq, while differences between policy options remain very small.

[229] Greenhouse gas emissions are monetised using a fixed damage cost of EUR 800 per tonne of CO_2 eq, based on estimates by the German Environment Agency (UBA).

duration rules imply changes but will simplify licensing over time. More stringent upfront conditions (e.g. coverage, investment milestones, QoS) may require moderate additional resources. Mandatory peer review would entail modest administrative costs, but legal complexity and enforcement risks are low. Increased coordination of award timing would require regular exchanges between institutions. The structured competition assessment may add modest costs but help prevent distortive awards. Promoting flexible authorisation and spectrum sharing in line with competition law may entail moderate compliance costs where new procedures or technical tools are required. Smaller operators may face transitional capacity-building costs, outweighed by efficiency gains in spectrum use. As the measures are largely non-binding and coordination-based, enforcement costs are minimal. Additional monitoring of licence conditions and interference is manageable. In terms of short-term indirect costs, adapting to new licence conditions could require capacity building. Longer licence durations may also reduce flexibility, where needs or technologies evolve rapidly, mitigated by mid-term reviews.

Regarding **benefits,** regulators and spectrum authorities may see legal costs decline over time through peer learning and reduced litigation or renegotiation. Operators benefit from lower risk premiums and more predictable obligations. A key direct benefit of option 1 is the adoption of minimum 25-year licence duration with conditional renewal, balancing investment security and accountability. Good practices for spectrum authorisation may enhance coherence and predictability, improving auction efficiency and leading to more balanced trade-offs between price-based and coverage-based objectives. However, competent authorities would still maintain large flexibility in auction design, limiting predictability in a manner similar to the baseline. Also, the absence of a veto power on market shaping measures might still occasionally lead to insufficient investment incentives and unexploited opportunities to increase quality of service. Mandatory notification of authorisation procedures and peer review would improve transparency in spectrum award conditions. Overall, the role of competent authorities, especially regarding measures implemented at national/local level, will be important as they will be the main enforcers of the rules responsible for coherence improvements.

Coordinating award timing on the basis of evolving roadmaps may foster investment planning and incentivise more synchronised technology adoption, especially where competent authorities use their powers to adjust the duration of rights to ensure simultaneous expiry, as currently provided for under Article 49(4) EECC. For end-users, it may lead to better service availability and quality, particularly in border regions affected by interference. By moderately improving policy coherence, reducing fragmentation, and preventing interference, option 1 contributes to wider macroeconomic and social benefits. Efforts for prior coordination in harmonisation work within CEPT in security or technology sovereignty may promote early alignment on sensitive topics, fostering a more cohesive EU position. Good practices for spectrum sharing and flexible authorisations may enhance **efficient spectrum use** by exploiting underused bands more efficiently. Common criteria and structured peer review may bring some alignment of competition assessments and moderately improve legal certainty.

6.2.2. Option 2: More Single Market to enhance investment and innovation

Consistent and investment-friendly spectrum policies foster macroeconomic growth by accelerating network upgrades, coverage, private infrastructure spending and regional digital cohesion. Findings from the analysis of regulatory approaches and market outcomes presented in section 2.2.2.3 and Annex 4 section 3 indicate that more investment-friendly auction designs can ease cost pressures on operators, create better incentives for network upgrades and contribute to lower consumer prices. While the underlying correlations do not imply causality, they provide a useful signal of how market conditions may evolve under different award designs. In this sense, limiting set-asides and reservations under option 2 could facilitate lower spectrum costs for operators and improvements in 5G download speeds. Increasing burden of proof for access obligations could help remove constraints

on deployment, thereby enabling more extensive 5G population coverage. Furthermore, a progressive reduction of prices that MNOs pay per MHz/pop could potentially support higher 5G speeds. [230]

The main **economic impact** of option 2 is greater investment in high-quality mobile networks driven by a more harmonised spectrum policy, which improves predictability, reduces fragmentation and strengthens investment incentives, leading to increased quality of mobile connectivity for end users. Part of its impact on GDP over 2025 to 2035 is estimated using the model linking changes in midband coverage, take up and speed to GDP.[231] The model projects an increase in mid-band coverage from around 67% today to approximately 96% by 2035 under option 2, considering any mid-band spectrum.[232] This option's overall indicative GDP impact for the EU over 2025 to 2035 is estimated at EUR 1 553 billion compared to EUR 1 480 billion under the baseline. A sensitivity analysis accounting for potential uncertainties of the model yields a GDP impact ranging from EUR 179 to EUR 2 116 billion, with the lower bound reflecting model conservatism and the upper bound representing upside potential from increased 5G mobile broadband speeds.[233] Beyond the modelled estimates[234], additional spillover effects on different sectors are expected from enhanced 5G and IoT deployment.[235] The model can also not quantify longer-term effects related to the acceleration of 6G deployment and additional economies of scale, expected to materialise towards and beyond 2035. When comparing the options, these effects are taken into account qualitatively.

option 2 is expected to generate additional GDP effects due to timely 6G deployment, but this impact cannot be quantified yet given the technology is still under development, meaning real-world data on adoption, performance, and impact on productivity or GDP is not available.[236] Early standardisation efforts and research roadmaps suggest that 6G will enable enhanced capabilities (such as real-time distributed intelligence, ultra-low latency, integrated sensing and communication, and improved energy efficiency), with potentially cross-sectoral economic benefits similar or even superior to those of 5G. option 2 will enable a smooth transition to the next generation of mobile networks (6G) which

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[230] The regression analysis presented in section 2.2.2.3 points to a possible inverse relation between spectrum prices and overall download speeds. While this last association does not reach conventional levels of statistical significance in our regressions, it is consistent with GSMA econometric estimates that historically a 10 p.p. higher spectrum cost to recurring revenue ratio decreased coverage by up to 6 p.p. and decreased average speeds by up to 8%. GSMA, "Global Spectrum Pricing report," Global Spectrum Pricing, GSMA, London, 2025 (2025), p. 10.

[231] As under option 1 above. See Annex 4 for methodology.

[232] 5G mid-band coverage is defined as the 1–7 GHz range to capture the effects of the spectrum options on upcoming renewals and awards relevant for high-quality mobile connectivity. The projection builds on current DESI coverage data and the assumption that overall 5G coverage across all frequency bands will approach 99–100% by 2035. 5G mid-band coverage is therefore estimated by excluding from total 5G coverage areas expected to remain covered only by low-band frequencies. On this basis, mid-band coverage is projected to reach around 96% under option 2 as well as under option 3, as both options are assumed to provide comparable incentives for mid-band deployment within the period considered. See Annex 4, section 2.3.2 for the methodology also explaining considered speed and consumption assumptions.

[233] These estimates are based on the application of the lower and higher extreme coefficient estimated by Briglauer et al. (2025), therefore 0.01 % and 0.113 % compared to 0.084% to take into account uncertainties, as for example that the study period of Briglauer et al. (2025) ends in 2019 and was based on improvements related to the 4G era and not 5G or the fact that the estimate only accounts for adoption of mobile broadband but does not directly estimate speed increases. For details see Annex 4, section 2.

[234] These possible 5G-specific effects have not been included in the calculations - see also Annex 4.

[235] For more detailed examples of possible impacts in sectors like healthcare, manufacturing, automotive and transport, energy and environment and agriculture see Annex 9, section 3.1.1.

[236] While quantification of economic effects has been possible for 5G technologies, it is not yet feasible to reliably quantify the potential impacts of 6G given the technology is still under development, and no real-world data is available. Any forward-looking assessment of 6G's economic contribution must remain qualitative. See also Annex 9, section 3.1.2. on 6G standard timeline.

is essential to ensure Europe's position at the forefront of innovation. The first complete 6G standard (3GPP Release 21) is expected by 2028, with early commercial deployments starting around 2030.[237] The upcoming EU-level spectrum regulatory decisions will thus be crucial in shaping the conditions for early trials, early planning, industrial uptake, and Europe's global competitiveness to ensure that the EU will close the gap with countries such as the US, China, South Korea. In this context, by reducing the time between Commission harmonisation decisions and national authorisations to less than 24 months, option 2 would facilitate fast and simultaneous 6G deployment across the EU. However, due to the lack of reliable data, the analysis does not include a precise assessment of network densification, and it is thus not possible to quantify to what extent the initially estimated EUR 33 billion investment needs may be reduced.

The **environmental footprint** of 5G mobile networks under option 2 is estimated at 5,250,198 t CO_2 eq mobile/wireless broadband network emissions, lower than the 5,257,074 t CO_2 eq under the baseline. When monetised, environmental impacts under option 2 are estimated at around EUR 4.62 billion, compared to EUR 4.63 billion under the baseline. The reported values reflect a defined set of assumptions and should be interpreted as outputs of a scenario-based estimation rather than as precise measurements. The uncertainty range around these values depends on the sensitivity of key parameters and is addressed via a sensitivity analysis.[238]Across all options, emissions are projected to fall by more than 96% between 2025 and 2035, mainly due to substantial reductions in electricity consumption per gigabyte enabled by new mobile technologies. Differences between options are negligible. Option 2 will also accelerate spectrum assignment and subsequent deployment of future mobile generations such as 6G, which are being designed with energy efficiency and renewable energy integration as core principles.[239] The additional energy-saving effect of 6G is not included in the model, but it is likely to be significant. Spectrum measures enabling swift assignment of 6G frequencies are expected to yield further benefits not captured here, both in terms of absolute energy savings and the speed of their materialization. Edge computing and AI-driven energy optimization, such as adaptive sleep modes, intelligent traffic steering, and predictive maintenance, will further enhance the sustainability of mobile networks. Yet, while AI can increase energy efficiency, it may also increase electricity demand due to higher computing requirements. Any comprehensive assessment should therefore weigh AI-enabled efficiency gains against the incremental power needs of expanded compute infrastructure.

Mobile networks can also contribute to **emission reductions in other sectors**. This was not captured in the model. In industrial settings, 5G enables real-time process monitoring, predictive maintenance and automation, reducing CO_2 emissions, waste and energy consumption.[240] In logistics, 5G supported systems optimise routing and warehouse operations, lowering transport emissions. In the energy sector, 5G plays a key role in integrating decentralized renewable sources, improving grid stability and reducing fossil-based balancing energy. By enabling precise demand forecasting and load management, 5G helps lower CO_2 -intensive peak generation. In agriculture, 5G enabled precision farming reduces fertiliser and pesticide use and supports optimised irrigation and energy

[237] ETSI (2023). ETSI White Paper: 6G: Building the Foundation for the Next Decade.

[238] The model, the relevant assumptions as well as the sensitivity analysis are presented in Annex 4, section 2. Depending on the assumed annual energy-efficiency improvement factor (5%–30%), total emissions associated with Option 2 range between 5 104 940 and 5 678 545 t CO_2 eq.

[239] https://www.iis.fraunhofer.de/de/ff/kom/mobile-kom/6g-mobilfunk.html#cop2053987201.

[240] For this paragraph see: Franken, Wissner and Sörries (2019). Entwicklung der funkbasierten Digitalisierung in der Industrie, Energiewirtschaft und Landwirtschaft und spezifische Frequenzbedarfe, WIK discussion paper No 451.

use, further reducing emissions. Across all sectors, 5G's low latency and high device density allow for better monitoring and response, leading to lower energy losses and more sustainable operations.

Option 2 is expected to generate positive **societal impacts** in terms of digital inclusion, social equity, and public service delivery, by increasing high-speed mobile network coverage and quality of service and facilitating broader service availability via spectrum sharing and reduced barriers for wholesale-only operators. Enabling advanced 5G and early 6G deployment supports productivity, job creation, and innovation in key sectors such as transport, energy, health, and manufacturing. Improved network rollout facilitates the uptake of smart services, from remote health to connected mobility, generating positive environmental and social spillovers. Enhanced regulatory certainty supports rural coverage obligations and inclusive digital transformation, while spectrum sharing obligations in underserved areas would ensure a broader distribution of long-term spectrum benefits. Improved interference responses would enhance connectivity, particularly in cross-border regions. More predictable and stronger competition oversight would help prevent over-concentration or fragmentation, supporting market sustainability and consumer welfare through lower prices and better service availability.

Along the 14 647 km of EU-external land borders,[241] often coinciding with interference hotspots, this option could yield meaningful efficiencies and enhance EU sovereignty, investor confidence, and internal market cohesion while improving solutions for end-users. Mandating prior coordination at CEPT ensures that security- and sovereignty-related decisions reflect EU-wide interests, reducing risks of fragmented or contradictory national positions, with clearer position in CEPT and ITU. This may be particularly relevant for satellite navigation, defence communication, or constellation filings.

Option 2 introduces additional **costs** for public authorities at national and EU level, due to procedural adaptation and increased single market procedure of licence conditions. These would be proportionate in high-value bands where early harmonisation and coordination are critical for technology leadership. Mandatory spectrum sharing mechanisms would involve legal, technical, and administrative efforts. In terms of enforcement costs, monitoring renewal conditions and validating least-distortive spectrum remedies must be implemented at both national and EU levels, requiring institutional and legal oversight. Additional EU-level staff[242] would be needed to review national submissions, assess compliance and issue formal objections or Decisions. Enforcement costs may increase due to overseeing compliance with new pro-security and spectrum-sharing obligations, and because of enhanced cooperation to address petitions for harmonisation and to mitigate cross-border interference, particularly in non-harmonised bands. These tasks may require real-time monitoring infrastructure, due diligence mechanisms for licensing and central support functions for wholesale-only market access models.

In terms of **cost savings**, operators benefit from less harmful interference, lower legal risk and greater investment certainty, which lowers capital costs and improves access to financing. The public sector benefits from smoother coordination, better auction outcomes, and fewer failed awards. Regulatory intervention and litigation are reduced. By reducing the frequency of auctions, longer licence duration and renewals are likely to lower administrative costs significantly in the long term. Faster resolution of cross-border interference problems would decrease transaction costs for regulators and operators.

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[241] Buzmaniuk, S. (2021). The Union's external borders: a European debate revisited. Robert Schuman Foundation.

[242] Staffing implications for public authorities are assessed in section 6.4, which discusses impacts of governance options. Under spectrum option 2, administrative workload is expected to increase mainly at EU level, with an estimated additional 5 FTEs for the Commission and 15 FTEs for the BEREC Office, reflecting their expanded responsibilities both in spectrum as in satellite authorisation areas. Staffing levels in Member States are not expected to change materially, as many functions remain with NRAs.

Option 2 is expected to deliver significant competitiveness **benefits** for the EU industry by providing maximum investment certainty and regulatory clarity, especially for cross-border and long-term spectrum users. These benefits would translate into improved quality and coverage of 5G and 6G services for mobile operators and end-users. Catching up with leading world economies would allow for a more inclusive society by expanding access to high-quality mobile connectivity and quality-assured services across Europe. Indefinite licence durations by default provide a strong and credible long-term investment signal. Where shorter duration is applied, the reversed burden of proof removes the threat of unpredictable non-renewal decisions. Long-term licences secure sustained access to spectrum assets, encouraging long-term network investment amid rising spectrum needs.[243] They also enhance planning stability and financial predictability, lower risk premium on capital expenditures and reduce the cost for capital-intensive 5G and future 6G deployments, which require 5G SA core components supported by high-capacity fibre infrastructure. Further, long-term licences, strongly advocated by the industry,[244] could strengthen incentives for developing secondary markets, as entities acquiring spectrum through transfer or leasing would benefit from long-term certainty over its use. The Commission's role in overseeing authorisation processes would enhance regulatory convergence, and ensure more consistent, investment-friendly auction design, flexible licensing conditions and pro-security obligations[245]. The possibility to harmonise authorisation conditions would further facilitate cross-border service provision, allowing operators to achieve scale. Possible binding common conditions developed on request for private networks would enable innovators to scale up network-as-a-service solutions.

Option 2 would allow for early planning, timely authorisation, and cross-border coordination for 6G bands,[246] as well as appropriate 6G spectrum award conditions – such as duration, license flexibility, reserve prices, coverage and quality obligations – to support investment amid technological and commercial uncertainty.[247] Greater predictability regarding 6G deployment will incentivize timely deployment and long-term industrial research for high-value vertical use cases, benefit equipment manufacturers and operators, and ensure wide availability of devices and services. Pro-security and sharing obligations would contribute to more secure networks, ensuring coherence with forthcoming cybersecurity regulatory revisions. More widely applied spectrum-sharing mechanisms, such as "use-it-or-share-it" conditions and dynamic geolocation databases, would facilitate access to spectrum for a broader range of users and help ensure efficient spectrum use under indefinite licence durations.[248]

6.2.3. Option 3: Strong harmonisation and EU level awards

The main **economic impact** of option 3 lies in increased investment in high-quality mobile networks driven by stronger harmonisation and clearer EU-level rules. The underlying economic mechanisms are like those highlighted in the analysis of regulatory approaches and market outcomes presented in section 2.2.2.3 and in Annex 4, section 3. While not causal, the identified correlations between certain market shaping measures and market outcomes provide useful indications of how more predictable

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[243] Country-average spectrum assigned to mobile operators for frequency bands below 7 GHz in the EU has passed in the period from 2014 to 2024 from 457 MHz to 830 MHz according to GSMA and its likely to further increase with 6G.

[244] VVA, PolicyTracker and LS Telcom (2023), p. 19.

[245] As discussed in the Draghi Report, these may, e.g., include supply-chain scrutiny and trusted vendor requirements.

[246] RSPG (2024). Opinion on Spectrum Policy for Next-Generation Wireless Systems (6G).

[247] LS Telcom, PolicyTracker & VVA (2023). Study on Assessing the Efficiency of Radio Spectrum Award Processes in the Member States.

[248] Annex 3 includes indications on practical implications of spectrum measures under option 2 for main stakeholders. Annex 3, section 2.2. presents the main costs and benefits per stakeholders, comparing them with options 1 and 3.

and investment-friendly spectrum award conditions can support better network performance. The estimated GDP impact is the same as for option 2, as both options forecast the same mid-band coverage and assumes that similar economies of scale are to be reached in the 2025-2035 period via proposed policy measures.[249] Using the same modelling approach as for options 1 and 2, the overall EU-wide GDP impact of option 3 over 2025 to 2035 is estimated at EUR 1 553 billion compared to EUR 1 480 billion under the baseline, with a sensitivity range of EUR 179 to EUR 2 116 billion under alternative assumptions on the impact of increased mobile broadband speeds.[250] As under option 2, the quantitative model does not capture spillover effects on different sectors or longer-term effects related to the acceleration of 6G deployment and additional economies of scale. These effects are expected to materialise towards and beyond 2035, cannot yet be quantified, and are therefore taken into account qualitatively when comparing spectrum policy options in section 7.2.

The **environmental footprint** of 5G mobile networks under option 3 is nearly the same as for option 2, estimated at 5,403,147 t CO_2 eq of mobile and wireless broadband network emissions, below the baseline of 5,413,504 t CO_2 eq.[251] When monetised, environmental impacts under option 3 are also estimated at around EUR 4.62 billion, compared to EUR 4.63 billion under the baseline. The same considerations as for option 2 apply to the expected impacts of 6G.

By establishing uniform licensing conditions and EU-level awards, option 3 could improve equitable availability of high-quality mobile connectivity, with corresponding positive **societal impacts**, such as greater access to education, health, public services, alongside improved inclusion and progress in bridging the digital divide. However, this option entails potentially significant social risks from the far-reaching restructuring of a sector which has relied on national operators for over 100 years. EU level awards and longer or indefinite licence duration could, in the long run, reduce the number of operators to a small group of EU-wide players, leading to market exit and associated social impacts.

