BEREC
Body of European Regulators for Electronic Communications

BoR (24) 92

BEREC Annual Report for 2023

6 June, 2024

Contents

Foreword by the BEREC Chair 2023

In a year marked by significant advances and transformative changes in the digital markets, BEREC undertook a comprehensive range of actions and initiatives, while remaining steadfast to contributing to meaningful connectivity, addressing societal needs, and adapting to the ever-evolving digital landscape. Its ambitious Action Plan 2030 sets out its strategic vision of the future, outlined in five key objectives. These objectives are to: foster national and international connectivity, facilitate an open and sustainable internet ecosystem, supervise the evolution of the digital landscape, ensure the security and resilience of networks and services, and contribute to sustainability goals. BEREC's collaboration with the European Commission in the Gigabit connectivity package and its active participation in the High-Level Group for the Digital Markets Act are just two examples of how BEREC will play an influential role in shaping the regulatory landscape over the next few years.

Market dynamics

BEREC's focus on a wide range of areas, such as regulatory updates, investment implications, and ensuring competition in the evolving telecom sector, reaffirms BEREC's commitment to fostering a competitive European market. In response to the changing dynamics in intra-EU communications, BEREC carried out a thorough review which provides valuable insights into the effects of the existing measures on regulated services. Additional actions for addressing market challenges, such as the phasing out of 2G and 3G networks, exploring the role of artificial intelligence in the telecom sector, and evaluating the security of 5G networks, demonstrate BEREC's commitment to staying ahead of technological advances and potential regulatory impacts. In the same context, BEREC explored areas such as cloudification, virtualization, and softwarization. It studied the competitive dynamics of tower and access infrastructure companies not directly providing retail services. It updated the Very High Capacity Networks Guidelines. It analysed the indicators for measuring the environmental impact of electronic communications networks and services. It issued a draft report on the General Authorisation of submarine connectivity, with a suggestion to adapt a comprehensive European policy to assist stakeholders in deploying a submarine cable system in multiple European countries.

Consumer focus

Ensuring that consumers enjoy equal and effective access remains a top priority for BEREC. In recognising the importance of reliable broadband access for all, BEREC evaluated definitions of adequate broadband internet access service. It published a report on comparison tools and accreditation, examining independent tools that empower consumers to make informed decisions. BEREC also reviewed the Guidelines for Quality of Service (QoS) parameters set out in the 2020, thus reinforcing its commitment to ensuring that electronic communications services meet consumer needs.

Ukraine, Moldova and international collaboration

In 2023 and in view of the ongoing war against Ukraine, BEREC strongly encouraged and monitored the signing of a Joint Statement between Ukraine and EU Operators. BEREC further facilitated an agreement on retail price caps among operators to reduce roaming charges when traveling between the European Union and Moldova. BEREC strengthened its international collaboration and global presence by organising a four-lateral summit with EAPEREG-EMERG-REGULATEL, during which all four organisations committed to creating a sustainable and inclusive digital future, and to improving international connectivity.

As we now pass the baton on to Tonko Obuljen, Head of HAKOM, and his team, we reflect on a year of remarkable achievements. Our sincere gratitude for all this work is extended to the National Regulatory Authorities, the stakeholders, and the entire BEREC community for its unwavering support and commitment to getting work done. Together, we have navigated the complexities of the digital markets, laying the groundwork for a connected, sustainable, and inclusive future. BEREC emerges as a key player, ready to embrace the challenges and opportunities that lie ahead.

Prof. Konstantinos Masselos

BEREC Chair 2023

PART A: Annual Report on market developments in the electronic communications sector in 2023 – in accordance with Article 4(1)(j)(v) of Regulation (EU) No 2018/1971

Annual Report on market developments in the electronic communications sector in 2023, in accordance with Article 4(1)(j)(v) of Regulation (EU) No 2018/1971 of the European Parliament and of the Council of 11 December 2018 establishing the Body of European Regulators for Electronic Communications (BEREC) and the Agency for Support for BEREC (BEREC Office).

Executive summary

The Body of European Regulators for Electronic Communications' (BEREC) Annual Report for 2023 highlights the key developments and market trends in the electronic communications sector in Europe over the past 12 months, and puts its focus on market dynamics and the development of European Union public policies and regulatory practices. The report presents the perspectives of BEREC, based on the collective expertise and knowledge of the member national regulatory authorities (NRAs). In addition, it describes BEREC's own contribution to the development of the electronic communications sector in Europe. The analysis presented in this report includes qualitative reasoning based on information from the activities of BEREC Working Groups (WGs) and quantitative data based on periodic BEREC data collection exercises and other public documents.

Following the provisions of the European electronic communications regulatory framework, in 2023, BEREC worked on the approval and publication of a considerable number of regulatory best practice-related documents and implementation reports, aiming at fostering a transparent, harmonised and effective application of legal provisions, and ensuring a consistent and predictable application of the rules across the European digital single market. Part A of this report showcases the most substantial aspects of BEREC's 2023 activities, while Part B summarises the key deliverables that were set out in BEREC's Work Programme 2023 and published in late 2022. The report highlights the successful implementation of this remarkably ambitious programme under the Chairmanship of Prof. K. Masselos (EETT, Greece), focusing on BEREC's three strategic goals: promoting full connectivity, supporting sustainable open digital markets and empowering end users. The key deliverables underscore BEREC's commitment to fostering the independent, consistent and high-quality regulation of digital markets for the benefit of Europe and its citizens (BEREC strategy 2021-2025). At the same time, they show BEREC's continuous engagement and cooperation with stakeholders and international organisations, as well as BEREC's underlying analytical and monitoring work that helps BEREC to react and provide input and opinions based on a comprehensive data-collection exercise.