In terms of **costs**, this option entails the highest direct compliance costs across all stakeholder groups. Centralisation would limit the autonomy of NRAs, triggering legal reform, and systemic procedural changes. A fully centralised model requires a well-resourced EU-level institutional structure with legal, economic, and technical capacity that would coexist for a relatively long transitional period with national spectrum governance structures that would monitor numerous existing spectrum holdings previously assigned at national level and manage renewals to possibly align diverging national expiry dates in a way to allow for future EU level assignments. Overall, the costs are very high, both in absolute terms and relative to current practice, making a differentiated approach – targeting only certain bands or cross-border use cases – essential to mitigate excessive burdens. Enforcement costs would be substantial both at national and EU level, as a new governance framework would need to be established. The complexity of Commission decisions subject to judicial review by EU Courts might increase. Private enforcement in cross-border interference cases increases litigation risk. Enforcement would need to balance consistency with subsidiarity. A dedicated high-level group introduces a new governance layer, requiring additional administrative resources. Indirect costs arise from transition complexity, and possible short-term disruptions to network rollout due to legal and administrative overheads.

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[249] See Annex 4, section 2.2.3 on how economies of scale are taken into account in the model.

[250] These estimates are based on the application of the lower and higher extreme coefficient estimated by Briglauer et al. (2025), therefore 0.01 % and 0.113 % compared to 0.048%. For details see Annex 4, section 2.

[251] The reported values reflect a defined set of assumptions and should be interpreted as outputs of a scenario-based estimation rather than precise measurements. The model, the relevant assumptions as well as the sensitivity analysis are presented in Annex 4, section 2. Depending on the assumed annual energy-efficiency improvement factor (5%–30%), total emissions associated with Option 3 range between 5,104,733 and 5,678,338 t CO_2 eq.

While potentially generating economies of scale for licensees, **EU-level spectrum awards** could also introduce **inefficiencies** that risk disrupting the functioning of the EU mobile market and delaying 6G deployment and with costs to be sustained both at national and EU level, especially in the short-medium term. EU-wide awards would most likely apply to auctions of new 6G spectrum around 2030, as 5G spectrum has only very recently been assigned by Member States for a duration of at least 15 years. For example, an EU-level award allocating four blocks in the upper 6 GHz band would result in only four MNOs holding spectrum across the EU. For any MNO without substantial national holdings in lower bands, this amount and kind of spectrum would be insufficient to support broad coverage and sustainable, high-quality 6G deployment. Conversely, MNOs failing to obtain spectrum in EU-level awards would still be expected to offer 6G services. However, while benefiting from the technology, they would not have access to the new mid-band spectrum required for capacity and performance. The use of spectrum is hence likely to be inefficient in the **short term,** particularly given the very limited secondary markets for mobile spectrum in the EU to date, which constrains the ability of operators to reallocate spectrum efficiently.[252]

In the **medium term**, if multiple future bands are assigned via EU-level awards, structural imbalances could deepen. MNOs repeatedly failing to obtain spectrum, notably smaller and local operators, could be forced to exit the mobile market or become MVNOs. EU-wide auctions would also face practical challenges, as Member States have awarded spectrum at different times and under varying conditions. Substantial efforts and time would be needed to synchronise licence expiry dates and band-specific conditions to enable centralised auctioning, likely creating significant uncertainty for market players and delays. During the transition to a new market structure, deployment could be disrupted or even stalled, and administrative cost high as NRAs would need to continue managing and monitoring existing national licences with non-synchronized deadlines alongside a parallel EU-level licensing framework. Effective market functioning would require well-developed secondary markets and instruments preventing spectrum hoarding and maximising efficiency of spectrum use, such as spectrum sharing. In the **long term**, larger operators could benefit from reduced regulatory fragmentation, lower cross-border interference and reduced need to redesign network strategies for each Member State. Public authorities would avoid inconsistent award outcomes and reduce national litigation. EU institutions would benefit from standardised reporting, performance metrics and streamlined enforcement.

Option 3 offers broad **benefits** by aligning spectrum policy with EU-wide investment, innovation, and connectivity objectives. These benefits are likely to materialise in the long term, in which larger operators could benefit from reduced regulatory fragmentation, lower cross-border interference and reduced need to redesign network strategies for each Member State, which would support a more effective exploitation of economies of scale. Public authorities would avoid inconsistent award outcomes and reduce national litigation. EU institutions would benefit from standardised reporting, performance metrics and streamlined enforcement. Centralisation would better ensure that awards contribute directly to strategic goals. Operators would benefit from consistency in licence duration, award timing, and renewal criteria. Private enforcement in interference cases may facilitate faster resolution of problems. A legally binding EU-wide mechanism for response to third-country interference significantly would strengthen EU's capacity to defend its interests in international spectrum and satellite matters. This option ensures that discussions related to security or sovereignty matters affecting spectrum harmonisation are made within a closed, politically accountable forum.

[252] The EECC Evaluation report finds that spectrum trading, leasing and sharing mechanisms in the EU mobile sector have been used only to a very limited extent in practice. See Annex 11, section 5.5.3.

In terms of **indirect benefits**, a more coherent and integrated spectrum regime could generate strong macroeconomic impacts in the long term. It could accelerate deployment of advanced networks, strengthen the single market, and support industrial transformation and green transition objectives, such as remote work, smart mobility and precision farming. Spectrum harmonisation could facilitate cross-border expansion. However, while the industry recognizes the need for consolidation, it focuses more on in-country consolidation and does not view centralized auctions as the most effective way to achieve better market outcomes. Centralised planning enhances transparency, accountability, and data availability, facilitating better monitoring of public policy outcomes. However, the deployment of mobile networks is local and requires extensive capex in physical infrastructures, such as base stations or antennas. Thus, access to spectrum at pan-European level would not necessarily result in higher economies of scale. According to interviews conducted for the 'Study on Finance and USO', the majority of MNOs identifies only limited advantages from cross-border provision of mobile services, mainly linked to cloud and core networks, rather than to radio access networks. While operators could optimise network deployment, they would still sustain additional costs to offer retail cross-border services stemming from remaining fragmentation of legal requirements in areas such as legal interception, cybersecurity, data protection, data retention and end-user protection. Those factors and other non-infrastructure-based costs might affect commercial interest to provide EU-level services.

In the long run, EU-level spectrum auctioning could generate **large cost savings for Member States**, as the overall cost of organising such auctions would be comparable to that of a single large Member State, such as Germany. However, organising such auctions would entail a **significant increase in specialised EU-level staff** and could require additional funding from Member States or the industry, as it would represent a new task for EU institutions, while in the short-medium time horizon, many tasks would also remain with national authorities due to existing spectrum holdings monitoring and renewals as well as the need to align timeline of expiry of holdings.[253] Further costs may arise from national-specific conditions, including harmful interference and monitoring of national licences in the medium-term.

Overall, Option 3 offers significant strategic and integrated benefits in the long term, particularly for EU-wide investment mobilisation, innovation leadership, and industrial resilience. However, it also presents considerable challenges in the short-medium term.

6.3. Authorisation

6.3.1. Option 1: Partial harmonisation of authorisation (general and satellite)

Option 1 incurs many one-off costs for the **general authorisation regime**. However, simplified procedures such as a unified notification template and single notification reduce administrative and compliance costs, enabling providers – especially SMEs – to allocate resources to innovation and growth rather than bureaucracy. By lowering barriers to market entry, option 1 stimulates cross-border service provision, fosters greater competition, and expands consumer choice, directly contributing to a more dynamic and competitive European digital market[254].

[253] Staffing implications for public authorities are assessed in section 6.4, which discusses impacts of governance options. Under spectrum option 3, administrative workload is expected to increase mainly at EU level, with an estimated additional 5 FTEs for the Commission and 15 FTEs for the BEREC Office, reflecting their expanded responsibilities. Staffing levels in Member States are not expected to change materially, as many functions remain with national authorities.

[254] More detailed description of the impact can be found in the accompanying Annex 9, part 1.3. and 4.

As regards **satellite authorisations** more specifically, option 1 offers a modest improvement in the consistency, transparency, and predictability of satellite authorisation across the EU. It however simplifies the regulatory environment through a common template for authorisation conditions, potentially reducing compliance costs and enabling satellite operators to better plan investments. This provides some legal certainty and regulatory predictability for businesses, including SMEs. The broader macroeconomic and social benefits depend on the uncertain outcome of new satellite operators entering the market. This option would have a slight positive impact to New Space SMEs through reduction of regulatory burden but remains doubtful if it would promote investment confidence and if it would facilitate creation of EU-wide MSS networks contributing to strategic autonomy in space-based communications by reducing reliance on third-country operators.

Option 1 brings positive **impact on digitalisation,** enhances accessibility and reduces administrative burden across Member States, by linking national single points of contact with the Single Digital Gateway for businesses [and/or] the BEREC website, and by providing digital tools for coordination among national authorities beyond the EECC conditions. This directly supports the European 2030 Digital Compass vision of a connected, digitally empowered Europe with seamless cross-border services and could also contribute to the goals of the Digital Decade by potentially improving the efficiency of EU connectivity services through satellite constellations.

While no direct **environmental impacts** are expected under option 1 for authorisation measures, indirect benefits may arise as digitalised procedures reduce paperwork and physical interactions, supporting more sustainable administrative practices. Option 1 measures facilitating EU wide authorisation of services would to a minimal extent produce indirectly the environmental and societal impacts illustrated under option 2 and in Annex 9.

6.3.2. Option 2: Single "passport" for other networks and services than satellite and an EU-level authorisation for satellite spectrum

Single passport

The benefits of the single 'passport' applicable to all cross-border networks and services, except satellite, include cost savings for different stakeholders The maximum list of conditions to be attached to the general authorisation, the mandatory use of the BEREC notification template and simplification of the annual reporting will result in reduced administrative burden and compliance costs for all cross-border ECN and ECS providers. Simplification of conditions attached to the rights of use of extraterritorial numbers will further reduce costs for B2B service providers.

For the operators the benefit would be significant in comparison to the baseline with around 50–80% faster market entry and reduced regulatory uncertainty. The savings would also include reduced human resources costs, especially of new market entrants and cross-border operators, with reduction of costs linked to the need to have compliance teams present across 27 Member States and around 50% reduction of reporting (e.g., by cutting red tape on different reporting forms and reporting periods). Further savings will be achieved thanks to harmonising and removal of specific national conditions such as: national language requirements, the need to have national representative or digital ID, adaptation to local notification portals, and having specific national reporting forms. The single passport will cover the authorisation conditions that will be harmonised for all Member States and the national (non-DNA) rules that will still apply and that will be approximated. Further cost reduction for single passport providers will come from the approximated conditions to facilitate the compliance with the applicable non-DNA related conditions – such as cybersecurity and lawful interception obligations. For public administrations (Member States/NRAs and reinforced BEREC

Office), the changes will reduce staff requirements for a savings of some 50%.[255] Assuming a burdened labour cost of EUR 95 400, this could represent annual savings of around EUR 82 000.

The strategic outcome of option 2 is that especially smaller or mid-size providers can expand cross-border more easily, fostering a more integrated EU telecom market with greater services' choice for end-users.

On the other hand, the single 'passport' brings **costs** linked to BEREC guidelines to clarify the applicable conditions in MS and for issuing standard declarations by Member States of notification, as well as costs for coordination between authorities for approximation of national rules over time. The single passport must be issued by a MS upon request of an operator wanting to operate cross-border, but it is optional for purely local providers, who prefer to operate nationally or regionally and remain authorised under national rules. They can still benefit from harmonised BEREC guidelines and templates. The new recurrent costs will thus depend on the number of such notifications from cross-border operators but are likely to be lower than under option 1. NRAs are likely to still have internal databases and documentation that they need to create for the purposes of monitoring. Certain divergences at the national level will remain in relation to procedural issues related to general authorisation (e.g. administrative fees, fees for scarce resources) and to matters beyond the DNA.

Option 2 promotes **digitalisation** thanks to a centralised BEREC database and mandatory notification template which reduce administrative burdens and compliance costs for providers, particularly SMEs while enabling faster market entry and deployment of electronic communications networks and services.

As regards the impact on the environment the introduction of the single "passport" has no direct impact.

EU satellite authorisation

As regards EU satellite authorisation, the positive impact on competitiveness will materialize in terms of cost savings for different stakeholders, thanks to the simplification of the regulatory environment, in particular for services which rely on scarce spectrum such as D2D, and the long-term benefits of creating a streamlined and harmonised system for the authorisation of satellite spectrum. Removing the barrier of navigating 27 authorisation regimes benefits all constellations, particularly those which currently lack spectrum in all Member States. Existing satellite operators can scale up services where they previously lacked authorisations. Providers, in particular new entrants, save primarily on administrative costs and delays associated with regulatory fragmentation and different conditions (see section 2.2.4), and secondarily on direct economic costs. This can have a greater positive impact to New Space SMEs than option 1.

The **economic benefits** and simplification potential can be also assessed in terms of:

(i) Satellite communication service providers would avoid a reduction of revenues due to delays caused by Member State-by-Member State authorisation and spectrum assignment, and occasionally due to legal uncertainty. Indeed, the largest cost burden on satellite communication service providers stems from delays to commercial launch, which can amount to tens of millions of euros in foregone revenues for a provider with a large client base. As an example, for a major LEO constellation with

[255] This will not include MS which do not require GA (DK) or which have GA but require notification (FR).

a global average number of subscribers of around 300.000, the inability to deliver services due to authorisation issues for 4 months in one of the more populated MS could cost a company in terms of lost revenue 18,3 million EUR[256]. Based on a similar logic, the inability to deliver IRIS^2 services for the EU would be EUR 50 million per month, see section 5.1.3.

If these delays in authorisation happen when the satellite communication service provider is first entering the market, then the immediate financial impact is lower because the number of customers is initially low and increases progressively. However, such delay in obtaining authorisation and spectrum assignment can affect the business case with delayed revenues possibly stretching out over many years with a substantial loss of potential revenue. Similar consequences could apply to any satellite communication service, subject to the obvious adjustments for the size and characteristics of the specific service. See Annex 9, Section 3.2. for a more detailed assessment.

(ii) Reduced costs and staff needs for both satellite communication service providers and national regulatory authorities (NRAs/SMAs), stemming from the elimination of duplicative and fragmented regulatory processes. An important cost driver today is the need for operators to comply with differing national authorisation conditions that are often not adapted to satellite services (see Section 2.2.4 on fragmentation).

The introduction of a single EU-level authorisation for satellite services could lead to considerable reduction in administrative costs, staff needs and delays for satellite communication service providers. The exact magnitude of such reductions is difficult to assess, as costs depend on numerous specific factors and vary significantly across Member States; moreover, in some cases the administrative cost for the authorisation can't be clearly distinguished from the spectrum cost. The reduction of administrative costs quantified in section 2.1.3 is expected to be most significant in cases involving individual rights of use and authorisation of ground components, compared with the use of satellite spectrum under general authorisation. Regarding staff resources, some operators estimate that securing spectrum authorisations across all Member States for an EU-wide constellation requires roughly 6 FTEs centrally plus 1–2 FTEs per Member State; these costs would be around EUR 200.000 per EU country/year. Finally, as part of the authorisation process, operators are asked to conduct in-country testing in each MS, which would require at least 6 FTEs dedicated to regulatory testing, deployment of a temporary ground station/gateway (which incurs in CAPEX costs) with an additional EUR 120.000 for gateway movement, as well as, engineering resource required for the movement/installation of the gateway. Overall, this would cost indicatively around EUR 3.2 million across all Member States.

The staff savings for competent authorities linked to the introduction of an EU-level authorisation for satellite services can be estimated based on current staffing levels and expected efficiency gains. Data from 16 NRAs and SMAs indicate around 63.5 FTEs currently engaged in satellite authorisation and spectrum assignment and another 34 FTEs in enforcement, corresponding to roughly 98 FTEs EU-wide.[257] Including about 1.5 FTEs at the European Commission for its present coordinating role brings the total to approximately 100 FTEs involved in satellite-related spectrum tasks. Under the EU authorisation, **staffing reductions** would mainly occur at NRAs and SMAs, as much of the administrative assessment and licensing work would be centralised at EU level. Member States would, however, remain responsible for monitoring, interference management and inspection of ground components. Additional resources would be needed at the BEREC Office (up to 12 FTEs) to

[256] Study for Digital Single Market.

[257] See 'Study for Digital Single Market' for explanation on how this estimate has been done based on a Survey among RSPG members.

manage operational functions transferred from Member States at the Commission (roughly 3.5 additional FTEs) to oversee and coordinate implementation. Overall, staffing would decrease by about 20–30%. Assuming an average labour cost of EUR 95 400 per FTE, this corresponds to annual savings of roughly EUR 2–3 million once the system is fully operational.

The proposed EU-level authorisation regime could enable Member States and EU institutions to absorb the expected rise in authorisation requests without requiring additional administrative resources**.** As regards the expected workload, we consider the rapid growth of Low Earth Orbit (LEO) constellations[258] and data from the US indicating significant growth in applications for space and earth stations. If such growth was to continue, the associated labour requirements and budget would also increase, yet at a lower rate due to economies of scale. Under business-as-usual conditions, staffing needs might increase by roughly one-third over the next five years, but with the expected efficiency gains discussed above, overall personnel would likely remain close to today's level.

(iii) more efficient addressing of harmful interferences issues which cause serious operational challenges due to the difficulty to enforce compliance with Radio Regulations; option 2 ensures all players play by the rules, thanks to the coordinated enforcement of satellite rules. This is particularly relevant in markets characterised by big LEO constellations, where interference issues are likely to increase in the next years.

(iv) Users of Satellite communication services would fully benefit from the consumer surplus thanks to timely availability of services and reduced legal uncertainty, without coverage gaps in some MS. If the satellite communication service provider is not authorised to offer the service, consumers cannot purchase or use it. There will always be a loss of surplus when a satellite communication service provider lacks authorisation to deliver its service, but the net loss of consumer surplus might be higher or lower than the loss of revenue to the satellite communication service provider, depending on availability or not of substitute services.

Even if investment decisions about launching services/operations are not taken based on initial general authorisation or licensing requirements, option 2 could overall facilitate pan-European services, especially in the cases of spectrum scarcity where a Single Market approach from selection to authorisation and enforcement would facilitate the deployment and expansion of satellite technologies, which will play a major role in advancing digital transformation and connectivity across Europe.

As regards **costs,** the shift from national to EU-level authorisation would result in substantial direct compliance costs for Member States and EU. Member States would undertake legal reforms, and the roles among national regulators, the Commission, the RSPG, and the COCOM would need to be redefined. This requires expanding administrative and technical capacities at EU level, which could be covered by administrative charges and fees. For an assessment of additional FTEs at EU level for tasks related to EU satellite authorisations see Governance Section 6.4.1. Indirect costs could include

[258] Higher number of satellite authorisation requests are expected in the future, in particular for LEO constellations. According to the Detecon MSS Study (2025), around 9 000 LEO satellites were in operation worldwide at the beginning of 2025, and this number is expected to grow by at least a factor of six over the next decade, equivalent to roughly 60 000 operational LEO satellites by 2035 globally. This study also identifies around 25 global operators/LEO constellations with launched, planned or announced LEO satellites relevant in the coming years. These numbers will surely impact the FTEs needed to address these requests and ensure enforcement, monitoring and dealing with increasing harmful interferences. Detecon International GmbH 2025, p. 11 and p.105.

institutional friction, alongside potential political and administrative resistance from some Member States over ceding authority on spectrum rights. For additional analysis, see Annex 9.