1. Introduction

This section of the Annual Report highlights important market trends and developments in the European electronic communications sector in 2023, focusing on market dynamics and the development of European Union public policies and regulatory practices under Article 4(1)(j)(v) of the BEREC Regulation. Presented from the perspective of BEREC, the analysis integrates insights based on the expertise and knowledge of the member national regulatory authorities (NRAs). The analysis presented in this section includes qualitative reasoning based on information from the activity of the BEREC Working Groups (WGs) and quantitative data based on periodic BEREC data-collection exercises and other public documents. Particular attention is paid to Broadband and Very High Capacity Networks, Mobile Broadband, Regulatory Accounting and 5G. In this context, the Chair's Study 2022 and Chair's Study 2023 should also be mentioned. The 2022 Study, which was finalised in April 2023, assessed the nature, evolution and market conditions of new business models that are enabled by new 5G capabilities and technologies. The 2023 Study, finalised in December 2023, analysed the technology trends, market and business developments as well as the impacts on competition and regulation of cloudification, virtualization and softwarization in telecommunications.

1.1. Chair's Study for 2022 (concluded in 2023)

In 2022, the BEREC Chair proposed a study on wholesale mobile access connectivity, trends and issues for emerging mobile technologies and deployments. The tender for this study was published in May 2022 and a contract was awarded to Wik GmbH so that the study could start in September 2022.

The mobile communications sector is currently in a state of transition, as 4G networks are being upgraded to 5G, and physical SIM cards are replaced by eSIMs. Further technological and service developments will follow with the deployment of 5G Standalone networks which support quality-assured services.

These technological developments could provide significant opportunities for a range of players to offer tailored services to businesses and develop IoT applications in the field. eSIMs will open up opportunities for consumers to have multiple subscriptions on their handsets which could increase competition in segments such as 'travel' communications, or enable users to separate business and personal communications.

The development of industrial applications in sectors such as automotive, healthcare and smart cities is likely to involve a range of players beyond those traditionally involved in telecommunications, and some applications (such as future applications in connected automotive mobility) will also require global connectivity, potentially with quality of service guarantees that cross borders.

Tapping on the innovation of different players across the value chain, including customers, specialist application providers and MVNOs, could better ensure that the diverse needs of different customer groups are met. At the same time, consumers that have relied on low cost offers and basic handsets should not be left behind in the transition to a 5G and eSIM-enabled mobile environment.

This Study examined the technical developments in mobile connectivity, implications for the value chain and the possible roles that could be played by various stakeholders including mobile network operators, MVNOs, verticals and other stakeholders. It looks at the consequences for sustainable competition and consumer welfare, and discusses the possible roles that NRAs could play in supporting competition, innovation and digital inclusion in the context of these technological developments in mobile communications.

The Study[1] on wholesale mobile access connectivity, trends and issues for emerging mobile technologies and deployments was approved via the BoR e-voting procedure, concluded on 13 April 2023.

1.2. Chair's studies in 2023

1.2.1. Study on the trends and cloudification, virtualization, and softwarization in telecommunications

Cloud services have become increasingly important in many sectors. In the telecom sector, the growing use of cloud services and cloud computing has been the catalyst of a number of fundamental developments in network technologies, including Software-Defined Networking (SDN) and Network Functions Virtualization (NFV). NFV and SDN have been deployed in both fixed and mobile architectures, but they are particularly relevant in the context of 5G networks which have been designed to fully exploit the benefits of the cloud. Open RAN solutions which are emerging in 5G are software-based solutions that make use of open and modular Radio Access Network interfaces. This makes it possible for hardware and software components provided by multiple suppliers to be integrated into one overall solution, and virtualization and cloudification enable network operators to run software services from multiple vendors on generic hardware.

While these technical developments are still in their early stage, the telecommunication industry is witnessing a paradigm shift that is affecting the ECS provision value chain. The traditional model of ECS provision characterised by proprietary hardware and software network equipment and on-premises software solutions, is becoming more complex and more

[1] BoR (23) 41, Study on wholesale mobile connectivity, trends and issues for emerging mobile technologies and deployments, 13.04.2023, see: https://www.berec.europa.eu/en/document-categories/berec/reports/study-on-wholesale-mobile-connectivity-trends-and-issues-for-emerging-mobile-technologies-and-deployments

dynamic as a result of cloudification, virtualization and a general pattern of software run on commodity hardware replacing dedicated hardware.

Against this backdrop, in 2023, BEREC commissioned an external Study on the technology trends, market and business developments and impacts on competition and regulation of cloudification, virtualization and softwarization in telecommunications. The project was undertaken for BEREC by Plum Consulting and Stratix.

The approach to this exploratory study was based on a mixed methodology, combining desk research and stakeholder interviews. More than 20 interviews were organised to assess the preliminary findings against the experiences and expertise of stakeholders, to get their real-world insights, and to disentangle hype from reality.

The study addresses the issues and trends associated with cloudification, virtualization, and softwarization in the provision of electronic communications networks and electronic communications services. It firstly comprises the description of the current state of the art related to network virtualization, the identification of key actors in the value chain and use cases and, secondly, provides a more analytical analysis of the identification of potential regulatory and competition problems and challenges, and of expected future trends, including possible new business models that could be enabled by virtualization.

Key findings in this Study on the trends and cloudification, virtualization, and softwarization in telecommunications, may be summarised in the following categories:

Technology evolution - the report describes the evolution from vertically integrated service-specific network architectures through the growth of IP networks to the current ecosystems, in which network and service functions which were previously reliant on dedicated physical resources have been moved into virtual environments where they are controlled by software. These functions are increasingly hosted in private or public cloud environments.

Impact on business dynamics and competition - alongside this technology evolution, the cloud market landscape is changing the business dynamics in ways which affect both regulated markets and other areas of communications service providers' (CSP) activity. For example, CSPs have embarked on a digital transformation driven by technical evolution, CSPs are adopting a cautious 'wait and see' approach in some cases, CSPs are exploring new business models but face uncertainty, hyperscalers have an increasing and multifaceted role, and additional factors include vendor diversification, open APIs and interoperability and standardisation.

Impacts on regulation - potential regulatory challenges gathered in this study include: (i) the impact that migrating to cloud-based networks may have on the vendor ecosystem and competition; (ii) the potential for hyperscalers to affect competition in adjacent markets, including telecommunications; (iii) the potential disadvantages for smaller markets and operators to compete on a level playing field globally; (iv) the role of NRAs in promoting investment (including network improvements); (v) the role of NRAs in preventing digital

exclusion in terms of the affordability of enhanced services and devices; (vi) new network and data security challenges, and (vii) the environmental impact of this technological development.

This Study will serve as input for the cloud services report to be approved for public consultation in March 2024.

1.2.2. Study on the evolution of the competition dynamics of tower and access infrastructure companies not directly providing retail services

BEREC commissioned this Study from WIK Consult to analyse the evolution of the competition dynamics of tower and access infrastructure companies that are not directly providing retail services. In the context in which the electronic communications operators feature a trend towards divesting key network assets, by contrast to the previous features of vertical integration, BEREC wanted an in-depth view of how such trends are affecting the competitive environment in the telecom sector, and should competition failures be identified which are the most appropriate means to address them.

The objectives of the Study were:

1) To define in-depth the companies targeted.
2) To gather, process and present detailed data and description of the key network assets of the targeted companies.
3) To address relevant regulatory and competition aspects, such as describing the regulatory provisions and initiatives applicable to the targeted companies and, specifically, to the assets under scrutiny, while reflecting on the competitive background of the relevant markets on which the key network assets have an impact, including the interactions between all the actors of the value chain.
4) To deliver an analysis of the case law related to the subject of the Study in the specific geographical location, where relevant.
5) To research and reflect on the specificities of the contracts between electronic communications providers and the companies holding the key network assets.
6) To draw some recommendations and include some consideration on the future outlook and perspectives.

The Study covers two main types of infrastructure companies: the tower companies, mainly capable of supporting the rollout of mobile networks, and the fibre companies that enable deployments in fixed networks. However, physical infrastructure assets are also considered under the ‘umbrella’ of network companies. The deliverables of the Study were in the form of a methodology report together with all the outcome of the data collection process, a workshop with stakeholders held on 20 June 2023 in Brussels, and the Study itself, both in its public and confidential versions.

More specifically, WIK Consult analysed a range of inputs from authorities (NRAs and NCAs) and industrial stakeholders, including a stakeholder workshop held on 20 June 2023, data gathering from 10 focus companies (Open Fiber and INWIT (IT), Nexera (PL), Onivia (ES),

Glasfaser Nordwest (DE), XP Fibre (FR), Cellnex (multiple), Vantage Towers (multiple), American Towers (multiple), Openreach (UK)) and 7 focus countries (France, Germany, Italy, Poland, Spain, the UK, and the USA), 15 interviews, and the results of an online survey (done in the period June-July 2023), responses to which were received from 30 NRAs, 41 infrastructure companies and 34 telecom operators. Additionally, the annexes of the Study contain important information on the competition cases which infrastructure companies have been involved in, as well as detailed country fiches for all the focus countries.

The final Study provides an overview of recent (typically a 5-year view) developments in relation to infrastructure divestments, and subsequent creation of infrastructure companies. It looks at the motivation for their creation, the impact on competition and investments, as well as the implications for regulation.

In mobile markets, the largest operators have all externalized their existing tower infrastructure, either directly to independent investors or in stages, but with the common aim of attracting capital. The Study shows increases in the net worth of telecom operators and a release of capital in the short term, but such decisions will increase operational expenditures in the long term. Additionally, this is expected to increase dependencies on infrastructure companies, and wholesale services that they will not be able to do without. This is the main reason for which maintaining adequate levels of competition at the level of essential mobile infrastructures will be of outmost importance. In terms of means of addressing competition-related issues, when merges or concentrations occur, the NCAs are generally adequately equipped to intervene if needed. There may be some caveats on this in the case of time-limited behavioural remedies imposed, more details on this are in the Study. As regards the European framework for electronic communications (BCRD and EECC), the Study takes the view that there are limited tools available for addressing potential competition issues, and explanations are in the Study. One of the main drawbacks of the current legislation is that it links the potential to regulate tower companies through their ownership by a mobile operator, under a literal transposition of the measures concerned. This aspect should however be resolved by the future Gigabit Infrastructure Act.

Divesting of assets for the purpose of accessing funding is a relevant reason for the creation of local fibre network companies as well. Additionally, partnering with other strategic players (e.g. in the energy field, such as SIRO) or forming joint ventures amongst telcos (e.g. FiberCop) for the coordinated deployment of VHCNs are also important, at least in some areas. Quite generally, independent fibre network companies play a crucial role in stimulating infrastructure-based competition in Europe. However, in areas where competition is (economically) viable, the creation of such companies (especially those in which the incumbent is involved or when volume discounts are offered or when volume commitments are required) may be problematic in terms of competition. Because they are authorised as electronic communications providers, the regulation of fibre network companies is possible (and is actually done) in a variety of ways in line with the legislative provisions covering the telecom sector.

Overall, the competitive conditions are different depending on whether it is fixed and mobile. While network companies have been more closely monitored by the authorities, this has not been the case with the tower companies, especially because of the legislative provisions included in the BCRD and the EECC rights of way. Moreover, the practice in the Member States shows various approaches.