As regards **social impact**, satellite services can fill the connectivity gap in unserved areas[259] where terrestrial roll-out is not technically or economically viable. They can enhance the provision and resilience of public services and contribute to public safety, environmental monitoring, and civil protection and enable digital inclusion and wider access to e-health, distance education, and e-government services.

Option 2 promotes **digitalisation** thanks to a centralized satellite authorisation system which reduce administrative burdens and compliance costs for satellite operators, including SMEs, while enabling faster market entry and deployment of electronic communications networks and services. The measure contributes to a more connected and efficient digital single market across Europe. It further promotes D2D, accelerating digital transformation across Europe.

As regards the impact on the environment in terms of satellite services, greater availability of pan-European services might further enable and ensure scale for satellite based environmentally beneficial services[260]. In terms of infrastructure, satellite systems do not require extensive terrestrial infrastructure, therefore satellite broadband may represent a less invasive and more environmentally benign alternative to large-scale physical deployment of cables, towers, or roadside base stations, especially in remote or environmentally sensitive areas. However, the environmental sustainability of satellite connectivity also depends on factors such as satellite manufacturing, launch activities, orbital lifetime, energy consumption during operation, and end-of-life disposal. As an example, the carbon footprint of LEO satellite-based broadband – when calculated per subscriber per year – may be significantly higher than that of terrestrial fibre or mobile networks. Depending on assumptions, emissions per user for LEO-based services could be between 100 kg and 469 kg CO_2 eq annually, compared to around 60 kg CO_2 eq for typical 4G mobile access.[261] This is due in part to the energy intensity of manufacturing, frequent satellite launches to maintain constellations, and less efficient ground infrastructure. Future EU-wide satellite frameworks as the Space Act, could however incentivise more sustainable system design and operations reducing environmental impact of space activities.

Annex 3 includes indications on practical implications of the EU satellite authorisation measures for main stakeholders and Annex 3 Section 2.3. presents the main costs and benefits per stakeholder of option 2, comparing them with option 1 and option 3.

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[259] Large connectivity gaps still remain to reach full territorial coverage. According to the Digital Decade targets, all EU households should have access to gigabit connectivity by 2030. However, studies estimate that between 33 and 71 million EU residents may still be left without gigabit-capable fixed access by that time if relying on fibre and mobile networks alone· Johnson, O., & Kürsteiner, A. (2023). The role of the satellite market in provisioning broadband access in Europe up to 2030. Paper presented at the 32nd European Conference of the International Telecommunications Society (ITS): Realising the Digital Decade in the European Union – Easier Said Than Done?, Madrid, Spain, 19–20 June 2023.

[260] Satellites can indirectly contribute to emission reductions and more efficient resource use in other sectors. For example, satellite-enabled IoT systems can optimise irrigation, energy grids, or logistics chains, while reliable broadband access supports remote work and reduces travel needs. In the EU context, such co-benefits are particularly relevant for agriculture, energy, and transport sectors, especially in rural regions – see European Investment Bank (EIB). (2025). Global Broadband MEO Satellite Constellation (Project No. 20230498).

[261] Ogutu B. Osoro, Edward J. Oughton, Andrew R. Wilson & Akhil Rao. (2023). Sustainability assessment of Low Earth Orbit (LEO) satellite broadband megaconstellations (arXiv:2309.02338).

6.3.3. Option 3: Country of Origin regime for cross border/B2B providers

Under **option 3**, the Member State of notification would incur **increased administrative costs** to handle the authorisation, compliance and enforcement process, for satellite and B2B services for the entire EU, including liaising with other authorities. Other Member States will forego the direct costs of the authorisation process but will incur costs for participating in the coordination and enforcement mechanism. This option reduces administrative burden for satellite operators, by streamlining costs for authorisations, testing and reporting. EU Member States would need to agree to mutually recognize spectrum authorisations granted by the Country of Origin and, develop trust and cooperation across them. Given the strong national components of spectrum regulation, this option would be politically challenging. MS would essentially relinquish complete control over their spectrum assets to other jurisdictions without oversight or authority.

In terms of **indirect costs**, a transitional period would be needed, which would be accompanied with some uncertainty or administrative complexity as Member States phase in the harmonised conditions. Delays in fully implementing the EU-level selection framework could also be expected, which, based on the experience with the MSS 2 GHz Decisions, could persist for some years, but are not necessarily disproportionate to the scale of market and governance improvements. The additional **cost savings** of this option will all accrue for satellite and other B2B providers, and the SMEs among them will benefit significantly. There is also a clear benefit for the development of the single market of satellite services and B2B services, as well as increase in the offering of such services. The savings will occur due to the reduction in administrative and compliance costs.

In terms of the **benefits**, option 3 enhances consistency and reduces administrative burden for providers of cross-border services, for instance costs incurred due to mandatory in-country testing will no longer apply. The application of one framework for spectrum selection and assignment, backed by EU-wide authorisation conditions, would reduce fragmentation and regulatory uncertainty in the long term. However, given that cross-border operators would still need to abide by the legislation of the Member State of the provision of the service, the benefits would not be maximised and we would not expect that such a regime would encourage new multi-Member State market entry, or pan-European coverage that would not have occurred in its absence. Where the country of origin/notification is the same as the one under the EU Space act, **indirect benefits** from the relevant synergies could be expected.

Option 3 facilitates EU wide authorisation of services and would to a smaller extent produce indirectly the **environmental and societal impacts** illustrated under Option 2 and in Annex 9.

6.4. Governance

6.4.1. Option 1 - BEREC and RSPG as two separate bodies supported by the BEREC Office

Option 1 represents a relatively small change to the current governance structure (cf. section 5.2.4).

In terms of **economic** impacts, it implies a relatively small increase in direct and indirect costs for the EU budget, mainly due to increased tasks and functions of the BEREC Office. Based on the tasks assigned to BEREC and RSPG under the preferred options in the areas of access, spectrum, general authorisation and satellite authorisation, it is estimated that to provide support to both BEREC and the RSPG, the BEREC Office's staff would need to increase by an additional 25 FTEs, implying that under option 1 the Office staff would grow by slightly more than half (52%) compared to the current situation. The vast majority of these FTEs (80%) would be needed for RSPG related activities, i.e. spectrum related (including ex ante spectrum single market procedure) and EU satellite authorisation.

Currently the BEREC Office has 48 staff (in 2024)[262] and annual costs amount to EUR 8.1 million (of which 62.2% is staff expenditure, 21.5% expenditure for buildings, equipment and similar and 16.3% is operational costs). The current staff expenditure (yearly average) in BEREC per employee is approximately EUR 104 939. Therefore, the indicated increase of FTEs would result in staff increase by slightly more than a half (52%) to 73 FTEs. Assuming that the new total staff expenditure would be approximately EUR 7.661 million (average cost of 1 FTE x 73), and other costs increase by 20%, i.e. the costs for building and equipment would rise to EUR 2.090 million and the operational costs would rise to EUR 1.589 million; therefore, the annual costs for the BEREC Office would increase to approx. EUR 11.420 million. This increase in budget (EUR 3.320 million) includes additional costs associated with the increase in the organisation of BEREC and RSPG working groups' activities; an increase of 25% in the latter would amount to upward of EUR 80 000 per year in additional organisational and reimbursement costs. The above figures do not include the possibility of establishing a small liaison office in Brussels. For comparison purposes, the costs of maintenance of the ENISA local office in Brussels for up to 10 FTEs are around EUR 170 000 per year, and staff expenditures are higher as standard rates applies with no corrective coefficient[263].

The increase of staff represents the largest increase of costs and will be partially offset by Commission staff no longer providing administrative support to RSPG (1.5 FTE), and synergies realised when BEREC and RSPG are supported by the BEREC Office. The Commission will also need reinforcement to cope with its additional tasks, in particular in terms of additional decision-making powers for satellite authorisation, petition for rule making or ex ante single market procedure. This required increase is estimated at 10 FTE; additional posts could be partially financed from fees.

Participation cost in working groups for NRAs and CAs are expected to increase for both BEREC and RSPG. Assuming 25% increase in activities of both these bodies, for BEREC, the average time spent by the NRAs on working groups would increase by c.a. 550 hours corresponding with EUR 26 400[264] in additional staff expenditure for participation in BEREC per year. An increase of 25% in RSPG activities would amount to 115 additional hours per Member State, or on average around EUR 5 500 in additional costs for staff per Member State[265]. However, some cost savings will materialise on the side of the NRAs and other CAs, thanks to the work done by the BEREC Office staff on substance, which will to an extent offset cost increases. In this regard, the largest impact results from possible Co-Chairmanship of the BEREC working groups, estimated to require 70-90% FTE for each working group[266]. Likewise, cost savings at national level are likely to happen thanks to EU satellite authorisation. Most of the costs entailed by this increase would be borne by the EU budget and, in the case of BEREC Office, possibly also by contributions from the NRAs or other CAs, and via direct fees paid by market participants, such as for EU satellite authorisations for services performed by it.

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[262] The Commission has, in its Opinion on the BEREC Single Programming Document, consistently over the past years signalled that the current staffing levels (48 in 2024) are above the authorised levels (36 FTEs). However, no action has been taken to address this de facto situation further to asking the BEREC Office to address this discrepancy. As the current tasks of the BEREC Office are performed with the actual staffing level covered with the current budget of the BEREC Office, the Impact Assessment recognises the status quo and the corresponding budget allocation and costs.

[263] ENISA single programming document 2022-2024 – Table 28 on the indicative resources for the Brussels local office (one-off cost + maintenance costs).

[264] Using an EU27 average hourly staff costs of EUR 48 based on ISCO figures for relevant staff categories.

[265] For both BEREC and RSPG, the exact figures would vary depending on the Member State.

[266] Assuming that BEREC Office staff would co-chair all the BEREC WGs, total savings for NRAs would be equals 12 x [0.7-0.9] FTE per year. However, this would depend on the allocation of tasks to the BEREC Office staff and may not be justified or possible for all working groups.

Currently, under Regulation (EU) 2018/1971 and its Financial Regulation, almost all BEREC and BEREC Office revenue comes from an EU subsidy, with only small contributions from the EEA EFTA countries for example. The EU budget model offers predictability, transparency, and equal treatment, however, depending solely on EU budget allocations carries risks in particular in budget restriction phases.

Therefore, we explored a fee-based scheme (e.g. levying charges on electronic communications networks and services providers for certain kinds of authorisations, spectrum use for satellites) similarly to decentralised agencies that are relying on other sources of revenues. While the revamped BEREC Office will remain structurally distinct from many EU decentralised agencies as it will continue to support BEREC and the RSPG, it will be increasingly involved in delivering regulatory outcomes directly to private entities, which creates a possibility to charge for "service-based-fees". Specifically, the satellite fees could be linked to the procedure for upcoming EU-level spectrum assignment, extension and renewals established in the DNA. Such fees could be spread over periods longer than 10 years, providing for a constant and stable revenue. Furthermore, if needed and operationally feasible, administrative charges/spectrum fees could be collected from undertakings subject to EU satellite authorisation after the entry into force of the DNA.

Introducing contributions directly from the market (e.g. from providers of electronic communications networks and services) could appear equitable insofar as the industry benefits from BEREC (and RSPG) work. Yet, this raises concerns about double charging (since many providers already pay national regulators whose staff is also the main contributor to BEREC's work), and about smaller operators being disproportionately burdened, and is consequently not a favoured solution.

In summary, the optimal path seems to lie in retaining EU budgetary funding as the backbone of the BEREC Office's financing, while setting out complementary revenue sources in the form of satellite spectrum authorisation fees and, possibly, also fees for other scarce resources administered at EU level, supplemented by voluntary and in-kind national contributions. Such mix would provide for a stable and proportionate budget aligned with the functions of the revamped BEREC Office.

As regards **social impacts**, the arrangements with two advisory bodies and a supporting agency in option 1 largely corresponds to the baseline and is not expected to have significant direct societal impacts. An indirect social impact of a strengthened BEREC Office would be more harmonised implementation of telecom regulations, particularly as regards cross-border aspects such as satellite authorisations and EU-level access remedies.

With regard to **environmental impacts**, option 1 shows only minor differences from the baseline scenario. The number of in-person meetings is not expected to increase significantly even with new tasks, as additional interactions needed would remain mainly online (with no environmental costs). Assuming 1-3 additional large in-person meetings compared to the baseline, the added environmental impact translates into 43-130 tons of CO2 emissions per year, due to air travel[267]. In addition, higher BEREC Office staffing would require larger premises, and these environmental costs would not be offset by reductions on the NRAs' side.

There is no expected impact on **fundamental rights**.

[267] According to BEREC Office's GHG calculations, 3 Plenary meetings per year contribute 110-130 tons of CO2 emissions.

6.4.2. Option 2 - EU Agency (BEREC and BEREC Office), supporting also the RSPG as Spectrum office

Option 2 involves merging BEREC with the BEREC Office into an EU agency with full legal personality (and related responsibilities), which would also provide administrative support to RSPG, which would remain an advisory body like in option 1.

In terms of **economic impacts**, transforming BEREC and the BEREC Office into a fully-fledged agency with increased responsibilities is expected to require significantly increasing the staffing levels of the latter to 90 FTEs (by 88%) and a 50% increase in operational expenditure (premises, equipment), raising the EU budget contribution to around EUR 14.2 million. For example, the working groups that are now managed by BEREC would be managed by the BEREC agency and it might be assumed that the BEREC agency's representatives could (co-) chair working groups. To the extent that the agency would also support the RSPG work, the same assumptions regarding the FTEs were made as in option 1. The budget increase would also cover additional costs associated with the increase in the organisation of working groups' activities; an increase of 50% in the latter would amount to upward of EUR 160 000 per year in additional organisational and reimbursement costs. At the same time, shifting certain decisions to the EU level would also bring cost savings for NRAs and other CAs, thereby reducing the burden on Member States. The impacts of supporting the RSPG are comparable to option 1 (depending also on the Office's location). Under this option, the costs entailed for the agency would mostly be borne by the EU budget and via direct fees/contributions paid by market participants, and possibly also by in-kind and voluntary contributions from the NRAs and other CAs (like in option 1). The Commission will also need reinforcement to cope with its additional tasks (estimated at 5 FTEs, down from 12 FTEs in the baseline). The efficient use of resources would be addressed by mandating a positive opinion of the Commission in BEREC's decisions pertaining to budgetary and HR matters. Ultimately, the main positive economic effect stems from increased harmonisation and more centralised approach to spectrum management, leading to consistency across Member States and more integrated communications markets.

As in other options, option 2 is not expected to have significant direct **societal impacts**.

Its **environmental impact** is also relatively insignificant, and broadly comparable to option 1. However, the largest effect arises from the need for significantly larger premises to accommodate around 75 FTEs. In addition, one-off environmental impacts would result from staff relocations to and from Riga, given the BEREC Office high staff turnover.

There is no impact on **fundamental** rights.

6.4.3. Option 3 - Two separate agencies – (BEREC + BEREC Office) & RSPG

As regards **economic impacts**, option 3 is the costliest for the EU budget. The cost of merging BEREC and the BEREC Office into an EU agency is similar to option 2 (reduced by the costs related to providing support to RSPG), driven mainly by a staffing increase to 80 FTEs equivalent to around EUR 8.955 million, with expenditures for buildings and equipment and operational costs raising by 20%, respectively, to approx. EUR 2.090 million and approx. EUR 1.589 million. Consequently, it is estimated that its annual costs of the BEREC agency will increase from EUR 8.1 million to around EUR 12.235 million per year. At the same time, establishing of the RSPG as fully-fledged agency with decision-making powers would entail one-off costs (e.g. for premises) and recurrent expenses for staffing, office space, equipment and operations. The RSPG agency would be comparable in size to the BEREC agency under option 2. It will take over support and preparatory tasks (under option 1 and 2 performed by the BEREC Office) as well as take on some of the substantial tasks (performed

by the Commission under option 1 and 2). In addition, it will also need to be equipped with support staff. With these assumptions, and assuming that the RSPG agency is located in a Member State similar in terms of salary coefficient, its annual costs will be similar to those of BEREC described under this option. However, creating another independent agency would also generate additional costs from duplicating certain roles and services (e.g. support staff, finance, HR, administration, IT), which could not be shared. The costs entailed for the two agencies would be covered from the EU budget, and – as under option 1 and 2 – via direct fees paid by market participants and possibly NRAs and other CAs' contributions. The efficient use of resources could be ensured by requiring a positive opinion from the Commission on BEREC and RSPG decisions related to budgetary and human resources matters. To enhance cooperation between the two agencies, regular check-point meetings should be organised. However, the separation of the two bodies would not allow for realising the full synergy potential.

Similar to other options, option 3 will not have significant direct **societal impacts**, while the indirect impacts will be similar to both option 1 and option 2 (i.e. increased harmonisation in the implementation of the EU legislation).

Option 3 will have the greatest **environmental impact**, as in addition to those described under option 2 (which will remain), RSPG – as a separate agency - will require its own premises. It is not expected that the transformation of RSPG into an agency would imply a significantly higher number of in-person meetings or travel costs, compared to baseline scenario or other options.

There is no impact on **fundamental rights**.

7. HOW DO THE OPTIONS COMPARE?

7.1. Transition to fibre

The key differences among the various options considered for the transition to fibre are: 1) the approach taken towards the copper switch-off obligation; 2) the kind of access regulatory framework to be used (exclusively SMP–based versus other approaches) and 3) the introduction of EU-wholesale access products with different degrees of involvement from the Commission.

Effectiveness

Baseline option: The current regulatory framework is not intended to accelerate the migration from copper to fibre. Article 81 of the EECC provides for NRAs' involvement in the migration only if the legacy infrastructure is regulated (based on SMP) and after the operator decided to decommission (or replace) parts of its network. Most relevantly, the NRAs' role is limited to ensuring that the decommissioning process includes a transparent timetable and conditions - with the aim to safeguard competition and the rights of end-users. Consequently, Article 81 can slow down but not accelerate the copper switch-off process.

Option 1 – Non-binding CSO and limited updates to the access regulation

Option 1 maintains the current access regulation regime, offering regulatory predictability to support continued investment and competition in fibre networks. However, the framework's flexibility may hinder progress in Member States lagging in fibre deployment or failing to implement wholesale access products that encourage innovation and differentiation. Non-binding targets and national plans alone are unlikely to fully resolve investment stand-offs in countries with extensive FTTC networks, leaving entrenched concerns unresolved.

Option 2 - Conditional CSO and updated access regulation

The conditional but mandatory copper switch-off in this option is likely to significantly boost FTTH deployment and adoption, increasing end-user speeds without raising retail prices and by ensuring appropriate safeguards for vulnerable end-users. However, these benefits depend on several factors being pursued together:

- Member States producing Transition to Fibre Plans to address commercial deployment gaps and support in-building fibre standardization.
- NRAs collecting data, reviewing CSO plans, and conducting market reviews to assess impacts on market dynamics and adopt possible measures as needed
- Addressing competition barriers through a combination of the three-criteria test, followed by Article 61(3) and/or SMP access regulation (in particular SMP-based PIA remedies), and wholesale access products based on best-practice that enable quality and price differentiation.