2. Market trends

2.1. Broadband and Very High Capacity Networks

Article 3(2)(a) EECC stipulates that the national regulatory and other competent authorities as well as BEREC, the Commission and the Member States shall, inter alia, pursue the new general objective of promoting connectivity and access to, and take-up of, very high capacity networks, including fixed, mobile and wireless networks, by all citizens and businesses of the EU. This objective is at the core of the EU's aim to set up a Gigabit Society and, therefore, the concept of a very high capacity network is used in other initiatives taken by the EU institutions e.g. the Gigabit Infrastructure Act.

Connectivity and the use of electronic communications are an integral element of European society and welfare. Very high capacity networks support innovation in content-rich internet services, strengthen the international competitiveness of the EU and have enormous potential to deliver benefits to consumers and businesses across the EU.

Article 2(2) EECC defines the term 'very high capacity network' and Article 82 provides that BEREC shall issue guidelines on the criteria that a network has to fulfil in order to be considered a very high capacity network, in particular in terms of down- and uplink bandwidth, resilience, error-related parameters, latency and its variation. In October 2023, BEREC updated the first version of these Guidelines published in October 2020 regarding criterion for wireless networks. These Guidelines[2] determined (paragraphs 19 and 22), in accordance with the EECC, that any network that fulfils one (or both) of the two criteria below is a fixed very high capacity network[3]:

(i) Any network providing a fixed-line connection with a fibre roll-out at least up to the multi-dwelling building.
(ii) Any network providing a fixed-line connection that is capable of delivering, under usual peak-time conditions, services to the end users with the following quality of service:

[2] BoR (23) 164, BEREC Guidelines on Very High Capacity Networks (2023), 05.10.2023, see: https://www.berec.europa.eu/en/document-categories/berec/regulatory-best-practices/guidelines/berec-guidelines-on-very-high-capacity-networks-2023

[3] In addition, these BEREC Guidelines (paragraphs 18 and 21) also set out the criteria that a network must fulfil in order to qualify as a wireless very high capacity network.

Quality of Service Parameter	Threshold
Downlink data rate	≥ 1000 Mbps
Uplink data rate	≥ 200 Mbps
IP packet error ratio	≤ 0.05%
IP packet loss ratio	≤ 0.0025%
Round-trip IP packet delay	≤ 10 ms
IP packet delay variation	≤ 2 ms
IP service availability	≥ 99.9% per year

From this, it follows (see paragraph 63 of the Guidelines) that fixed networks based on fibre to the building (FTTB) or fibre to the home (FTTH) qualify as a very high capacity network. Fixed networks with a fibre roll-out that is not at least up to the multi-dwelling building may also qualify as a very high capacity network. However, they have to meet the Quality of Service (QoS) thresholds listed above, which depend not only on the access technology deployed in the fixed network, but also on, for example, the access network architecture (i.e. the extent to which fibre is rolled out, e.g. FTTN/C/dp[4]), the length and quality of the copper loop, and the number of subscribers who share the same coax access network (see BoR (20) 226, question 27, pp. 19-20)[5].

Therefore, in general, fixed networks with G.fast 212 MHz access technology on copper access lines, with copper loop lengths comparable to copper loops in a multi-dwelling building, may qualify as a very high capacity network, as the QoS thresholds of the BEREC Guidelines were set based on such a scenario (see BoR (23) 164, Annex 3). However, not all fixed networks based on VDSL2 vectoring qualify as a very high capacity network. Similarly, in general, fixed networks based on DOCSIS 3.1 with a coax-based access network of comparable size to a coax access network within a multi-dwelling building may also qualify as a very high capacity network, as the setting of the QoS thresholds in the BEREC Guidelines also examined this scenario. However, not all fixed networks based on DOCSIS 3.1 qualify as a very high capacity network.

Article 22 EECC provides that national regulatory and/or other competent authorities shall conduct a geographical survey of the reach of electronic communications networks capable

[4] FTTN, FTTC and FTTdp stand for 'Fibre to the node', 'Fibre to the cabinet' and 'Fibre to the distribution point'.
[5] BoR (20) 226, BEREC's reply to the targeted public consultation on the evaluation of the state aid rules for the deployment of broadband networks, 10.12.2020, see: https://berec.europa.eu/eng/document_register/subject_matter/berec/others/9724-berec-response-on-the-targeted-public-consultation-on-the-evaluation-of-the-state-aid-rules-for-the-deployment-of-broadband-networks

of delivering broadband by 21 December 2023. This geographical survey may also include a forecast of the reach of broadband networks, including very high capacity networks.

Article 22(7) EECC also states that BEREC shall issue guidelines to assist national regulatory and/or other competent authorities on the consistent implementation of these obligations, which BEREC published in March 2020[6], March 2021[7] and June 2021[8], and use the term 'very high capacity network' in line with Article 2(2) EECC and the BEREC Guidelines on very high capacity networks[9]. Therefore, in the future, the deployment of very high capacity networks may be tracked based on these data.

According to the Study on 'Broadband coverage in Europe 2022'[10] and its predecessor studies commissioned by the European Commission, FTTP (defined as FTTB and FTTH) coverage in the EU[11] increased significantly between 2013 and 2022, from 16% to 57% of households (see Figure 1 below).

The coverage of fixed very high capacity networks is comprised of the FTTP coverage, as networks based on FTTP qualify directly as a fixed very high capacity network under Article 2(2) EECC, together with fixed networks without a fibre roll-out of at least up to the multi-dwelling building and which meet the QoS thresholds (see Figure 1 below).

In six countries (Romania, Spain, Portugal, Latvia, Bulgaria, Sweden), the FTTP coverage, and therefore also fixed very high capacity network coverage, is already higher than 80%, while in two countries (Germany, Belgium) the FTTP coverage is still below 20% (see Figure 2 below).

---

[6] BoR (20) 42, BEREC Guidelines to assist NRAs on the consistent application of Geographical surveys of network deployments, 05.03.2020, see: https://berec.europa.eu/eng/document_register/subject_matter/berec/regulatory_best_practices/guidelines/9027-berec-guidelines-to-assist-nras-on-the-consistent-application-of-geographical-surveys-of-network-deployments

[7] BoR (21) 32, BEREC Guidelines on Geographical surveys of network deployments. Articles 22(2), 22(3) and 22(4), 11.03.2021, see: https://berec.europa.eu/eng/document_register/subject_matter/berec/regulatory_best_practices/guidelines/9884-berec-guidelines-on-geographical-surveys-of-network-deployments-article-22-2-22-3-and-22-4

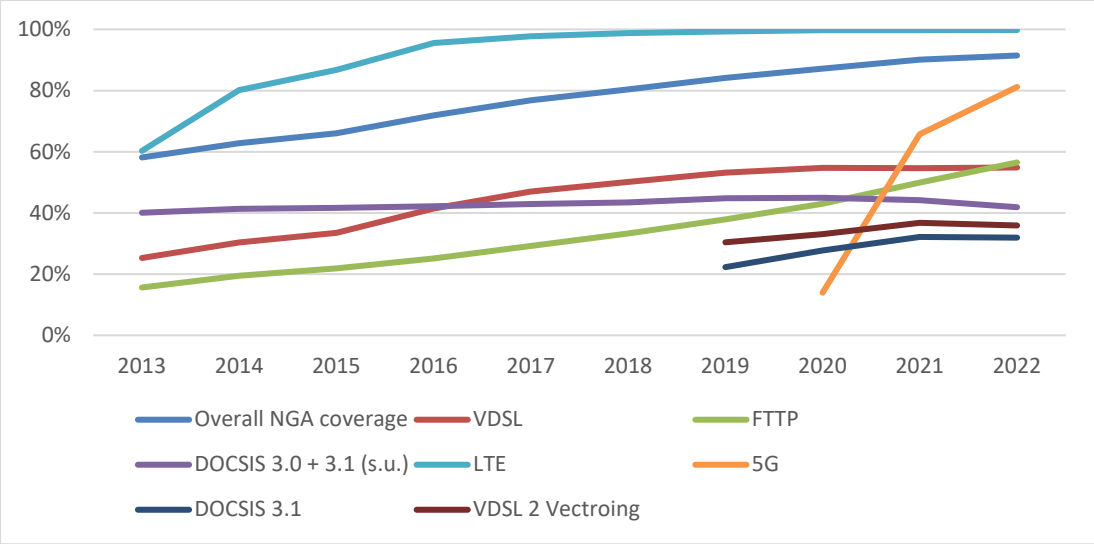
[8] BoR (21) 82, BEREC Guidelines on Geographical surveys of network deployments. Verification of information, 10.06.2021, see: https://berec.europa.eu/eng/document_register/subject_matter/berec/regulatory_best_practices/guidelines/9980-berec-guidelines-on-geographical-surveys-of-network-deployments-verification-of-information

[9] BoR (23) 164, BEREC Guidelines on Very High Capacity Networks (2023), 05.10.2023, see: https://www.berec.europa.eu/en/document-categories/berec/regulatory-best-practices/guidelines/berec-guidelines-on-very-high-capacity-networks-2023

[10] Broadband coverage in Europe 2022, see: https://digital-strategy.ec.europa.eu/en/library/broadband-coverage-europe-2022

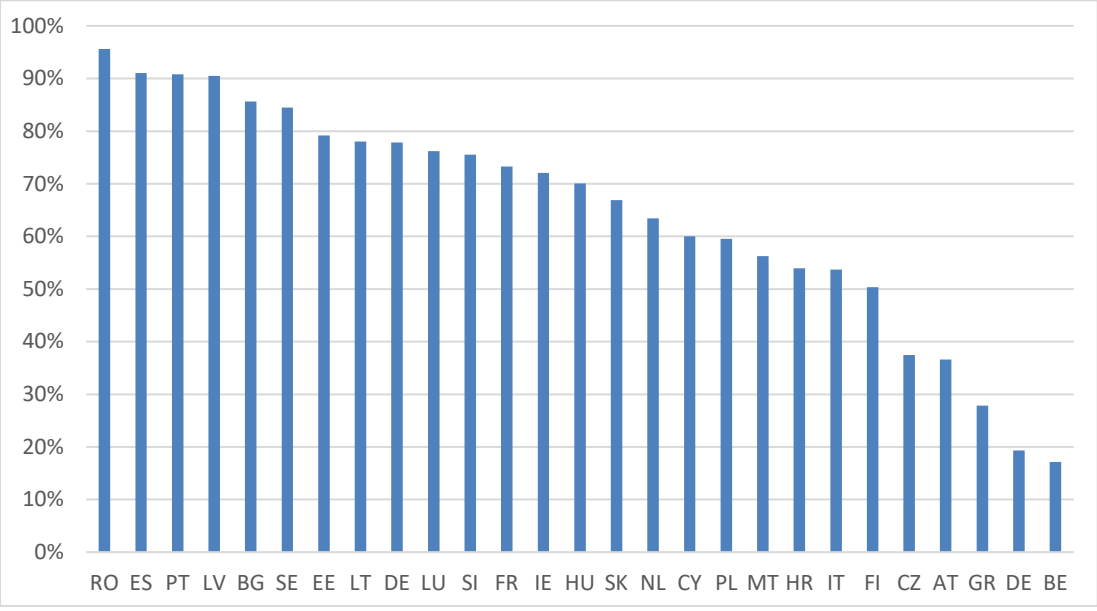
[11] EU-27.