The review of the RRM is a separate procedure outside of the current impact assessment. Possible effects of a potential Commission's decision not to issue a RRM or not to recommend any markets for ex ante regulation are discussed in detail in Annex 9, section 1. If there is no longer a requirement for the Commission to publish such a list of recommended markets, this would change the presumption, which has applied until now, that there are likely to be wholesale markets which are susceptible to ex ante regulation across the EU. This will result in indirect costs and benefits for **ECN operators** which will differ depending on the implications this has for specific operator groups that may have been (or might otherwise be) considered likely to be subject to ex ante regulation or may have relied on ex ante regulation to provide broadband services to end-users.

However, making the RRM optional does not automatically imply that it will be removed (or that it will be adopted). The potential impacts discussed are hypothetical and depend on several factors: the Commission deciding not to adopt an RRM, and NRAs choosing not to act proactively. Therefore, the actual effects of making the RRM optional remain uncertain and contingent on future decisions and actions.

Option 3 - Market driven CSO and bottleneck-based access regulation

Option 3 shifts access regulation towards deregulation, relying on existing measures for physical infrastructure access under the GIA. Ex ante regulation of fibre networks would be limited to areas with a single closed network, and SMP and Article 61(3) measures would be removed. The goal is to let the market drive fibre deployment and take-up. However, this approach creates uncertainty and may undermine confidence among alternative fibre investors due to a shift from SMP regulation to GIA, potentially increasing wholesale prices and deterring investments. Reduced oversight could worsen fibre access conditions in less competitive areas, and voluntary wholesale access might not ensure fair competition with ultimate negative effects on end-users in terms of reduced choices and affordability. Copper switch-off could accelerate in areas benefiting incumbents but harm alternative providers in FTTC-dominant countries with negative results on end- users.

Option 4 - Mandatory CSO and symmetric regulation

Option 4 simplifies the regulatory framework by replacing the current SMP and Article 61(3) regime with an obligation for all operators for wholesale access. A strict deadline for copper switch-off would accelerate FTTH deployment but might over-rely on public funding and leave some consumers without adequate fixed broadband. 9 countries plan to switch off copper by 2030, while others lag in fibre roll-out and may need additional public funding. Obligating former SMP controllers to provide

duct access on cost-oriented terms would increase certainty for alternative fibre investors, fostering more deployment. Symmetric regulation for wholesale fibre access could increase broadband choices but might make access obligations less stringent, focusing on bitstream access with fair and reasonable pricing. This could reduce support for differentiated offers, increase administrative costs, and create uncertainty, potentially lowering competition quality compared to other options.

The following table provides a synthesis of expected effects of the different options on outcomes, taking into account the combined effects of the individual policies.

Table 23: Overview of effectiveness of options compared with the status quo

Options and associated policy measures	FTTH coverage (homes passed as % HH)	FTTH take-up (homes connected as % HH)	Competition: infrastructure / service	Effects on quality (speed / take-up of Gigabit)	Effects on price (affordability of high speed BB)	Single market / consistency	Simplification
Option 1: non-mandatory CSO and continuity on SMP with some updating of Art 61(3), and best practice wholesale (non-binding)	+ Effects from CSO	+ Effects from CSO and right to connect	(+) Some limited negative effect from CSO, but addressed through SMP, Art 61(3) and EU wholesale access products	(+) Art 61(3) and best practice wholesale	0	(+)	(+)
Option 2: Conditional CSO and updated access regulation (data requirements, Art 61(3)). RRM optional	++ Effects from mandatory CSO conditioned on FTTH coverage,	++ Effects from CSO and right to connect	(+) Negative effect from CSO, but addressed through CSO-linked market review obligation, art 61(3) and EU wholesale access product. optional RRM may have later negative effects from uncertainty.	+(+) Positive from CSO, market review linked to CSO, wholesale products, but later uncertainty if RRM optional	0 CSO provisions safeguard affordability on lower bandwidths, higher bandwidths addressed through market review linked to CSO. Later uncertainty if RRM optional	(+) More consistency regarding CSO, uncertainty regarding access if RRM optional	(+)
Option 3: Reliance on market forces for copper switch-off and access	- Delays in CSO, deterrence of alternative fibre investment	- Effects from FTTH / CSO delays	-- Shift away from current access regulation and removal of required measures and uncertainty around new rules	-- Negative impacts from reductions in competition, reduced FTTH	-- Negative impacts from reduction in competition	+	++
Option 4: CSO obligation	++ Rapid effects to 2030	++ Effects from CSO	+ Reduced infrastructure comp from	+ Positive from CSO / FTTH,	- Negative effects from move to	+	+

without sustainability clause, strong PIA regulation, extension of wholesale access obligations to all operators while limiting strength of obligations	mitigated by FWA and slower FTTH deployment after 2030	and right to connect	CSO mitigated by strong PIA + greater service competition (but on bitstream)	strong PIA but negative from move of access regulation to bitstream regulation	bitstream / fair and reasonable pricing		

Coherence

Coherence within the DNA and with other EU instruments is considered across all options:

- Internal Coherence: All options aim to remove inconsistencies.
- References to 100 Mbps in geographic surveys, inconsistent with VHCN objectives, are updated or removed.
- Options 3 and 4 face challenges due to their reliance on ex ante regulation concepts not directly linked to competition analysis and as far as option 4 is concerned some concerns related to proportionality may also arise.
- Option 2 ensures coherence by coupling copper switch-off with market reviews and standardized wholesale access specifications, promoting a harmonized FTTH framework. However, the periodic market reviews may be conducted only if and when the NRAs consider this to be justified. This could lead to some uncertainty.

External Coherence:

- Removing Article 76 addresses potential conflicts with the assessments of cooperation agreements.
- Updating 100 Mbps aligns with the Broadband State Aid Guidelines and Digital Decade Policy Programme targets.
- Options 1 and 2 align with competition law by using the SMP concept.
- Options 3 and 4 depart from competition law principles, potentially leading to incoherent access regulation rules compared to competition authorities' conclusions.

Coherence with the GIA:

- All options are coherent with the GIA.
- Option 2 reinforces this coherence by prioritizing GIA-based regulation for ducts and poles, aligning with the 2024 Gigabit Recommendation.
- Option 3 replaces SMP regulation by access to civil engineering infrastructure, handled via the GIA exclusively.
- Option 4 establishes specific rules to grandfather SMP PIA provisions, triggering Article 3(9) GIA (i.e. passive networks that are already subject to some access regimes (e.g. State aid) fall under those regimes for as long as such access obligations are in place) and adding symmetric measures for fibre access.

Efficiency[268]

The opportunity costs (i.e. lost profits) of copper switch to the operators cannot be quantified due to lack of publicly available data. However, it is clear that operators will need to replace their copper networks to keep pace with demand and competition thus the mandatory copper switch-off, subject to conditions, has only the effect of bringing forward the date of the switch-off.

The administrative costs measured in FTEs and converted in monetary values can be: (i) divided in one-off and recurrent costs and (ii) attributed to competent (i.e., public) authorities and stakeholders (i.e., operators). The annual cost for an FTE, that has been considered in the analysis, is EUR 95 400. The result for the different options is compared with the one of option 0 (status quo).

Costs have been allocated for the following categories: (i) one off: FTTH and copper switch-off plans and implementation, Data gathering under Article 22, forecasts and declarations, Market analysis, SMP and symmetric (Article 61(3)) regulation, Best practice wholesale access specifications, and (ii) recurring: Data gathering under Article 22, forecasts and declarations, Market analysis, SMP and symmetric (Article 61(3)) regulation, Dispute resolution in relation to EECC.

Table 24: Estimated change in one-off and recurring administrative costs

Option	One-off FTE (CSO + data + market review + wholesale products)	Change in one-off FTE	Change in one-off costs	Recurring FTE (Data gathering, market analysis, dispute resolution)	Change in recurring FTE	Change in recurring cost (€000)	% Change in recurring cost
Option 0: Status quo	150	-	-	2 172	-	-	
Option 1: Non-binding CSO and limited updates to access regulation	417	267	25 471 800	2 331	159	15 69	7%
Option 2: Conditional CSO and updated access regulation	915	765	72 981 000	2 570	398	37 922	18%
Option 3: Market driven CSO and bottleneck-based access regulation	-	-150	-14 310 000	948	-1 224	-116 770	-56%
Option 4: Mandatory CSO and symmetric regulation	944	794	75 699 900	2 939	767	73 124	35%

Source: Study on Access Regulation

It is worth noting that option 3 has a very positive impact on both one off and recurring costs, as it results to significant reduction for both (EUR 130 million). All other options are "more expensive" from the baseline scenario, as their additional total costs range from approximately EUR 40 million for option 1 to almost EUR 150 million for option 3, with option 2 lying in-between at EUR 110 million.

Option 1 will result in low one-off and recurring direct costs and minimal indirect costs. The improvements in coverage, penetration, and speeds are modest, but there are some gains in GDP and CO2 emissions. This option is a middle-ground approach, providing some benefits without significant disruptions

[268] Concrete information on direct and indirect costs, explaining who will bear the costs, distinguishing between administration (public authorities), businesses (operators) and citizens, end-users, is included in Annex 9, section 1.1.

Option 2 will result in moderate one-off and recurring direct costs and high indirect costs. It also has high impact on coverage, penetration, and speed improvements, along with notable gains in GDP and CO2 emissions. This option is balancing high costs with high benefits.

Option 3 would lead to the lowest direct costs but high indirect costs due to investor uncertainty and reduced competition. The benefits in terms of coverage, penetration, and speeds are modest, with minimal impacts on GDP and CO2 emissions.

Option 4 will result in high one-off and recurring direct costs and significant indirect costs. It offers the highest benefits in terms of penetration, GDP and CO2 emissions. This option is would be the most effective, but also the most costly and disruptive.

In summary, option 2 provides the highest GDP growth and significant environmental benefits, while option 4 offers the best FTTH coverage and take-up but with stronger intervention. option 3 is the least economically beneficial and has minimal environmental impact, and option 1 maintains the status quo with minimal interference in business operations.

Stakeholders' feedback

The acceleration of the **copper switch-off** process is mainly supported by alternative fibre companies which favour binding copper switch-off deadlines. Financial investors point to ongoing losses by fibre companies and challenges to achieve take-up targets due to the persistence of legacy copper networks. Incumbents are favouring non-binding targets. Business associations are largely against a mandatory copper switch-off date. Public authorities express support facilitating the copper switch-off but mostly argue for a nuanced approach. BEREC considers the suggested date of 2030 for completing copper switch off "overly ambitious".

The stakeholders' feedback **on in-building fibre wiring** shows that alternative fibre investors favour the inclusion of the in-building fibre wiring in the definition of VHCN. In contrast, some incumbent operators and alternative operators consider the costs of extending the definition of VHCN to cover in-building fibre wiring to exceed the benefits. Yet, as indicated in the Evaluation Report (Annex 11), eight NRAs, decided to regulate access to in-building wiring (which is done at request of operators). Consumer protection organizations have a more balanced view, with a slight preference towards including in-building fibre in the definition of VHCN.

The stakeholders' feedback on the **removal of rarely used provisions** shows that 50% of NRAs and 62% of alternative operators favour removing Article 76 (co-investment). 35% of NRAs and 57% of alternative operators consider removing wholesale-only provisions (Article 80). While some incumbents and fibre investors consider that provisions regarding functional separation (Article 77) could be removed, this is opposed by NRAs, consumer protection authorities and alternative operators.

The feedback on the **EU-wide wholesale product** indicates that stakeholders specialized in the provision of services to multi-national businesses confirm its value in supporting cross-border service provision. Other stakeholders, which are more focused on national service provision, suggest that the impact of standardised wholesale characteristics on cross-border provision in multiple countries would be limited. Some NRAs and national competent authorities signal that there could be some value from such provisions in facilitating the provision of retail broadband services in national markets with different wholesale access providers and potentially different legal bases for regulation. BEREC and two national regulators (AKOS and HAKOM) question the feasibility and usefulness of the pan-EU harmonised access product(s).

The need for **access regulation** is still considered necessary by nearly all respondents, except some of the incumbent operators. Most respondents, including all alternative fibre investors and alternative operators prefer the status quo to be retained as regards access regulation. Only some former incumbent operators suggest that access provisions could be entirely removed. Telecom operators, and particularly those making use of SMP PIA favour the status quo or the direct inclusion in the DNA of an obligation on operators with previous SMP obligations regarding PIA to provide this under strict conditions.

EU-added value

The options vary significantly in the added value they provide compared to Member States acting alone:

- Option 1: Introduces EU-wide non-binding targets and best practice guidelines, offering some added value. However, these are unlikely to drive significant changes as they lack binding requirements to address issues like ambition in copper switch-off targets and inconsistencies in wholesale access products.
- Option 2: Provides additional added value by introducing binding requirements for copper switch-off, data gathering, and wholesale specifications. It supports subsidiarity and proportionality by:
  - Allowing Member States to determine the most appropriate dates and means for copper switch-off.
  - Making switch-off conditional on consumer benefits.
  - Empowering NRAs to oversee the process and apply necessary conditions.
  - Enabling NRAs to adopt remedies beyond best practice specifications if justified.
- Option 3: Could limit the scope for authorities to intervene in copper switch-off and apply ex ante regulation, reducing flexibility to foster VHCN availability and competition. While it grants flexibility in wholesale product specifications, this may compromise consistency at the EU level.
- Option 4: Achieves consistency in access regulation across the EU by limiting derogations and requiring all operators to meet reasonable wholesale access requests. However, this may limit subsidiarity and proportionality, restricting Member States' ability to adapt rules to specific circumstances like low FTTH coverage and limited speed competition, thereby reducing scope for innovation and differentiation.

Summary

The table below shows a comparison of the options in terms of effectiveness, efficiency, coherence and EU added value.[269] Effectiveness is compared as the likelihood to achieve the specific objectives of the measure - fostering fibre take-up (including take-up of Gigabit offers) and coverage but also includes a comparison of the effect on the Single Market as a result of the proposed access regulation and variation of the wholesale access products. Option 2 is the preferred option.

[269] EU-added value is analysed under Annex 9, section 1.1.

Table 25: Comparison of the Transition to fibre options

	Effectiveness				Efficiency			Coherence		EU added value
	FTTH cove-rage	**FTTH take-up / boost penetra-tion**	**Take-up of Gigabit speeds**	**Consis-tency / single market**	**Admini-strative cost (short / long run)**	**Main unintended costs 251**	**Benefits in relation to cost**	**Inter-nal**	**Exter-nal**	
Option 1	+	+	+	+	-	n/a	+	+	0	+
Option 2	++	++	++	+	- /-	A small % consumers may need to transition to wireless / mobile. Copper network owners not investing in fibre may experience reduced profitability	++	+	+	++
Option 3	-	-	-	-	++	--- Risk of delays to copper switch-off and under-regulation impacting competition and single market	-	-	-	--
Option 4	++	++	+(+)	+++	---	- Risk of unconnected households, reduced quality of competition	+	-	-	++

7.2. Spectrum

Effectiveness

The baseline offers limited effectiveness in promoting investment. Regulatory uncertainty, divergent assignment conditions and insufficient licence duration, stall deployment, especially cross-border.

Option 1 partially addresses the problem by promoting best practices, however the voluntary nature of the approach limits its effectiveness. Structured spectrum Single Market procedure and coordination of timing of awards via evolving roadmap improves consistency and transparency, while maintaining flexibility, but may not deliver tangible results in terms of single market.

Option 2 is more effective as it provides legal certainty by introducing default indefinite license duration (conditional and with safeguards of revocation). It improves predictability through pro-investment and pro-security authorisation conditions and facilitates access to spectrum for wholesale-only operators. The combination of *ex ante* spectrum single market procedure of assigning measures with possibility to veto on market shaping measures and limited licence duration, binding authorisation conditions and increased transparency and predictability of the timing of auctions ensures consistent pro-investment authorisation practices, incentivises cross-border provision of services and facilitates attaining scale. These features are particularly effective in unlocking investment in key bands for high quality 5G (and future 6G) which are estimated to generate the highest GDP impact, as confirmed by the historical data analysis and correlations between regulatory approaches and market outcomes and by the model indicative estimates of up to EUR 1.55 trillion in cumulative GDP benefits (and even more for 6G investments in the longer term). This option promotes harmonised EU-wide 6G deployment in strategically important bands, reinforces EU competitiveness, particularly for vertical sectors and opens up new opportunities for development of new spectrum-based services thanks to spectrum sharing.

Option 3, while yielding a comparable GDP impact to option 2 over the 2025–2035 period,[270] reaches the highest level of effectiveness in the long term, as effectiveness is not assessed solely on the basis of the GDP estimates but also reflects effectiveness gains beyond the modelling horizon and scope.[271] Through EU-level spectrum awards for specific bands, harmonised licence conditions, and indefinite license durations option 3 addresses persistent sources of regulatory fragmentation and lack of predictability at national level. By mandating coordinated spectrum authorisation and enabling shared governance at EU level, option 3 establishes a highly stable, scalable investment environment across the Union, possibly fostering cross-border consolidation between telco operators. It is the most effective option as it also includes a compliance mechanism at EU level, introducing a binding interference response framework and substitutes CEPT with an EU-only high-level group in sensitive areas, thereby maximising the EU's strategic coherence and response capacity. It enables deployment in mid-band spectrum which provides the largest economic gains, and the harmonised framework strengthens conditions for pan-European investments.

Sensitivity analysis: To account for potential uncertainties of the model that estimated indicative GDP impacts, a sensitivity analysis has been conducted, relying on varying estimates based on the methodology presented in Annex 4, Section 2. Under the lower-sensitivity scenario, accounting for multiple uncertainties and assuming a smaller impact of increased mobile broadband speeds on productivity and GDP (e.g., due to uncertainties regarding effective use of 5G-enabled technologies across sectors or slower diffusion of digital applications), the cumulative GDP impact for the EU over the period 2025–2035 is estimated at EUR 179 billion for options 2 and 3, compared to EUR 171 billion for the baseline and EUR 174 billion for option 1. Conversely, under the upper-sensitivity scenario, which assumes a higher responsiveness of GDP to broadband speed improvements (for instance, reflecting faster adoption of 5G-driven innovations or stronger network effects), the overall GDP impact for the EU over the same period is estimated at EUR 2,116 billion for options 2 and 3, compared to EUR 2,015 billion for the baseline and EUR 2,049 billion for option 1. These results illustrate that while the magnitude of impacts varies substantially across sensitivity assumptions, the relative differences between policy options remain limited, suggesting that the overall ranking of options is robust to variations in the assumed elasticity of GDP to broadband speed increases.

Efficiency

The baseline scenario involves minimal administrative costs, but its inefficiencies lie in missed investment opportunities and persistent market fragmentation.

Option 1 is cost-effective: promoting long licence durations and best practices brings improved predictability with relatively low regulatory burden. Replacing the peer review processes with the spectrum Single Market procedure and coordinating the timing of assignment through an evolving roadmap slightly increases procedural complexity but remains manageable for Member States.

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[270] The GDP model estimates economic impacts based on projected changes in mid-band coverage and mobile broadband download speeds from 2025 to 2035. For this period, options 2 and 3 are assumed to yield similar model inputs, with mid-band coverage increasing to around 96% and average download speeds reaching approximately 265 Mbps by 2035.