Figure 1: Development of LTE and NGA coverage in the EU by technology, 2013-2022



Source: Broadband coverage in Europe 2022[10]

Figure 2: FTTP coverage by country in 2022



Source: Broadband coverage in Europe 2022[10]

The coverage of other types of broadband networks developed in the EU[11] between 2013 and 2022 is as follows: total Next-Generation Access (NGA) coverage in the EU increased significantly from 58% to 92% of households (see Figure 2 above). This increase mainly came from growth in VDSL and FTTP coverage, while cable (DOCSIS 3.0 and DOCSIS 3.1) coverage was fairly constant during this period. The NGA coverage increased fairly steadily on average by 4.0 percentage points per year, except in 2022 where the yearly increase fell to 1.4%. The FTTP coverage also increased fairly steadily between 2013 and 2020 on average by 3.9 percentage points per year. However, in 2021 and 2022 the yearly increase rose to 6.9 and 6.6 percentage points. VDSL coverage growth peaked in 2016 at 8.0 percentage points per year, then declined to 0 percentage points per year in 2021 and also stagnated at 0.2 percentage points per year in 2022. Because of these developments, the total FTTP coverage surpassed the total coverage of VDSL and became at 56.5% the fixed access technology with the highest coverage in the EU in 2022 for the first time. The coverage of the more advanced VDSL and DOCSIS technologies, VDSL2 vectoring and DOCSIS 3.1., increased between 2019 and 2021 from 30% to 37% (VDSL2 vectoring) and 22% to 32% (DOCSIS 3.1) and remained unchanged in 2022.

In relation to mobile networks, the long-term evolution (LTE) was rolled out between 2013 and 2022 from 60% coverage to 99.8%, reaching 99% already in 2018. The 5G roll out began around 2020 and increased rapidly from 14% in 2020 to 81% in 2022.

2.2. Mobile broadband

According to DESI 2022, 4G coverage of populated areas is almost universal in the EU, reaching 99.8% and it is widely available also in rural areas (99.6%). DESI 2023[12] shifts to providing different variables to measure evolution to 5G, indicating that 80% of the households in the European Union are located in an area with 5G.

Mobile broadband take-up in the EU continues to grow in 2023. According to DESI 2023 indicators, the average number of mobile data subscriptions per 100 people at the EU level (aged 16-74) reached >86%. The mobile broadband take-up of 10 countries (Ireland, Denmark, Finland, Luxembourg, Sweden, Netherlands, Spain, Austria, Cyrus, and Belgium) is higher than 90%. 14 EU countries (France, Estonia, Slovenia, Malta, Germany, Slovakia, Latvia, Czechia, Lithuania, Hungary, Poland, Romania, Portugal, and Croatia) have a mobile broadband take-up of between 80% and 90%. Three countries have a mobile broadband take-up of between 70% and 80% (Italy, Greece and Bulgaria).

[12]DESI 2023 dashboard for the Digital Decade, see: https://digital-decade-desi.digital-strategy.ec.europa.eu/datasets/desi/charts

2.3. Forward-looking trends in the telecommunication sector

As the importance of the next generation connectivity increases, massive investments in the network infrastructure are needed to accommodate and integrate new technologies while at the same time attending to growing redundancy and cybersecurity requirements. An increase in traffic volume and the demand for enhanced quality of service requirements is reported and this trend is likely to continue and intensify in the future. A very fast evolving market with new digital developments can be expected (e.g. metaverse, Web 3.0). Network virtualization is becoming increasingly common as is the convergence between connectivity (moving towards cloud-based networks), cloud and edge computing, AI and storage (edge clouds).

New generations of fixed and mobile communications require huge investments in fibre and antenna densification. New performance will enable critical use cases and the connection of objects. The growing requirement for strategic autonomy, security and sovereignty regarding key enabling technologies in the electronic communications area will also have a significant impact on future developments. Moreover, it should not be overlooked that environmentally, information and communications technologies are an important enabler of emission reductions for many sectors in the economy, while at the same time they themselves need to make an effort to reduce their carbon footprint.

Electronic communications networks (ECN) are expected to evolve towards the disaggregation of software and hardware by means of network virtualisation[13]. This is likely to offer possibilities to reconfigure most electronic communications assets and lead to a significant transformation of the value chain. Hardware facilities will be subject to increasing network shared use between market actors, not only among electronic communications operators but also industry sectors. In particular, network slicing will enable new market actors in the sector to operate virtual networks just as they would operate a proprietary physical network. Overall, this could lead to the future network physical architecture becoming more a platform type of architecture.

Network virtualization will also allow providers of ECN to transform a large proportion of incremental investment costs into linear operational expenses (shifting CAPEX to OPEX). In this new context, other layers are likely to concentrate on hardware infrastructure while a diversity of other players, incumbents as well as many new entrants, are likely to address market needs in the upper layers: namely software development, virtual connectivity services, and the actual applications. Existing providers of ECN will likely need or want to adapt to the new paradigm, possibly not only as connectivity providers but also as infrastructure-as-a-service provider or even as innovative software providers.

[13] BoR (23) 208, External study on the trends and cloudification, virtualization, and softwarization in telecommunications, 07.12.2023, see: https://www.berec.europa.eu/en/document-categories/berec/reports/external-study-on-the-trends-and-cloudification-virtualization-and-softwarization-in-telecommunications

At the same time, new types of operators and business models (e.g. wholesale-only, independent tower companies ('towercos'), infrastructure sharing, co-investment) are emerging. In these business ecosystems, new cooperation models or partnerships trends will emerge.

European entities are more interconnected and interdependent, which makes them stronger and more efficient but also more vulnerable in case of incidents. Increased cyber threats may nevertheless trigger additional needs and increased costs to strengthen the cybersecurity, resilience and redundancy of networks. In the last years, the EU regulatory framework for cybersecurity has undergone a considerable change. It has introduced several new obligations, initially as guidelines but which have since become largely mandatory. As such, BEREC expects significant investments in cybersecurity by the telecom industry. While technological advances bring new services to market, they also present new challenges for cybersecurity.

In brief, BEREC's reply to the EC exploratory consultation on the future of the electronic communications sector and its infrastructure[14] highlights the way technological trends are changing the way we communicate and transforming the internet ecosystem. Several market and technological trends are blurring and reshaping the traditional boundary between ECN and ECS and digital services. Moreover, some new technologies (e.g. AI or cloud) require access to inputs, raising concerns about new challenges in terms of competition, end-users' rights, EU sovereignty, security, sustainability, and network resilience.

While the evolution of network architectures entails new business opportunities and may unlock advantages for ECN/S providers, additional infrastructure investments will have to be made to meet the EU Digital policy objectives in a context where new competitors and players may take up key roles.

2.4. Evolution of digital markets

Digital markets have undergone a significant evolution in the last decades, driven by technological advances, changing consumer behaviour and emerging trends.

Open digital markets are a key component of the European Union's digital strategy. The EU recognises that open digital markets are essential for fostering innovation, promoting competition, and ensuring that consumers have access to a wide range of goods and services at competitive prices and of good quality. Open digital markets also contribute to economic growth, job creation, and social inclusion.

[14]BoR (23) 131, BEREC input to the EC's exploratory consultation on the future of the electronics communications sector and its infrastructure, 19.05.2023, see: https://www.berec.europa.eu/en/document-categories/berec/others/berec-input-to-the-ecs-exploratory-consultation-on-the-future-of-the-electronics-communications-sector-and-its-infrastructure

The EU has adopted a number of initiatives to promote open digital markets, including the Digital Markets Act (DMA), the Data Act (DA) and the Data Governance Act (DGA). The DMA aims to make digital markets more competitive and fairer by imposing obligations on gatekeepers providing specific core platform services. The DA sets harmonised rules on fair access to and use of data, while ensuring the protection of personal data. The DGA provides a framework for the governance of data, and aims to ensure that data are used in a responsible and ethical manner while facilitating data access and reuse.

In 2023, BEREC continued to work towards the implementation of the key principles of open digital markets:

- **Fair competition**: all businesses should have a fair opportunity to compete in the digital markets, regardless of their size or power. This means that large digital players should not be allowed to stifle competition or create barriers to entry.
- **Open access:** data, platforms, and technologies should be accessible to all users. This means that digital platforms should not be able to lock away data to prevent others from using them.
- **Interoperability:** some specific digital services should be able to work together seamlessly (e.g. messaging services provided by gatekeepers). This means that users should be able to use such products and services without encountering compatibility problems.

3. Regulatory accounting

The Regulatory Accounting (RA) Annual Report gives an overview of the main remedies imposed on significant market power (SMP) operators in relevant markets subject to ex-ante regulation. Specific focus is given to the relevant costing methodologies, applied in relation to the corresponding price control schemes, adopted by NRAs for single products.

The overall picture of the cost accounting methodologies (Section 3) is relatively stable in comparison to last year with just a small number of changes by NRAs since last year. There are clear preferences for price control methods (cost orientation alone or in combination with a price cap, but the overall picture is more differentiated), cost base (current cost accounting – CCA) and allocation methodologies (mainly long run incremental costs (LR(A)IC), with fully distributed costs (FDC) preferred only for a few products). The degree of consistent application of methodologies in accordance with the EU Regulatory Framework continues to be high and accommodates the use of elements or parameters that reflect national circumstances.

The RA report 2023 provides an analysis with more of a focus on single products (increasing the scope of monitoring) than previous editions. The 2021 report collected information on 23 main products (13 in 2015). As in the 2022 report, the 2023 report collects information on 17 main products, as reported in Figure 2, and simplifies the information previously collected mainly due to a reduced set of products on the copper network.

The regulation of legacy products in markets 1/2020 and 3b/2014 is more frequent: 85% of EU NRAs still maintain SMP remedies on ULL and 67% on market 3b over the legacy copper network (reduced from 81% compared to last year's report). In the case of the former market 3a/2014, VULA product over FTTC and FTTH, the situation has remained unchanged since last year. In relation to market 3b/2014 the number of NRAs that no longer regulate NGA products has increased since last year. The SMP regulatory remedies have been applied by NRAs generally towards a single national SMP operator. In some cases, the SMP regulation has been applied to more than one SMP operator.

The number of NRAs that face different competitive conditions across their national territory thus justifying a geographically differentiated approach (in terms of market definition or remedies application) has increased in comparison to last year for some markets/products. Looking at geographically differentiated regulation, the deregulated areas range from 5% of households up to 70% in market 3b/2014, very often between 20% and 50%, marking an increase on the 2022 report.[15] The percentage of households falling under a geographical regulation in combination with less regulatory obligations in markets 3a and 3b (ES, PL, PT, FR) is in line with the regulatory path where a geographical regulation is applied to avoid non-proportional regulation (the range of countries in Figure 9 follows the one reported in Figure 6). Also, the competitive areas are increasing.

Most NRAs apply the whole set of remedies when the SMP regulation is imposed on a specific product/market, where access obligation in combination with non-discrimination are the most frequently applied remedies.

Within the copper network, ULL is still the most regulated product. Focusing on RA in general, the accounting separation is often imposed together with the cost accounting obligation. Some NRAs consider it necessary to impose both obligations in order to ensure that robust regulatory accounting information is available for each product. This rationale is related to the fact that accounting separation is useful for vertically integrated undertakings by using cost models to supplement price control measures in order to prevent unfair cross-subsidies (e.g. if the result of the cost model is higher than the cost derived from the accounts of the significant market power (SMP) operator), and when the regulatory framework, in perspective, can become less intrusive.