[271] The effectiveness gains of option 3 do not fully materialise in the short to medium term. Due to the continued relevance of existing national spectrum holdings and non-harmonised regulatory frameworks, including rules on lawful interception and consumer protection, EU-level assignments initially complement rather than replace national spectrum holdings. As a result, their immediate impact on network deployment and performance is limited. Only in the longer term, as existing rights of use expire and spectrum is progressively assigned under the EU framework, do the full effectiveness gains of Option 3 materialise, including better conditions for pan-European deployment and the realisation of economies of scale.

Option 2 introduces moderately higher compliance and procedural costs for public authorities due to increased monitoring of renewal conditions, increased transparency of spectrum assignment procedures and implementation of pro-investment and pro-security authorisation conditions, including robust competition analyses/review mechanisms and safeguards for competition law compliance. However, in the long run, cost reduction should be expected thanks to longer duration, reduced re-auctioning and efficiency gains which would contribute to the development of new services. Option 2 enables economies of scale through greater harmonisation of authorisation conditions and improved alignment of auction timelines, reducing regulatory fragmentation and compliance costs for operators active in multiple Member States. This option's measures are proportionate and highly efficient for strategic spectrum bands, which are expected to bring GDP gains. Options 2 and 3 demonstrate comparable superior environmental efficiency, with the lowest CO_2 per euro of GDP among all scenarios.

Option 3, while slightly more effective than option 2, entails the highest administrative and legal costs and is thus less efficient than option 2, particularly during the transition period characterised by parallel EU and national governance structures. Member States would need to adjust national laws and procedures to accommodate for a centralised framework, and the EU would require significant institutional capacity to oversee assignments, monitor compliance, and resolve disputes. Initially operators would keep holdings they already have in several bands to ensure mobile services and the additional spectrum awarded at EU level to a limited number of operators would only add up to the existing spectrum holdings of a significant number of operators and would not be sufficient on its own for network deployment, also considering that 6G networks are expected to be built as an evolution of 5G networks, There would be a need to maintain both spectrum governance structures at national and EU level. Only in the long term when existing national assignments would come to an end and the timelines would be aligned additional bands could be assigned at EU level and additional efficiencies would materialize, including at the administrative level (linked with the lower number of providers. EU-wide awards, though having the potential to maximise economies of scale for certain operators in the long term, would also bring significant uncertainty and could disturb the functioning of the mobile market, until a new structure of the market is established, a process which could take years, given the number of spectrum bands and their different expiry dates.[272] The long-term benefits for pan-European infrastructure and high-value bands could potentially justify the significant initial cost. In the long term, it is likely that only few undertakings (3-4 maximum) would be able to retain enough spectrum at EU level for sustainable operation, and the majority of operators currently operating in the EU would be forced to sell assets, exit the market or become virtual operators.

Sensitivity analysis: To account for potential uncertainties of the model that estimated indicative environmental impacts, a sensitivity analysis has been conducted for the energy-efficiency factor, which is set at 22% per year in the base model. Variations in this factor accordingly affect the different options. Annex 4 shows the results of this analysis that leads to a stable ranking across all scenarios: option 3 always performs best, followed by options 2, 1, and 0. However, the differences between options are very small, around 0.1–0.2% (e.g., baseline 22%: 5,257,074 vs. 5,250,198 for option 0 vs. 3). Around the baseline, absolute emissions decline almost linearly by several tens of

[272] EU-wide awards have the potential to generate economies of scale in the long term, notably where operators deploy networks on a pan-European basis. However, given the inherently local nature of network deployment (e.g. geography, site acquisition, permitting and local workforce requirements), as well as the continued application of non-harmonised rules in areas such as lawful interception, data protection and consumer protection, such economies of scale are unlikely to materialise in the short to medium term (until 2035). Within the modelling horizon, they are not expected to offset the transition costs associated with restructuring governance and market arrangements at EU level.

thousands of units per additional efficiency percentage point, with slightly diminishing marginal returns. Prioritizing an increase in the efficiency factor delivers meaningful GHG reductions, while the choice among options 0–3 yields only marginal gains. For details see Annex 4, Section 2.

The below table shows the costs and benefits of all options, explaining who will bear the costs, distinguishing between administration (public authorities), businesses (operators) and citizens, end-users.

	SPECTRUM		
	O1. Soft harmonisation	**O2. More single market to enhance investment and innovation (PREFERRED OPTION)**	**O3. Strong harmonisation and EU level rules**
Costs by stakeholders			
End users: Citizens and industrial sectors (e.g. verticals)	neutral	neutral	neutral
Operators	(0/+) Neutral to low adaptation costs to new licence types (0) Neutral adaptation costs related to spectrum sharing as no operator generated barriers will be tackled (0/-) Neutral to reduced costs of acquiring new spectrum and retaining used spectrum, even with licence duration of 20+5 years, provided recommendations on investment-oriented auction designs and conditions are followed	(+) Low costs for adaptation to new licence types (+) Low costs for adaptation to spectrum sharing under principle "use-it-or-share-it" (-) Reduced costs of acquiring new spectrum due to auctions more focused on incentivising investments, more targeted usage of market shaping measures and investment-oriented spectrum licensing conditions (--) Reduced costs of retaining already used spectrum thanks to less re-auctioning under a default indefinite licence duration (e.g. for 3.6 GHz spectrum)	(+) Low cost for adaptation to new licence types (+/++) Low to medium cost of adaptation to spectrum sharing, especially via dynamic geolocation database (--) Reduced costs of acquiring new spectrum due to harmonised auction process aspects and conditions (--) Reduced costs of retaining used spectrum – as under option 2 (++) High cost of market restructuring resulting from EU-level spectrum awards – in short term, a risk of inefficiencies if only few operators (3-4 maximum) are able to acquire spectrum at EU level, and in the medium term, a risk for operators that will repeatedly fail to secure spectrum to sell assets, exit the market or become virtual operators. These costs decrease in the long term.

	SPECTRUM		
	O1. Soft harmonisation	**O2. More single market to enhance investment and innovation (PREFERRED OPTION)**	**O3. Strong harmonisation and EU level rules**
Administration	(0/+) Neutral to low compliance costs of the toolbox of best practices (e.g. award conditions, auction formats, fee models, and obligations) as non-binding, compared to 6G roadmap, mandatory ex ante spectrum Single Market procedure (+) If relevant, a low one-off adjustment cost to EC recommendations (e.g. adapting internal procedures): (0/+) Neutral to low additional expenses due to mandatory ex ante Single Market procedure; applied on a case-by-case basis, at each auction, with a lower expected frequency due to longer licence duration; mostly administrative costs (e.g. dossier and presentations preparation) as substantiation of market shaping measures is required already under the EECC (+) If relevant, low compliance costs linked to the non-binding EC opinion resulting from the spectrum Single Market procedure (+) Increase in BEREC office cost for activities surrounding the spectrum scrutiny (up to 2 FTEs) (the current staff expenditure in BEREC Office per employee EUR 111.935 x 2 = EUR 223 870) (0/+) Neutral to low costs of removing barriers to spectrum sharing	(+) Moderate adaptation costs (continued) to EC recommendations and decisions addressing authorisation process aspects and conditions, authorisation regimes, updating EU spectrum strategy and roadmaps, and national roadmaps, including after successful petition, mandatory ex ante Single Market procedure (+) Limited additional expenses for the ex-ante spectrum Single Market procedure, but higher than under option 1; on case-by-case basis, but fewer auctions expected than under option 1 due to in general unlimited licence duration; (+) If relevant, moderate costs with ensuring compliance with the binding EC opinion, especially in case of EC veto (+) Higher increase in BEREC office cost for activities relevant to the spectrum Single Market procedure (2 FTEs) than in option 1 due to more formalised procedure (the current staff expenditure in BEREC Office per employee EUR 111.935 x 2 = EUR 223 870)	(++) High adaptation costs to fully harmonised authorisation process aspects and conditions, mandatory assignment deadlines and extended mandatory ex ante spectrum Single Market procedure (++) High compliance costs related to introduction of the EU-level spectrum awards due to synchronisation of existing licences' expiry dates and conditions and need to conduct procedures at EU level (+/++) Limited to high additional expenses with ex ante spectrum Single Market procedure because NRA needs to prove dominance in case it would like to introduce market shaping measures; (+/++) If relevant, moderate to high costs to ensure compliance with the binding EC opinion, especially in case of EC veto (+) Increase in BEREC office cost for activities relevant to the spectrum Single Market procedure (2 FTEs) similar to option 2 (the current staff expenditure in BEREC Office per employee EUR 111.935 x 2 = EUR 223 870) (+/++) Moderate to high costs for introducing monitoring and enforcement of sharing mechanisms that

	SPECTRUM		
	O1. Soft harmonisation	**O2. More single market to enhance investment and innovation (PREFERRED OPTION)**	**O3. Strong harmonisation and EU level rules**
	(0/+) Neutral to low additional cost of monitoring compliance with licence conditions' due to longer duration (20+5 to currently 15+5 years) (+) On case-by-case basis, additional costs in monitoring / enforcing intra-EU 3rd state cross-border interference (0/+) Neutral to low administrative costs with monitoring the 6G roadmap developments (+) Low mainly administrative costs related to a system for petition for harmonisation;	(+) Moderate costs for introducing monitoring and enforcement of sharing mechanisms that may require real-time monitoring infrastructure (e.g. dynamic database) (+) On case-by-case basis, moderate costs associated with implementation of measures resolving cross-border interference issues (+) Moderate costs associated with establishing and implementing a system for petition for harmonisation	may require real-time monitoring infrastructure (e.g. dynamic database) (+/++) On case-by-case basis, moderate to high costs with implementation of measures resolving cross-border interference issues (++) High costs associated with establishing and implementing a system for petition for harmonisation and ensuring adequate follow up
Benefits by stakeholders			
End users: Citizens and industrial sectors (e.g. verticals)	(+) Limited improvements to quality of service due to wider high quality 5G coverage and higher speeds (+) Limited benefits for industry from increased possibility to ask for harmonisation of spectrum (+) Increased investment planning for vendors and verticals on the basis of 6G roadmap leading to more synchronised technology adaption (0/+) Neutral to low benefits from spectrum sharing thanks to removal of legal barriers	(++) Considerably improved coverage and quality of service for mobile connectivity, faster availability of 6G (++) End users, especially in rural/underserved areas benefit indirectly from faster rollout, broader service options, higher QoS and higher coverage with high-quality networks enabled by investment oriented spectrum licensing, local licensing, shared access and interference free connectivity, especially in cross-border areas. (++) Innovation acceleration for Industry (verticals, SMEs, R&D actors) benefiting from enhanced 5G QoS and specialised services offers and from access to localised/licensed spectrum for innovative services (e.g. private 5G, IoT), particularly	(++) Considerably improved coverage and quality of service for mobile connectivity, faster availability of 6G The benefits are comparable to option 2

	SPECTRUM		
	O1. Soft harmonisation	**O2. More single market to enhance investment and innovation (PREFERRED OPTION)**	**O3. Strong harmonisation and EU level rules**
		in manufacturing, health, agriculture, and transport and from the capacity to scale up thanks to the harmonisation of authorisation conditions. (++) Accelerated shift from 5G to 6G with enhanced capabilities such as real-time distributed intelligence, ultra-low latency, integrated sensing and communication, and improved energy efficiency, all of which may generate cross-sectoral economic benefits similar or even superior to those observed for 5G.	
Operators	(+) Greater coherence and predictability thanks to 6G roadmap and toolbox of best practices that could result in lower entry barriers, facilitation of networks expansion and avoidance of overlay high prices based on new auction designs. Direct benefits of longer licence duration (min 25 years with conditions for renewal) resulting in increased investment capacity, planning stability and reduced risk premium on capital expenditures Greater level playing field as spectrum Single Market procedure helps to identify potential national measures which would create a barrier in the Single Market or do not comply with EU law.	(++) Increased investment capacity, lower financing cost thanks to higher predictability, improved legal certainty, clearer, more predictable procedures through EU-level licensing guidance, in general unlimited licence duration, automatic renewals and stakeholder petition mechanisms. Investment oriented spectrum auctions overall, reducing spectrum costs and increasing investment incentives. Lower entry barriers for SME: Simplified and more flexible access regimes and harmonisation of authorisation conditions reduce administrative and regulatory burdens for SMEs entering niche or local spectrum markets. Benefits from increased flexibility: The preferred option adapts certain eligibility restrictions that previously	(++) Increased investment capacity due to fully harmonised authorisation procedures aspects and conditions, unlimited licence duration and consistency in award timing and renewal criteria Benefits associated with reduction of compliance costs borne by cross-border operators due to misaligned conditions between Member States Other benefits comparable to option 2

	SPECTRUM		
	O1. Soft harmonisation	**O2. More single market to enhance investment and innovation (PREFERRED OPTION)**	**O3. Strong harmonisation and EU level rules**
		limited participation in spectrum awards (e.g. requirements linked to network coverage or service provision), which enables wholesale-only operators and new entrants to gain better access to spectrum; this stimulates service competition and service diversification. Better response to interference translates into reduced costs by enabling the use of otherwise underutilised spectrum through the resolution of cross-border interference issues, both within the EU and with third countries (mainly along external land borders), thereby preventing related service disruptions.	
Administrations	(+) In the long term, limited benefits from the reduction of some costs due to the simplification of some processes and harmonisation	(++) In the medium/long term, benefits from significant reduction in administrative costs due to fewer auctions and greater use of licence renewals, which can ease administrative workload, improve planning certainty and lower transaction costs. Increased spectrum efficiency due to a push towards innovative spectrum sharing solutions. The preferred option supports the uptake of advanced sharing mechanisms (e.g. dynamic spectrum access, AI-based coordination), unlocking additional efficiencies and supporting coexistence in dense spectrum environments.	(+/++) Improved auction efficiency and spectrum use by applying standardised metrics and binding rules In the long term, benefits from a reduction in administrative costs, but lower than in option 2 due to too the high effort required to maintain harmonisation, which might be burdensome for smaller administrations Enhanced coordination in addressing harmful interference from third countries
Net Value for Stakeholders			
Net Value for Citizens and	Positive ++	Positive +++, no additional cost for citizens, but several additional benefits from	Positive +++, no additional cost but several additional benefits from improved

	SPECTRUM		
	O1. Soft harmonisation	**O2. More single market to enhance investment and innovation (PREFERRED OPTION)**	**O3. Strong harmonisation and EU level rules**
industrial sectors (e.g. verticals)		improved quality of service and increased competitiveness for businesses (e.g. verticals) due to use of quality-assured services	quality of service and increased competitiveness for businesses (e.g. verticals) due to use of quality-assured services
Benefits	++ Some benefits linked to better quality of service (speeds, latency, etc.) and increased coverage with high quality 5G and accelerated 6G deployment.	+++ Considerable benefits linked to better quality of service (speeds, latency, etc.) and increased coverage with high quality 5G and accelerated 6G deployment. Considerable spillover effect on different sectors of the economy from high quality 5G/specialized quality-assured services and IoT, especially in sectors like healthcare, manufacturing, automotive and transport, energy environment and agriculture.	+++ Benefits linked to better quality of service (speeds, latency, etc.) and increased coverage with high quality 5G and accelerated 6G deployment. Considerable spillover effect on different sectors of the economy from high quality 5G/specialized quality-assured services and IoT, especially in sectors like healthcare, manufacturing, automotive and transport, energy and environment and agriculture.
Costs	(0) Neutral for citizens Industry might need to invest in innovation to introduce quality assured services and make best use of the offered connectivity	(0) Neutral for citizens Industry might need to invest in innovation to introduce quality assured services and make best use of the offered connectivity	(0) Neutral for citizens Industry might need to invest in innovation to introduce quality assured services and make best use of the offered connectivity
Net Value for Operator	(+) the benefits outweigh the costs for operators	(+++) the benefits largely outweigh the costs for operators	(++) the benefits largely outweigh the costs for main operators
Benefit		Increased predictability and investment capacity, reduced costs associated with the inability to use spectrum due to harmful interferences	Increased predictability and investment capacity.
Costs		(-) Low costs for adaptation to new licence types (-) Low costs for adaptation to spectrum sharing under principle “use-it-or-share-it”	(--) In the short term, only few undertakings (3-4 maximum) would be able to acquire spectrum at EU level, which means that most operators currently operating in the EU would be forced to sell assets, exit the market or become virtual operators.

	SPECTRUM		
	O1. Soft harmonisation	**O2. More single market to enhance investment and innovation (PREFERRED OPTION)**	**O3. Strong harmonisation and EU level rules**
			Costs reduced in the long term.

Coherence

The baseline is only partially coherent with EU investment needs and Digital Decade goals. High quality 5G and future 6G investments are expected to be financed mainly by the private sector (see section 2.1.2 and 2.3.2 and Annex 7, Section 1.2.1.). Diverging licence regimes and insufficiently investment-oriented auctions hinder the coherent rollout of 5G.

Option 1 falls short of ensuring sufficient incentives for private investments. The use of a toolbox, peer review, and coordinated roadmaps for spectrum awards supports convergence without imposing binding obligations, marginally improving policy coherence.

Option 2 improves coherence significantly by integrating spectrum policy with wider EU objectives on connectivity, investment, and preparedness as well as cybersecurity. Renewal conditions, coherent pro-investment authorisation and spectrum sharing ensure a more strategic, structured and predictable policy environment. The integration of the 5G toolbox in the conditions attached to rights of use of spectrum will increase coherence with the Cybersecurity Act. The coordination of national roadmaps under a common EU framework ensures synchronisation across Member States. This option supports coherence with broader strategic agendas, such as the Digital Decade, 6G roadmap coordination, the European Preparedness Union Strategy and the ProtectEU Internal Security Strategy, without removing Member State autonomy in non-harmonised bands.

Option 3 has the potential to bring the highest level of internal coherence by embedding spectrum governance into a common investment strategy but challenges the balance of powers with national regulators. It ensures that awards for strategic bands are aligned with cross-border deployment objectives, security priorities, and Digital Decade targets. Indefinite licenses, a harmonised approach to renewal, remedies aiming to safeguard or increase competition, all support long-term planning and minimise policy fragmentation. However, full centralisation requires careful alignment with existing structures to ensure subsidiarity is respected.

Stakeholder's feedback

As regards **option 1** operators are positive to longer license duration, easier renewals, more harmonisation of authorisation procedures and of conditions. They, however, favour an even more ambitious mechanism similar to the existing framework for market analysis. They see positively the evolving roadmap on spectrum availability and policies incentivising sharing and flexible use. Member States and NRAs do not see the need for license durations beyond 20 years or for common

spectrum authorisation procedures and conditions. The RSPG acknowledged the potential for improvement of the peer review as well as the need for pro-investment assignment conditions.

The bundle of measures in **option 2** received most support from telcos which support measures increasing regulatory predictability and reducing market fragmentation: indefinite or very long license durations, automatic renewals, lower spectrum costs, and flexible usage rules. Telcos converge in that market-shaping measures should be controlled on the basis of a competitive analysis scrutinised ex ante. While in favour of pro sharing and flexibility policies, they caution against mandatory obligations. Stakeholders endorse EU-wide harmonisation of the availability of spectrum and technical and economic conditions. Member States and NRAs see no need for harmonised spectrum authorisation and oppose common authorisation procedures and conditions. The RSPG expressed a view against a mandatory single market procedure with veto. Competent authorities were more positive to measures promoting sharing and flexibility in spectrum use.

As regards **option 3**, while telcos and vendors are in favour of unlimited license duration and full harmonisation of spectrum authorisation conditions, they are strongly against awards at EU level or under strict deadlines and are split with regard to cross-border coordination and interference management. The RSPG recognised the potential to improve the cooperation between Member States in addressing cross-border interference. It expressed strong preference for maintaining the current model, including the preparation of technical harmonisation of spectrum by CEPT. The Electronic Communications Committee of the CEPT also expressed the view that the existing framework between the EU and CEPT is resilient and working well.

Summary

The table below summarises the overall costs and benefits for the different stakeholders by each option. Annex 3 Section 2.2. presents in detail the main costs and benefits per stakeholders of the three Options.

Table 26: Summary of costs and benefits for Spectrum options

	O1. Soft harmonisation	**O2. More single market to enhance investment and innovation**	**O3. Strong harmonisation and EU level awards**
Net Value for Citizens and industrial sectors (e.g. verticals)	Positive ++	Positive +++, no additional cost for citizens, but several additional benefits from better quality of mobile services and increased competitiveness due to use of quality assured services	Positive +++, no additional cost but several additional benefits from better quality of service and increased competitiveness due to use of quality assured services
Net Value for Operator	+ the benefits outweigh the costs for operators	+++ the benefits largely outweigh the costs for operators	++ the benefits largely outweigh the costs for main operators

The table below shows comparison of the options in terms of effectiveness, efficiency, coherence and EU added value. Based on this assessment, option 2 is considered to be the preferred option.

Table 27: Summary assessment of policy options – spectrum high quality mobile networks

Criterion	Baseline	Option 1	Option 2	Option 3

Effectiveness	–	+	++	++
Efficiency	–	+	+++	++
Coherence	0	+	++	++
Relevance	–	+	++	++
EU added value	0	+	++	++

7.3. Authorisation

Effectiveness

The **baseline scenario** is not effective in achieving the stipulated objectives, as it does not allow reducing the costs of compliance nor removing obsolete/simplifying complex provisions.

Option 1 moderately simplifies and reduces fragmentation. For **cross-border services**, like satellite and B2B, it moderately improves effectiveness through a **one-stop shop notification system** coordinated by the BEREC Office. However, it does not fully address fragmentation e.g. on cybersecurity, lawful interception, data retention, administrative charges, and emergency communications. It preserves national decision-making, but promotes convergence in satellite authorisation conditions and also includes costly reporting obligations. The EU-level satellite selection mechanism supports scale, certainty for pan-European satellite operators, eases spectrum access and market entry.

Option 2 improves compliance with all authorisation conditions (through coordination mechanism) and removes excessive national authorisation requirements as they would be embedded in the EU regulation as fixed and exhaustive list of conditions. It centralises the selection, assignment and authorisation for satellite spectrum entirely at EU level and offers the highest level of effectiveness, considerably simplifying satellite authorisations and avoiding duplications. This reduces the burden for providers and national competent authorities and maximises predictability for operators ensuring spectrum is authorised throughout the EU territory, without white spots, facilitating scale. It enables providers to innovate and grow across borders supporting EU competitiveness and strategic autonomy, also ensuring more effectively that all players play by the rules. While enabling wider availability of satellite services it fully ensures economic, social and environmental benefits described in section 6.3.

Option 3 removes MS flexibility to include additional general authorisation requirements and reduces significantly the administrative burden and supporting scale based on a **country-of-origin regime** with mutual recognition. It promotes convergence in satellite authorisation conditions aligned with ITU rules, more likely effective enforcement in the hands of one MS, and introduces an EU-level selection mechanism for MSS spectrum, which may enhance coordination for pan-European networks. However, its effectiveness is limited as satellite providers remain bound by Member States laws and enforcement stays national.

Efficiency

The baseline scenario shows very low cost-efficiency since undertakings face additional administrative and compliance burdens without clear benefits. **Option 1** entails a better trade-off than the baseline scenario with slightly reduced burdens for cross-border providers, especially SMEs,

more competition and innovation thanks to coordination mechanisms. Benefits are however limited to cross-border services providers, such as B2B and satellite. The harmonised authorisation template adds some moderate coordination overhead, as it builds on existing multiple structures. Minimum common requirements facilitate smoother market entry in the satellite market. **Option 2** brings more significant costs and benefits. Providers will benefit from a reduced administrative and compliance burden, quicker access and lower costs likely increasing competition, EU competitiveness and innovation capacities, and end-user choice. One-off costs are expected e.g. for the national single point of contact, for coordination with Member States, or linking with the Single Digital Gateway/ BEREC website. This option implies a higher EU-level costs for the centralisation of all satellite spectrum assignment and authorisation procedures (dedicated staffing, governance structures, and legal enforcement mechanisms). These are, however, off-set by cost saving at the national and operators level due to elimination of duplicative national procedures. This option is highly cost-effective in the long run, enables faster processing of market access, and provides a single, standardised route for all satellite operators, including pan-European constellations. Transaction costs drop and economies of scale are achieved through unified procedures and enforcement mechanisms, enhancing the competitiveness of EU space sector. **Option 3** (country of origin regime for satellite operators and B2B services) entails the highest administrative costs, requiring dedicated staffing, governance structures, and legal enforcement mechanisms in all Member States and BEREC/RSPG Office. It entails the highest adaptation costs although less efficient than option 2 in eliminating duplicative national procedures with a worse cost benefit ratio.

The below table shows the costs and benefits of all options, explaining who will bear the costs, distinguishing between administration (public authorities), businesses (operators) and citizens, end-users.

	General authorisation and authorisation for satellite services		
	O1. Partial harmonisation of authorisation	**O2. 'Single passport' for other networks and services than satellite and an EU–level authorisation for satellite spectrum (PREFERRED OPTION)**	O3. Country-of-origin authorisation for cross-border and B2B services
Costs by stakeholders			
End users (Citizens/businesses using connectivity)	neutral	neutral	neutral
Operators	(---) Higher costs than in Option 2 and 3 For GA: Many (up to 27) one-off costs for the general authorisation regime, emphasis on enforcement of the current regime. For GA: Cost of national authorisation in each MS remains, even with one-stop-shop (comparable to baseline).	(-) Small one-off cost to adapt to the harmonised conditions (both for GA and EU Satellite Authorisation) For GA: Lower than in option 1. Notification in 1 MS only (cost reduction from potentially 27) but (--) enforcement remains at country of destination level. For satellite: the overall costs for the operator for the authorisation process will be much lower than in option 1, see estimates of reduction of costs under operator's benefits (substantial	(-) Lower costs of adaptation to the new GA regime than in option 1 and 2 (but only for a limited scope of players, i.e. cross-border and B2B) For GA: Reduction from 27 to 1 GA regime and enforcement in the country of origin only, but only for limited scope of players (cross-border and B2B). For satellite: the costs are much lower than under option 1, see estimates of reduction of costs under operator's benefits

	Satellite operators: will still have to pay multiple administrative fees, reporting costs will not change, as there would be at least one reporting obligation per Member State. For those operating in several Member States, there would also be modest one-off costs to adapt to the common template for satellite authorisations. NRAs or SMAs impose, on average, one-off administrative cost for satellite authorisation (general and individual) of up to EUR 160 000. In addition, site authorisation for satellite ground stations entails a one-off permit cost of up to EUR 130 000, with annual cost reaching up to EUR 30 000. Furthermore, some Member States also apply spectrum usage charges, which may amount up to EUR 10 000/ site annually (according to operators' input).	reduction of administrative burden due to EU-level authorisation replacing the 27 authorisations required under the baseline and option 1), despite the possible application of an EU-level spectrum fee or administrative charge	(substantial reduction of administrative burden due to country of origin authorisation replacing the 27 authorisations needed under the baseline and option 1). The centralized procedure is challenging to implement within a national country-of-origin authorisation framework for network service providers, including satellite operators, operating across multiple EU Member States. Therefore, this option is seen as less effective for ensuring consistent application of the GA regime and reducing fragmentation. While new satellite operators might benefit, existing satellite operations cannot be integrated into the new regime, and new authorizations would likely be granted at different times. Furthermore, operators will suffer from significant asymmetries, since they might direct notifications to few MSs seeking the best applicable regime due to the country-of-origin principle (forum shopping and a "race to the bottom").
Administration	(-) Administrations will have to face one-off costs to operationally adapt to the improved non-mandatory notification template for general authorisation by BEREC and the template for satellite authorisation. Fee collection and enforcement will continue at a national level. For GA: the total staff requirement across all MSs/NRAs would not increase under option 1 as it is in the baseline (currently MS/NRAs have approximately 8 FTEs). For satellite authorisation, the total staff requirement across all MS would be similar to the baseline estimated at 98FTEs for	(-) For GA: Very low recurrent cost for monitoring and information exchange. Lower than in option 1 – depending on the number of notifications from cross-border operators (cost of receiving and verifying notifications and issuing declarations, cost of coordination between authorities). Increase in human resources in BEREC Office (2 FTEs) taking over tasks and administrative burden from MSs/NRAs (the current staff expenditure in BEREC per employee EUR 111 935x2= EUR 223 870). **For satellite,** additional costs at EU level due to EU-level satellite authorisation and, in the case of	(--) Higher than in option 1 and similar to option 2 *(GA conditions of only one MS apply while other MS should respect, mutually recognise and assist CoO in enforcement).* National administrations to have increased costs for the notifying Member State and require other Member States to participate in coordination and enforcement without direct control. The application of fees might remain problematic if affected MSs would maintain collection of fees from satellite operators providing satellite services across the Union. Satellites: Some MSs might need to considerably increase FTEs due to forum shopping.

	authorisation and enforcement plus increases to cope with the increased workload steaming from satellite authorisations requests (estimated increase of authorisation requests x 2.4 times).	spectrum scarcity for satellite providers, selection, spectrum assignment, and monitoring / enforcement. The increase in resources at EU level will be more than compensated by the overall savings at national level (see benefit section). In a context of considerable increase in the workload, it could be expected that the proposed EU-level authorisation regime could ensure that, at least over the next years, workload increases are absorbed without requiring additional administrative resources at national level. At EU level, for all spectrum measures (including terrestrial authorisation in Section 7.2 above), a progressive annual growth (depending on number of satellite authorisations requests), amounting to additional 5 FTEs for EC (approx. EUR 786 000) and 15 FTE for the BEREC Office (approx. EUR 1.6 m in the first year up to EUR 3.4 m in year 2034) is to be considered and is quantified in the governance section. These FTEs would handle the operational functions transferred from national authorities and will oversee and coordinate implementation and cooperation with Member States.	Similarly to option 1: the baseline estimated at 98FTEs for authorisation and enforcement plus increases to cope with the increased workload stemming from satellite authorisations requests (estimated increased x 2.4 times). Coordinated enforcement of ITU rules via authorisation conditions (e.g. harmful interference) might require additional FTEs efforts. One-off costs during the transitional period. There would be some uncertainty or administrative complexity as Member States phase in the harmonised conditions. The country-of-origin principle and mutual recognition would still leave multi-Member State satellite providers subject to rules of each Member State in which they operate, thereby increasing fragmentation and creating incentivises for forum shopping practices that are detrimental to the intervention objectives.
Benefits by stakeholders			
End users (Citizens/businesses using connectivity)	Neutral or minimal benefits	+++Greater choice of services for end-users (B2C included). Increased availability in all MS (EU-wide coverage) Increased **Consumer Surplus** due to timely availability of New Space innovative services, reduced coverage gaps and reduced legal uncertainty (e.g. one-month EU-wide service interruption estimated to reduce consumer surplus in the order of tens of millions EUR, depending on service substitutability and affected user base). Improved benefits from pan-European D2D services, better capacity to communicate in case of major disasters and in case of emergency situations in	+Like in option 2, but limited only to cross-border services and B2B (not B2C)

		underserved areas. More secure networks. Lower risk of service disruption for end users due to satellite harmful interferences.	
Operators	+ Indirect benefits thanks to simplified and digitalised procedures (max. list of conditions for GA, unified notification template for satellite services, single notification/one stop-shop for cross-border operators) For satellite, operators will work under simplified procedures such as a unified notification template and a single notification process. However, operators will have to fill in a common template to be sent to 27 different Member States whose reporting requirements could differ significantly in terms of procedures and fees structures.	++ (due to GA) +++ (due to satellite) For GA: Providers benefit from a single passport or declaration authorising the provision of networks and services, which is valid in all 27 Member States, instead of having to go through individual national procedures. Cost savings, reduced admin. burden and additional costs savings from lower compliance costs for all cross-border ENS and ECS providers of around 40-44%, as alignment with divergent national conditions (potentially over 1050 across MS) would no longer be required, amounting to approximately EUR 6-11 million per operator per year. For satellite: Solution to **harmful interference** issues (ensures all players play by the rules thanks to the coordinated enforcement of satellite rules) Other benefits: faster market entry and ECN/ECS deployment (**avoiding a reduction of revenues due to delays**, e.g. in a major EU constellation one-month EU-wide service interruption could lead to an estimated loss of potential revenue of some EUR 50 million per month,), greater consistency of regulatory conditions, innovative cross-border services e.g. B2B also New Space SMEs For satellite, operator savings linked to complying with one single set of authorisation conditions and limited loss of revenues due to possible delays in spectrum authorisation. As an example, some operators estimated that for securing spectrum authorisations for a satellite constellation covering the entire EU, an operator needs several FTEs centrally for assessing the scope and	++ For GA: Higher than in option 1 and 2, but limited to certain cross-border service providers, such as satellite services and B2B providers. Satellite operators could pick and choose (forum shopping) and concentrate all FTEs in the selected Member States for satellite authorisations. Therefore, administrative benefits would be similar to option 2 as well as the enforcement FTEs efforts, which will be concentrated in one or some MSs. Mechanisms to tackle harmful interference will benefit operators but the timely and efficiency of them might be lower than option 2.

		requirements to launch services across each Member States, including working on spectrum assignments and additional further resources per Member State to apply for spectrum authorisation and significant additional resources if Member States have specific in-country requirements such as testing before the launch of satellite services Overall, a digital single market for satellite could reduce costs by an estimated 60-80%.	
Administrations	+ One -stop-shop mechanism for cross-border operators might relieve some pressure from MS/NRAs to BEREC Office level.	++ Some cost savings for NRAs/MSs thanks to a single notification in 1 MS only and passporting procedure that simplifies entry to the market. For GA: ≈ EUR 382,000 in annual administrative savings, which corresponds to 50% reduction in staff effort from baseline: from 8 FTEs in MSs to 4 FTEs under option 2 (2 in BEREC Office and 2 in MS). Explained as follows: A standardised cost per FTE of EUR 95,400 per year ("burdened labour cost", including salary and overheads). multiplied by the reduction of 4 FTEs by this unit cost gives: 4 × EUR 95,400 = EUR 381,600 (≈ EUR 382,000) in annual administrative savings. For satellite: Savings in a context of a stable number of satellite authorisation requests: administrations would experience a net reduction in costs, with roughly 20-30% total staffing reduction to around 70-80 FTEs from previously 100 FTEs. This could result in annual savings of approximately EUR 2-3 million, although such savings will not occur automatically. However, considering the likely workload increase (despite high uncertainty on future numbers, applications for ground stations could double and those for satellites increase by a factor of 2.4), and considering scale	++ Similar like in Option 2 but limited due to narrower scope as some Member States would significantly reduce costs while a limited number of others will have their FTE costs increased substantially, similar to what would be expected under option 2 for EU bodies.

		economies as well as the progressive efficiency gain, the proposed EU-level authorisation regime could thus ensure that, at least over the next years, workload increases are absorbed without requiring additional administrative resources at national level.	
Net Value for Stakeholders			
End users (Citizens/businesses using connectivity)	Neutra to slightly positive, but limited global EU competitiveness in space	+++ Positive. Benefits are considerable, and the intervention is cost neutral for end users. Strong global EU competitiveness in space.	++ Positive, but limited global EU competitiveness in space
Benefits	+ Slightly positive. The measures will be insufficient to overcome the expected delays in the deployment of EU wide satellite services and D2D services foreseen in the baseline.	Timely and Increased offer of satellite services with EU-wide coverage (all MSs), improved benefits from D2D services, better capacity to react in case of major disasters and in case of emergency situations in underserved areas. More secure networks. Less service disruption due to satellite harmful interferences.	The measures will only slightly improve the expected delays in deployment of EU wide satellite services and D2D services foreseen in the baseline
Costs	Neutral	Neutral	Neutral
Net Value for Operator	(0) to + Slightly positive, benefits only marginally outweigh costs. While satellite operators will work under slightly simplified procedures such as a unified notification template and single notification process (benefits), they would have to continue dealing with various national fees and reporting requirements. Costs would remain similar to the baseline scenario, with however the improvement of the centralised selection system in case of scarce resources enabling scale for competitive services.	+++ Positive: Benefits largely outweigh costs, since minor initial adjustment costs are offset by major long-term savings, faster and simpler market access, shortened "time to market" and better level playing field between satellite operators with more efficient solutions for harmful interferences.	+ Positive: Benefits largely outweigh costs and risks, similar like under option 2 but limited to certain players (cross-border and B2B), and associated with risks, including incentives for forum shopping practices in areas that cannot be fully harmonised, such as national security, which should not be subject to a trade-off. Benefits in terms of immediate responses to harmful interference are slightly lower than under option 2.
Benefits	(0) + On GA: only small indirect benefits possible thanks to simplified and digitalised procedures	+++ Single streamlined authorisation procedure for all ECN/ECS cross-border providers to enter single market with passport valid across 27 Member States to provide innovative cross-border networks and services. Estimated cost savings (40-44%) due to reduction of	++ Simplified entry market conditions, but for a limited group of players. Lower costs of adaptation than in option 1 and 2, due to national procedures and conditions, including enforcement, as only those of the MS of origin would apply.

		admin. burden and compliance costs between EUR 6-11 m yearly per operator . Cost savings (reduction of admin. burden and additional reduction of compliance costs for all cross-border ECN and ECS providers) to align with existing national divergent conditions across UE MS. Satellite: Resolution of harmful interferences issues. Avoided revenue losses due to delayed market entry. For a major EU-wide constellation, such revenue losses are estimated at **EUR 50 M** per month of delay. Administrative costs will be indicatively reduced by around **EUR 3.2 M** per new service launched across all MSs. Reduced administrative and compliance burden for cross-border providers. Reduced staff cost. Overall cost reduction of 60%-80%	
Costs	Higher than in options 2 and 3. GA: Multiple one-off costs. No major reduction in national authorisation cost. Satellite: Multiple administrative fees and unchanged reporting costs, with modest one-off cost to adapt to the harmonised conditions for cross-border providers. Typical costs: one-off authorisation up to EUR 160 000 plus site permit up to EUR 160 000 (including annual fees). Annual spectrum charges up to EUR 10 000 per site.	Small one-off adaptation cost (small adjustment to harmonised conditions for GA and EU satellite authorisation). GA: lower cost than in option 1, single notification in one MS instead of up to 27. Satellite: Authorisation Cost considerably lower than under option 1, EU-level authorisation replaces 27 national procedures, greatly reducing administrative burden despite possible spectrum fees/administrative charges at EU level.	Lower than in options 1 and 2. GA: single regime and enforcement based on the country-of-origin principle; costs savings limited to cross-border and B2B providers. Satellite: major cost reduction vs option 1, one authorisation issued by a MS replaces 27 national ones. Implementation challenges: difficult to apply within national frameworks, limited consistency and integration of existing operators, risk of forum shopping and a "race to the bottom" due to the country-of-origin principle.

Coherence

The baseline scenario, as well as options 1 and 3 lack coherence with the overall EU simplification agenda and with national requirements on cybersecurity, lawful interception, data retention and e-privacy. **Option 1** moderately improves coherence supporting greater alignment with ITU rules but inconsistencies may persist and does not fully address strategic goals on sovereignty. Although option 1 entails some soft harmonisation of applicable general authorisation conditions by Member States where networks and services will be provided, in particular for satellite, it will not address the fragmentation, including as regards compliance requirements in certain areas, such as cybersecurity, lawful interception, data retention, administrative charges, and emergency communications. **Option 2** exhibits higher coherence providing mechanisms to address issues with national rules on cybersecurity, lawful interception, data retention and e-privacy and providing harmonised GA conditions /BEREC guidelines to ensure coherent application. As regards satellite, **options 2 and 3** provide highest coherence with EU-wide objectives, notably competitiveness, industrial policy, and international coordination with a fully harmonised and centralised authorisation regime for satellite spectrum, combined with joint or EU-level rights of use and standardised conditions for all operators directly supporting EU strategic goals in space policy, defence, and secure communications. The effective enforcement of market access rules will support the provision of innovative space services as envisaged in the proposed Vision for the EU Space Economy[273].

Sections addressing relevance and EU added value per authorisation option can be found in Annex 9, section 1.3.

Stakeholder's feedback

Amongst **stakeholders,** the telco community was generally positive on the idea of harmonising and easing applicable conditions attached to authorisation. They agreed on the need of harmonisation of security requirements, but were cautious about mandating any changes in the implementation of legal requirements which come with significant costs and efforts. On the specific application of the CoO principle stakeholders were rather sceptical, some ECNs raised the risk that non-telco new entrants that do not invest in network infrastructure could benefit "unfairly" from such regime, in particular if this was combined with the introduction of a standard EU wholesale access product. Member States and NRAs did not see added value for the application of the CoO principle indicating that a significant set of national rules would remain. A two-layer authorisation/governance would be unnecessary complex, not working in practice and bearing risks of "forum shopping". Consumer organisations acknowledged the benefits of harmonisation but were concerned that de-regulation lowers consumer protection and thus stressed the need to safeguard national consumer protection measures.

Operators with interest in pan-European satellite services stress that a harmonised, pan-European approach to **satellite market** access is essential to unlock the full potential of satellite connectivity across the EU and raise concerns that the growing demand for satellite access, combined with fragmented and non-harmonised authorisation procedures, may lead to discriminatory outcomes, encourage 'forum shopping', and create barriers to cross-border satellite service development. In the targeted consultation most support was expressed for a simplified and harmonised EU template (option 1), an EU-level mechanism for selection of satellite operators (e.g. based on MSS decision), and a common satellite authorisation at EU level were also reasonably popular with stakeholders, with positive opinion doubling the negative. Stakeholders have urged the Commission to create a

[273] See Building Block 1: A Single market for Space in European Commission (2025). A vision for the European Space Economy, COM(2025) 336, pp. 4-5.

level playing field for terrestrial mobile networks, incumbent satellite operators, and new satellite constellations in the EU market, while addressing potential interference risks of D2D satellite services to terrestrial systems. Their feedback also emphasised the importance of addressing issues related to security, strategic autonomy in the digital supply chain, and the preservation of EU sovereignty. The association of satellite operators calls for regulatory simplification by reducing unnecessary burdens and fragmentation in EU regulations. Additionally, the RSPG, recommends the Commission to adopt common requirements for access to the EU market and implement a coordinated enforcement mechanism.

Summary

The table below summarises the overall costs and benefits for the different stakeholders by each option. Annex 3, section 2.3 presents in detail the main costs and benefits per stakeholders of the three options.

Table 28: Summary of costs and benefits for Authorisation options

	O1. Partial harmonisation of authorisation	**O2. 'Single passport' for other networks and services than satellite and an EU – level authorisation for satellite spectrum**	**O3. Country-of-origin authorisation for cross-border and B2B services**
Net value for End users (Citizens/businesses using connectivity)	Neutral: to slightly positive with limited global competitiveness	+++ Positive – benefits are considerable and the intervention is cost neutral for end users. Strong global competitiveness	++ Positive with limited global competitiveness
Net Value for Operator	(0) to + Slightly positive, benefits only marginally outweigh costs. While satellite operators will work on slightly simplified procedures such as a unified notification template and single notification process (benefits), they would have to continue dealing with various national fees and reporting requirements. Costs would remain similar to the baseline scenario, with however the improvement of the centralised selection system in case of scarce resources enabling scale for competitive services	+++Positive: Benefits largely outweigh costs, since minor initial adjustment costs are offset by major long-term savings, faster and simpler market access, shortened "time to market" and better level playing field between satellite operators with more efficient solutions for harmful interferences A single market for satellite would reduce costs of delays, and avoid revenue losses that for a major EU-wide constellation are estimated at **EUR 50 M** per month of delay. Administrative costs will be indicatively reduced around **EUR 3.2 M** across all member states.	+: Positive: Benefits largely outweigh costs with risk, similar like under option 2 but limited to certain players (cross-border and B2B), associated with the risks (incentivise forum shopping practices in areas that cannot be fully harmonised such as national security), which should not be subject to a trade-off. Slightly minor benefits on immediate reaction to harmful interference than option 2.

The table below shows comparison of the options in terms of effectiveness, efficiency, coherence and EU added value. Based on the assessment option 2 is considered the preferred option.

Table 29: General and satellite authorisations: Summary assessment of policy options

Criterion	Baseline	Option 1	Option 2	Option 3
Effectiveness	0	+	+++	0/+
Efficiency	0	+++	+	0/+
Coherence	0	+	+++	0/+
Relevance	0	+	+++	0/+
EU added value	0	+	+++	0/+

7.4. Governance

Effectiveness

The effectiveness of the governance policy options is assessed with their ability to address the objectives related to regulatory harmonisation and improved decision-making on cross-border tasks and to accommodate the tasks resulting from the preferred options in other areas.

Baseline option has proven to have insufficient impact on regulatory harmonisation, and identified shortcomings in BEREC and RSPG work will continue. RSPG as an expert group served by a small secretariat provided by the Commission, even if enforced, will not be able to take on new tasks, including in the context of ex ante single market procedure of authorisation procedures. Without administrative assistance from the BEREC Office, the Commission will not be able to undertake EU satellite authorisation.

Option 1 will contribute to achieving the above-mentioned objectives hence increasing effectiveness, while preserving the main elements of the current governance setup. BEREC and RSPG will remain separate entities without legal personality. They will continue their respective tasks of advising EU institutions on spectrum policy (RSPG) and coordinating consistent application of regulation by NRAs (BEREC). The decisions related to cross-border issues will be more centralised and, therefore, more consistent and potentially quicker. The strengthened BEREC Office providing secretariat services to both BEREC and RSPG can exploit synergies, enhancing its effectiveness. Stronger support on substance by the BEREC Office to BEREC will lessen the burden on NRAs, while ensuring more consistency. Stronger administrative and preparatory support by the BEREC Office to the RSPG, as compared with current situation, will increase the latter's ability to undertake new tasks and ensure more consistency, while lowering the burden on the Commission that would be entrusted with additional decision-making powers. At the same time this option provides a more stable mechanism for close cooperation, in particular on spectrum issues that have regulatory implication.

In **option 2**, the main difference is in merging BEREC with its Office, which will result in integrating and strengthening BEREC bringing further synergies, increasing its effectiveness and simplifying the legal framework in line with the Common Approach. As in option 1, the increased support provided by the BEREC Office to the RSPG (comparing to the one offered today by the Commission), will enhance the effectiveness of the latter. Under this option, effectiveness gains may be reduced by BEREC and the RSPG remaining separate entities.

Option 3 with BEREC and RSPG as independent agencies can effectively address regulatory coherence and cross-border challenges (although it may not vary significantly from option 2). If there is a clear division of responsibilities between BEREC and the RSPG, the centralised decision-making by these agencies would allow for focused regulatory approaches. However, the effectiveness may be hindered by potential overlaps in competence and duplications and the need for coordination between the two agencies, which will be weakened in absence of the BEREC Office link.

Efficiency

Under the baseline scenario the potential for more coordinated spectrum management, including issuing EU satellite authorisation, and links between BEREC and RSPG work remain unexplored. It is expected that efficiency increases by empowering the Commission to take decisions on certain cross-border tasks proposed in **option 1**, especially EU satellite authorisation and in relevant cases selection of licensees for satellite spectrum. Furthermore, more centralised decision-making should bring cost savings for NRAs. Relocating the RSPG secretariat from the Commission to the BEREC Office could increase efficiency, if the latter is reinforced in terms of resources. Also, more involvement of BEREC Office in substantive tasks of BEREC could lead to increased efficiency of BEREC overall and possible reduction of pressure on NRAs and their constrained resources. Similarly, **option 2** should bring efficiency gains and some cost savings for NRAs thanks to more centralised decision-making as in option 1. There will be transition costs associated with merging BEREC and its Office and granting the new agency the additional role of secretariat to the RSPG. However, the potential for reduced duplication and more efficient resource use could lead to overall cost savings in the long run. BEREC can streamline operations, leading to better allocation of resources and reduced administrative burdens compared to the baseline. On spectrum, efficiency gains match those of option 1. In o**ption 3**, empowering the Commission to monitor certain cross-border tasks may lead to efficiency gains in this area compared to the baseline (but not as much as in options 1 and 2). However, the creation of two separate independent agencies (BEREC and RSPG) will lead to significantly increased administrative costs for the EU and potential duplication of efforts, as synergies will not be realised. The need for coordination between the two agencies may also create additional costs and slow down decision-making processes.

The below table shows the costs and benefits of all options, explaining who will bear the costs, distinguishing between administration (public authorities), businesses (operators) and citizens, end-users.

	Governance		
	O1. BEREC&RSPG as two separate bodies supported by the BEREC Office	O2. EU agency (BEREC and BO merged), providing an office to the RSPG	O3. Two separate agencies – BEREC + BO and RSPG
Costs by stakeholders			
Citizens	0/Neutral	0/Neutral	0/Neutral
Operators	0/Neutral, unless fees are considered	0/Neutral, unless fees are considered	0/Neutral, unless fees are considered
Administration	One-off cost for adaptations to new role: for EC limited and for BEREC Office moderate, including in overtaking the provision of RSPG secretariat from EC;	One-off cost for transforming BEREC and BEREC Office in EU agency, including Spectrum office Overall, BEREC agency will need around 90 FTEs (i.e.	One-off cost for transforming BEREC and BEREC Office One-off cost for establishing the RSPG agency

	Governance		
	O1. BEREC&RSPG as two separate bodies supported by the BEREC Office	O2. EU agency (BEREC and BO merged), providing an office to the RSPG	O3. Two separate agencies – BEREC + BO and RSPG
	Total annual cost increase from EUR 8.1. m to approx. EUR 11.420 m (increase EUR 3.320 m). In comparison to the baseline it translates to 56% more for staff expenditure and by 20% for other costs i.e. building, equipment + operational costs increase. Recurrent: Costs structure for BEREC Office: - EUR 7.8 m - increase of staff expenditure, - EUR 2.089 m - increase of other costs, - EUR 1.589 m - increase of operational costs, - Additional costs due to increase in the BEREC and RSPG working groups' activities – EUR 80 000 per year. Around EUR 170.000 yearly for one-off and maintenance cost. Recurrent costs for: - the COM: 12 FTEs to cover additional tasks, mainly in EU satellite authorisation and spectrum scrutiny • For MS: EUR 5 500 yearly (115 hours of working groups) For BEREC: EUR 26,400 yearly (550 hours of working group meetings). For the NRAs:2.5 recurrent FTEs per NRA to cover additional tasks, amounting to EUR 238,	doubling 2023 FTEs of BEREC Office) Recurrent: • EUR 14.8 m the annual cost of BEREC agency Cost structure for BEREC Office: - double increase of current staff, - 50% of operational expenditure (premises, equipment), - 50% increase in the organisation of working group activities – 160 000 per year.	Recurrent EUR 12.6 m per year for each of agency merged BEREC&BEREC Office and RSPG. Recurrent for RSPG: premises + recurrent expenses for staffing, office space, equipment and operations.

	Governance		
	O1. BEREC&RSPG as two separate bodies supported by the BEREC Office	O2. EU agency (BEREC and BO merged), providing an office to the RSPG	O3. Two separate agencies – BEREC + BO and RSPG
	500 in additional yearly cost per NRA.		
Benefits by stakeholders			
Citizens	+ Potential for increased competition and innovation due to increased harmonisation resulting from more effective governance system (expect moderate-high impact due to more centralised/ integrated governance system than in baseline)	+ like in option 1	0/+ Like in option 1 but only moderate- impact expected;/lower than in other options due to more complex governance set up.
Operators	+ Potential for increased harmonisation / level playing field and lower compliance costs for cross-border and satellite operators (expect moderate-high impact due to more centralised/ integrated governance system than in baseline)	+ Like in option 1	0/+ Like in option 1 but expect only moderate- impact; lower than in other options due to more complex governance set up.
Administration	+ Moderate cost savings for EU budget/increased efficiency and transfer of responsibilities to BEREC Office and RSPG. Preserving main elements of current governance set up. Moderate cost reduction for COM (limited effect on the EU budget). Cost savings for MS budget due to transfer of certain cross-border tasks to the EU level. BEREC Office takes more 'substance related' responsibilities and this relieves some pressure from NRAs. NRAs costs would increase only incrementally.	++ The agency takes over RSPG's secretariat function (lower burden/cost for the COM than in option 1) and provides support on admin and preparatory tasks to the RSPG. Cost savings for MS budget due to transfer of certain cross-border tasks to the EU level.	0/+ Lower benefits than in option 1 due to potential overlaps in competence and duplications, the need of coordination between two agencies. Cost savings for MS budget due to transfer of certain cross-border tasks to the EU level and 2 separate agencies.

	Governance		
	O1. BEREC&RSPG as two separate bodies supported by the BEREC Office	O2. EU agency (BEREC and BO merged), providing an office to the RSPG	O3. Two separate agencies – BEREC + BO and RSPG
	NRAs' costs would increase only incrementally, notwithstanding the need for their increased collaboration in BEREC.		
Net Value for Stakeholders	+	+	
Net Value for Citizens	+	+	0/+
Benefits	+	+	0/+
Costs	0	0	0
Net Value for Operator			
Benefits	+ indirect Increases effectiveness while preserving the main elements of the current governance set up. Further empowerment of NRAs and NCA, contributing to enhanced market development. Option 1 ultimately lower compliance costs for cross-border operators, and in terms of satellite spectrum/EU authorisation fosters innovation and investment in new technologies.	+ indirect	0/+ indirect (lower due to more complex governance set up than in option 1 and 2)
Costs	0/unless fees	0/unless fees	0/unless fees

Coherence

Under the **baseline scenario**, the division of tasks between authorities at national and EU level has shown shortcomings when it comes to coherence of the outputs. BEREC and RSPG works are separate, despite existence of interrelated topics, such as satellite communications, and synergies remain unexploited. Keeping the current setup would perpetuate that situation. **Option 1** promotes coherence as regards the application of the law across Member States by empowering the Commission to make decisions on certain cross-border-related tasks, including on harmonising spectrum authorisation conditions and procedures, and satellite spectrum authorisation issues. While separate roles of BEREC and RSPG may lead to some overlaps and potential contradictions, the BEREC Office can help build a unified approach and promote coherent regulatory responses on cross-border issues. **Option 2** could promote coherence by empowering the Commission to make decisions on spectrum similarly to option 1. Merging BEREC and the BEREC Office will bring together the regulatory work and the administrative support, potentially bringing more coherence in

BEREC's work and enhancing its ability to foster the consistent implementation of the regulatory framework. BEREC will also fulfil the role of secretariat of the RSPG, which could potentially contribute to the coherence in the work of the latter and BEREC. In addition to benefits of option 2, **option 3** could increase coherence by empowering BEREC and RSPG to make decisions as regards cross-border issues. However, this would contribute less to coherence than option 2 where competence to adopt cross-border decisions is with the Commission. The establishment of the RSPG as an independent agency could lead to clearer lines of accountability, but it may also create challenges in coordination and coherence with existing frameworks. The potential for conflicting decisions or approaches could undermine overall regulatory coherence.

Sections addressing relevance and EU added value per governance options can be found in Annex 9 section 1.4.

Stakeholders' feedback

In response to the **Call for Evidence**, many stakeholders mentioned the need to differentiate between (1) the national markets which should remain under supervision of independent NRAs whose expertise is invaluable and (2) horizontal/harmonised and cross-border issues which could be better addressed at EU level. Some mentioned also a need to differentiate between governance of access regulation and spectrum management. While acknowledging the achievements of BEREC and RSPG, various stakeholders (company/business group, business associations and public authorities) showed openness to improving coordination and to enhancements (including new tasks) aimed at handling single market topics, while avoiding overcentralisation and maintaining flexibility for national circumstances and Member States' competences. The responding public authorities acknowledged that the DNA could improve EU governance by enhancing respective roles of BEREC, BEREC Office and RSPG to address various pan-European tasks, and granting them sufficient administrative and regulatory capacity.

In the **targeted consultation** carried out in the context of the study, respondents were very positive for providing the RSPG with more administrative support (more than 75% of respondents), as proposed in option 1 and 2. However, over 75% of the respondents do not consider that a change of nature of the RSPG, from expert group to a body, would be beneficial. Respondents were also overwhelmingly against making the RSPG a fully-fledged EU agency with legal personality and decision-making powers on cross-border spectrum matters as proposed in option 3. Merging BEREC and BEREC Office as proposed in option 2 was supported only by few respondents, while the majority of respondents strongly opposed it. Looking at different aspects of the three different policy options investigated, the measures under options 1 gained more support among the respondents to the targeted survey than option 2 and 3.

Summary

The table below summarises the overall costs and benefits for the different stakeholders by option.

Table 30: Summary of costs and benefits for Governance options

	O1. BEREC&RSPG as two separate bodies supported by the BEREC Office	**O2. EU agency (BEREC and BO merged), providing an office to the RSPG**	**O3. Two separate agencies – BEREC + BO and RSPG**
Net Value for Citizens and industrial sectors (e.g. verticals)	+	+	0/+

Net Value for Operator	+ (unless fees)	+ (unless fees)	0 (unless fees)

The table below shows comparison of the options in terms of effectiveness, efficiency, coherence and EU added value. Option 1 is considered to be the preferred option.

Table 31: Governance: Summary assessment of policy options

Criterion	Baseline	Option 1	Option 2	Option 3
Effectiveness	0	++	++	+
Efficiency	0	++	++	-
Coherence	0	+	++	+
Relevance	0	+	++	++
EU added value	0	++	++	+

8. PREFERRED OPTION

8.1. Preferred options

8.1.1. Transition to fibre

Based on the assessment provided in section 7, option 2 is selected as the preferred option to achieve the objectives of the DNA set out in section 4. It has high cumulative score across key evaluation criteria including effectiveness and efficiency.

Option 2 has a good performance in addressing the identified problems in terms of accelerating FTTH deployment and take-up.

Regarding access regulation, option 2 builds upon the successful elements of the existing regulatory framework, retaining the well-functioning SMP regime and the three-criteria test, however, re-focusing intervention on market failures, enabling NRAs to use more easily symmetric measures, where appropriate, and putting emphasis on use of less intrusive regulatory tools where possible. option 2, like all the other options, includes some simplification by removing provisions of the EECC related notably to remedies that have not been used.

With respect to the economic and environmental impacts (see section 6), option 2 results (i) in the highest GDP impact with an increase in accumulated GDP in the range of EUR 157 - 327 billion (above baseline, depending on the selected scenario, i.e., more conservative – less conservative), (ii) in the second highest CO2 emission impact with a 5.1% decrease (EUR 0.56 billion less, compared to the baseline) and (iii) in the highest impact in terms of average download speeds (314 Mbps in 2030 and 743 Mbps in 2035).

As for the social impacts, the impact of the options cannot be quantified. However, option 2 is very likely to result in highest positive social impact as it is performing well in terms of FTTH coverage (83% in 2030 and 98% in 2035) and FTTH take-up rate (55% in 2030 and 78% in 2035). It delivers the highest coverage (together with option 4), and the second highest take up in the longer run.

Regarding the impact on fundamental rights, option 2 ranks medium, however, considering its positive effects on EU society and the economy—including increased internet speeds, GDP growth, and reduced CO2 emissions—it appears consistent with the principle of necessity. Due to the presence of the sustainability conditions which allow for the continued operation of copper networks in areas with insufficient FTTH coverage (below 95%) for additional time, this option is in line with the proportionality principle.

Option 2 leads to an increase in direct recurring (administrative) costs by 18% in FTEs per year (EUR 38 million) and EUR 73 million one-off cost, compared to the status quo. Those costs can be offset or mitigated by the significant benefits brought along with this option, including increased Gigabit connectivity and improved competition. As mentioned above, this is expected to generate substantial positive impacts on GDP and reduce the emissions linked to electronic communications.

8.1.2. Spectrum

Option 2 represents a balanced approach between the extremes of soft and strong harmonisation of rules, aiming to foster the Single Market while respecting the unique circumstances of individual Member States. It targets harmonisation primarily in areas where substantial investments are necessary, such as spectrum for public networks and focuses particularly on critical aspects like authorisation conditions for 6G. The strategy begins with soft harmonisation through Commission recommendations, escalating to mandatory measures only if disparities persist. This approach allows Member States to retain their competence in assigning terrestrial spectrum, albeit under the Commission's supervision, requiring ex ante spectrum Single Market procedure of their draft measures. The Commission holds veto power over market-shaping elements, such as spectrum caps, and limited licence duration while also providing input on other aspects. By maintaining a degree of flexibility in spectrum assignment, this option ensures a balanced solution that strengthens predictability and enhances legal certainty, improves financing access, reduces capital costs, and boosts investment. It avoids a rigid, uniform approach, allowing Member States to address specific national circumstances, such as geographical and population density-related coverage obligations, ensuring that authorization timelines can be adapted accordingly.

Option 2 delivers high and systemic benefits, for large-scale and cross-border spectrum investments. While costs are significantly higher than in option 1, the reduction in regulatory risk, combined with a credible, enforceable commitment to licence stability and market-friendly conditions, offers major advantages for accelerating the EU's connectivity goals, increasing EU competitiveness also opening up new opportunities to new spectrum users.

The preferred option 2 is the most efficient given that overall benefits significantly outweigh its costs. It would ensure timely deployment of high quality 5G and future 6G networks, and achieve the general objective of reinforced competitiveness and resilience. It would be synergic and coherent with the transition to fibre, which is needed to achieve full 5G, and the satellite options in ensuring the general objective of high quality and resilient connectivity. Moreover, in areas where fibre deployment is not economically viable, a high quality mobile or FWA (Fixed Wireless Access) solution, based on mid-band or mmW 5G SA could be deployed as a viable alternative for connecting cost-effectively end-users. Lastly, satellite options would be complementary since they would ensure not only wider territorial coverage through D2D services, including of the most remote regions, but also higher security, resilience and continuity of service, for example by providing backhaul (satellite based backhaul as complement to fibre based backhaul), disaster response and emergency network restoration and redundancy. It also strengthens coherence and synergies with security policy proposed in specific policy instruments (e.g. Cyber Security Act). Option 3 also has merits and would also achieve the objectives pursued, in particular as regards EU spectrum authorisation. However, by

harmonising spectrum award and authorisation conditions, option 2 can achieve the same outcome with less intrusive measures. Option 2 has similar economic and environmental impact as option 3 and its direct and indirect costs are significantly lower than option 3. It hence emerges as the one with the best benefits/cost balance and fully justifies the intervention. More specifically, option 2 would provide maximum investment certainty and regulatory clarity, creating an environment conducive to investment in high quality mobile infrastructure. Option 2 builds upon the current architecture of national authorisation procedures and improves regulatory predictability by strengthening the Single Market through an enhanced role of ex ante supervision carried out by the Commission with the support of BEREC and the RSPG. It ensures that all the objectives of the regulatory framework, including connectivity and competition are catered for in a consistent and coordinated manner, while taking into account national specificities and particularities. Although it requires to create an ex ante spectrum single market procedure mechanism, this can be done in a cost efficient manner, without unreasonable delay, by exploiting the 25-year experience gained by similar scrutiny mechanisms in ex ante market regulation. The cost is manageable, thanks to more frequent recourse to spectrum renewals, which is expected in the long term to significantly decrease the number of auctions. Option 2 ensures the most efficient use of spectrum, by creating the conditions for spectrum sharing where it is more impactful and where the benefits justify the costs, in particular interservice. Lastly, it presents significant cost savings, thanks to the increased predictability and legal certainty, which lowers capital costs and improves access to financing.

8.1.3. Authorisation

As regards authorisation, the preferred option is **option 2** with single authorisation for terrestrial networks and EU authorisation for satellite spectrum.

2 would reduce more significantly the administrative and compliance costs (lower one-off costs) as well as the reporting costs. This option would achieve greater consistency of regulatory conditions under the general **authorisation** and, consequently, more legal certainty for all providers. It would bring greater transparency and regulatory predictability, which would be more relevant for SMEs that have less resources to cope with legal requirements. Shorter time to enter the market by new providers should also be expected and an increased cross-border provision of ECS. As a result, barriers to innovation and to creation of integrated core network and service platforms would be removed to the benefit of increased competition and choice for end-users.

For **satellite authorisation**, the preferred option ensures a unified framework for the selection of licensees, spectrum assignment and enforcement, thereby eliminating fragmentation and regulatory uncertainty. It allows to fully exploit the strength of the Single Market as regards enforcement of authorisation conditions. It brings maximum benefits for all satellite operators, in particular those deploying pan-European or global constellations, by eliminating regulatory barriers reducing compliance costs and uncertainties in spectrum access, supports the objective of transition to resilient connectivity and early deployment of converged TN and NTN 6G networks. This option would be complementary to the EU Space Act and other EU instruments supporting EU investments in space, as it would maximise the chances of the EU to exploit satellite communications, in particular, the potential of D2D connectivity – including commercial, defence and emergency communications- with major benefits to end-users, and to the overall EU competitiveness in space, ensuring that all operators play by the same rules, through effective enforcement (e.g. as regards harmful interferences). It further allows for a more strategic and efficient use of scarce satellite spectrum to the benefit of the EU by better protecting its interests in terms of security, technological leadership, and economic autonomy.

The option would be complemented by the ancillary simplification measures mentioned in the introduction such as on end-users as well as incentivising a voluntary cooperation between actors in the extended connectivity ecosystem.

8.1.4. Governance

Regarding governance, the preferred choice is **option 1**, which ensures continuity while deepening cooperation and strengthening EU-level coordination. It builds on the existing set up of BEREC and the BEREC Office, while upgrading the RSPG from a Commission expert group to a body with a secretariat provided by the BEREC Office. Although this option ranked as second-best in the comparison in section 7.4, it is favoured by stakeholder consultation feedback. Option 1 scores the highest-equal to option 2 in effectiveness, efficiency and coherence. In terms of effectiveness, upgrading the RSPG to a body separate from the Commission, supported by the strengthened BEREC Office with new coordination tasks, will enhance the effectiveness of spectrum management. Since spectrum management will be governed in the same way under option 1 and 2, their assessment is equal. On coherence, the BEREC Office, by providing administrative and support services to both BEREC and RSPG strengthens the existing link between the two bodies, enabling better coordination and a more coherent outcomes than the baseline – again, equal under options 1 and 2. Furthermore, while option 2 scores higher in relevance and EU added value than option 1, both those option are equivalent as regards spectrum governance and differ in merging BEREC and BEREC Office into and agency. The new BEREC tasks will continue to be more of monitoring/advisory nature and there are no new tasks that would require equipping BEREC with a legal personality and, therefore, merging BEREC and the BEREC Office into an agency is not necessary for carrying them out. Under option 1 the decision-making powers will remain with the Commission, ensuring in such way stronger single market dimension. Consequently, option 1 will ensure the desired benefits with moderate costs.

8.2. REFIT (simplification and improved efficiency)

As regards, access regulation, the preferred option would remove a number of provisions relating to SMP regulation such as those regarding co-investment (Article 76 EECC) and functional separation (Articles 77 and 78 EECC)[274]. At the same time, enabling the NRAs to impose access to in-house wiring and beyond the first concentration point from own initiative (and not at request as this is currently the case) would simplify the way how access regulation is implemented. This would have the effect of simplifying existing rules and remove the perceived shortcomings and unnecessary complexities and potential lack of coherence associated with those provisions that led to the limited usage of them.[275] Furthermore, the impacts on fibre coverage, take-up and competition of their removal is likely to be limited. This is particularly true for Article 76 EECC[276], which has been superseded by wider analysis by NRAs of the implications of commercial arrangements including

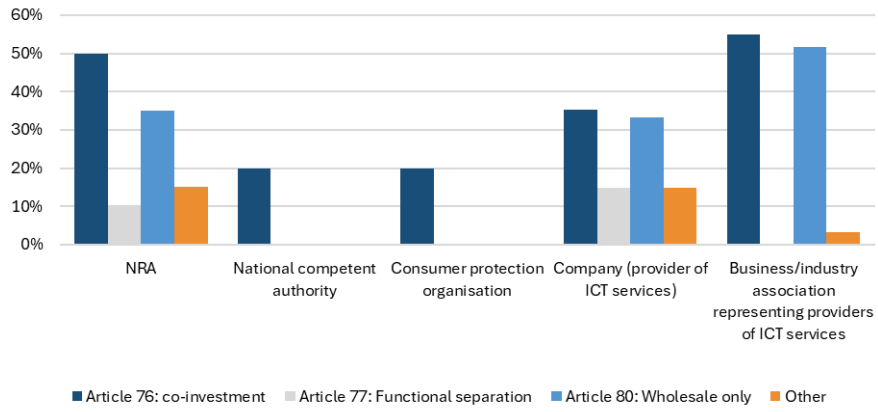
[274] While some incumbents and fibre investors consider that provisions regarding functional separation could be removed, this is opposed by NRAs, consumer protection authorities and alternative operators, as they consider that it provides a useful role as a last resort measure, which could be used to incentivise organisation changes within dominant firms that would improve compliance.

[275] Provisions relating to functional separation have never been used. There have been no approved instances of co-investment in line with Article 76 EECC and wholesale only provisions have only been considered relevant in two cases (DK and IT).

[276] Feedback from stakeholders tends to confirm that Article 76 could be removed. 50% of NRAs and 62% of alternative operators favour its removal.

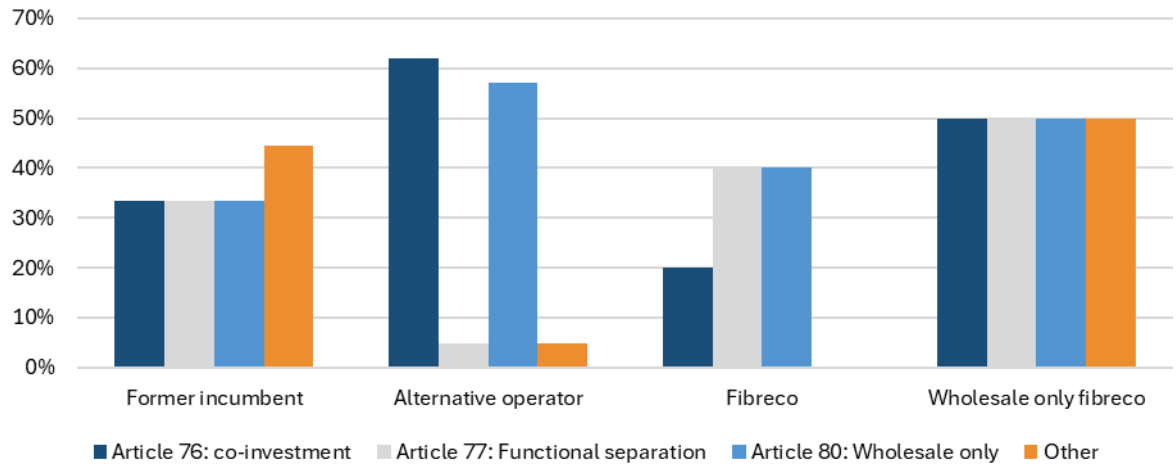
co-investment in the context of the market analysis procedure. The REFIT potential of these provisions had been also recognized by the stakeholders.

Figure 19: Potential for removal by article: stakeholder perspectives



Source: Stakeholder survey June-July 2025

Figure 20 : Potential for removal by article: perspective of telecom providers



Source: Stakeholder survey June-July 2025

Furthermore, the preferred option would simplify, strengthen and increase oversight with the aim of securing more uniform implementation of remedies in the benefit of the Single market. Harmonisation of specifications for key wholesale products as well as attention to quality of service guarantees for businesses should simplify the use of access products and also contribute to the development of competition in services for multi-site and multinational enterprises.

As regards spectrum, the consolidation of relevant provisions of the RSPP in the EECC presents significant REFIT benefits, as it ensures consistency, by eliminating duplicative and outdated provisions that hinder EU competitiveness in the deployment of innovative services.

The **EU authorisation for the provision of satellite networks and services and use of satellite spectrum** presents significant simplification and improved efficiency potential as it would reduce the cost of satellite authorisation for satellite operators, providers and national authorities. A satellite operator willing to provide services across the EU would not need to follow 27 authorisation

processes, respect 27 sets of authorisation conditions, which include diverse and costly reporting obligations and ineffective enforcement measures, and obtain spectrum rights in all Member States. On the contrary, the Commission, with the assistance of the Office, would receive the requests and issue the authorisations to provide satellite services as well as authorisations to use spectrum including individual rights of use of spectrum, either in some Member States where the provider wishes to provide services, or in the entire EU. The authorisation conditions, including reporting elements, would be common across the EU and developed with the assistance of the Office and the RSPG. The Commission would also ensure selection at EU level in case of spectrum scarcity.

The elimination of duplicative and fragmented regulatory processes will make it easier and less costly for satellite operators to comply with authorisation conditions and will ensure they can obtain quicklier EU-wide authorisation and will considerably reduce the risk of lost revenues in specific Member States, due to delays in national authorisations[277].

Further, there would be a **binding EU-level compliance and enforcement framework** for ensuring that satellite constellations' access to the EU market complies with the common conditions in line with international law. Enforcement at EU level (including withdrawal of the authorisation for the entire single market) would be effectively addressing interference issues simplifying the possibility for operators to be protected from harmful interference and, at the same time, it would incentivise preventively the respect of the authorisation requirements.

8.3. Application of the 'one in, one out' approach

The OIOO assessment examines exclusively the administrative costs and administrative cost savings resulting from the preferred policy options. The preferred policy option for transition to fibre introduces limited new administrative burdens for business, primarily linked to the conditional copper switch-off. These relate to information, notification, coordination and reporting obligations vis-à-vis national authorities and affected stakeholders. As summarised in Annex 3, these new administrative requirements are estimated to result in approximately EUR 73 million in one-off administrative costs, mainly reflecting efforts to prepare for copper swith-off plans and the new market analysis methods, and approximately EUR 38 million in recurring administrative costs per year.

At the same time, the preferred policy option is expected to generate administrative cost savings through the harmonisation of authorisation conditions and the simplification of regulatory requirements. These measures are expected to reduce administrative burdens for ECNs and ECS, in particular those operating cross-border, by streamlining information requirements, reducing duplication of procedures and lowering ongoing monitoring and compliance efforts (around EUR 60 million reduction across all Member States per year). While stakeholders confirmed the relevance of these administrative cost savings, the available information do not allow for a robust quantification. These savings are therefore assessed qualitatively as moderate and recurring, as reflected in Annex 3.

Due to the limitations in quantifying the administrative cost savings, a quantified net balance under the OIOO principle cannot be established. However, taking into account the limited magnitude of the identified one-off and recurring administrative costs and the presence of non-quantified but substantiated recurring administrative cost savings, the preferred policy option is expected to be

[277] For some quantifications see Section 6.3.2.

broadly neutral to positive in terms of administrative burden over time. As indicated in Annex 3, the recurrent administrative burden is therefore assessed as a net OUT under the OIOO framework.

9. HOW WILL ACTUAL IMPACTS BE MONITORED AND EVALUATED?

In the following table, we relate the problems and related objective identified in the context of this Impact Assessment to the specific indicators proposed to measure the success. Further details about the indicators can be found in Section 2 of Annex 9.

Table 32: Links between problems, specific objectives and indicators

Problem	Objective	Indicators
Fixed networks: Slow deployment and adoption of fibre networks and services	Swift roll-out and take-up of fibre	FTTH homes passed absolute and as % HH FTTH homes connected Take-up FTTH
Mobile networks: insufficient investment in high quality mobile connectivity	Close the gap with competing regions in the quality mobile networks	Quality of Service and Quality of Experience 5G SA coverage and availability 5G mid-band population coverage Spectrum readiness (MHz/pop, assigned in 5G mid-band and future 6G pioneer bands) 5G SA availability Time to obtain spectrum authorisation Number of Licenses with sharing conditions Amount of spectrum used by more than one user/category of user
Lack of pan-European networks and services	Increase pan-European network operation and service provision	Number of providers using the cross-border general authorisation regime Number of new EU satellite authorisation licensees Number of operators selected through a centralised selection procedure for satellite harmonised bands Time to complete satellite authorisation requirements Number of interference issues in the EU which have been timely and effectively addressed
Governance structure not fully suited to serve the requirements of the single market	Deepen the Single Market for connectivity through adjustment of regulatory competences and roles	Number of high-quality outputs that have a direct link to single-market objectives - strengthen harmonisation, support consistent regulatory implementation, and facilitate the completion of the EU single market for electronic communications. Measured by % of planned single-market-related outputs delivered on schedule (from the Work Programme) and their

Problem	Objective	Indicators
		quality (reflecting impact, uptake, and regulatory relevance of the outputs) and quantity (the volume of outputs relevant to single-market completion e.g. BEREC guidelines, opinions). Annual measurement, with at least yearly tracking by the BEREC Office.