As a stable result during the past few years, cost orientation remains the most commonly used price control method and it is applied mainly for legacy products, while the retail minus category refers mainly to VULA and market 3b products (Figure 18).

Economic replicability testing (ERT) price control methodology is still mainly used as a complement to cost orientation, albeit a slightly increased use of the ERT at least for NGA/VHCN wholesale products as a price control method can be observed. This suggests

[15] PT applies a differentiated market and remedies approach in ex market 4_2014; as this is a market targeted to companies (small, medium and large) the percentage of households covered (by regulated and/or deregulated areas) is not relevant.

that it is a substitute for cost orientation, in line with the Commission NDCM Recommendation (2013/466/EU) and the price flexibility tool under Article 74 EECC.

Cost orientation for FTTH is more frequent when a legacy network based on copper is still relevant for NGA products (FTTC), where there is a stronger relation of substitution with a legacy copper product. If there are no intermediate steps, such as FTTC for VHCN transition, more flexibility is granted when regulating FTTH, also when applying the ERT. The relevance of the legacy copper network for NGA take-up (e.g. the case of FTTC) appears to correlate to the regulatory approach in terms of remedies imposed in access markets and the level of the price flexibility tool, under Article 74 EECC, irrespective of the application of non-discrimination rules such as Equivalence of Inputs (EoI).

In general, the application of EoI models has been increasing over the years. The cumulative percentage of EoO and/or EoI is higher in relative terms in case of VULA (FTTH) and for market 3b/2014.

With regard to the cost base, CCA is by far the most commonly used methodology for all markets and there was no change to this in 2023.The most frequent cost allocation approach is LRIC/LR(A)IC, for almost all products/markets. In the access market (market 3a) a preference for LRIC/LR(A)IC can be found. In general, when LR(A)IC/LRIC is chosen as the main category, the most common approach is Bottom-up. FDC is a frequent approach for market 4 over legacy network. With respect to last year an increase in relative terms of the use of FDC was seen also for Market 3b for legacy products and NGA products. This is due to the fact that the NRAs that used LR(A)IC removed regulation (there is no 'transition' from LR(A)IC to FDC).

For copper LLU, most NRAs apply a cost orientation alone/LRIC-LR(A)IC/CCA approach. Generally there is an increase in the use of the combination of cost orientation/price cap with BU-LRIC approach and a reduction of accounting methodologies based on FDC; TD approach is significantly less frequently used.

Analysis of the structural data (Section 4) confirms that countries start from very different points in terms of population, topography, market situation, etc. These factors influence the regulation strategy of NRAs for the wholesale access markets.

Compared to the BEREC WACC parameters Report 2023 (BoR (23) 90), the section on BEREC Regulatory Accounting Report WACC (Section 5) in this report is of a more descriptive nature. The aim is on reporting and analysing NRAs' WACC calculations, just as they are, while showing the evolution over time, in line with previous versions.

Regarding the WACC, the in-depth survey and the update provided in this report (Section 5) shows that all NRAs use the Capital-Asset-Pricing-Model (CAP-M)[16] and hence similar parameters for determining the WACC. However, the value of these parameters naturally differs because they reflect different national financial market conditions. The statistical

[16] Cf. BoR (13) 110, BEREC Report on the Regulatory Accounting in Practice 2013, 16.09.2013, see: https://www.berec.europa.eu/en/document-categories/berec/reports/berec-report-on-the-regulatory-accounting-in-practice-2013

analysis (regression) of the data shows – in line with the previous exercises – that the differences of the final WACC values over time are mainly explained by the parameters in the WACC calculation that are more 'country related', such as the RFR, ERP and tax rate. There is a less relevant role for 'sector-specific' parameters, such as beta, gearing and debt premium. This is consistent with the survey results on 'used methodologies' which confirm that beta, gearing and debt premium are estimated mainly on a 'notional' basis (see also Annex II of Section 5). This is a practice in use by the NRAs which pre-dates the WACC Notice.

By taking into account only the most recent estimation over time (the last three most recent values for each NRA) in the pooled regression analysis, the results show that the ERP has become less relevant. The ERP had been the second most relevant parameter after RFR for explaining differences between the WACC values applied by NRAs until recently. Tax, a national parameter not under NRAs control, has become more relevant in explaining differences related to the ERP since last year. This result confirms the fact that the ERP estimation through a notional approach by most NRAs, due to the application of the Commission Notice, is reducing its spread. At the same time, beta is becoming more relevant for explaining the difference in WACC values between NRAs. This is due to an asynchronous update of the parameter and the fact that contrary to what happened in the past the variation of this parameter is more relevant than before. This also shows that the application of the WACC Notice continues to have a material convergent effect.

Generally, the 2023 data confirm a consistent approach to regulatory accounting and this indicates that NRAs are providing predictable regulatory environments in their countries. The convergence of regulatory accounting approaches for wholesale access markets must not lose sight of the fact that wholesale access markets reflect different national market circumstances and structural factors influence the regulatory strategies.

4. Regulatory framework

In 2023, the process for transposing and implementing Directive 2018/1972 establishing the European Electronic Communications Code (EECC) progressed further. By the end of the year, 25 Member States had notified the Commission that they had completed the transposition. For 18 of them, the Commission confirmed that the transposition was complete.

In 2022, the Commission decided to refer to the Court of Justice of the European Union ten Member States which by then had not fulfilled their obligation under the EECC to adopt and communicate to the Commission their national transposition measures. As of 31 December 2023, infringements proceedings against five Member States have been closed following full notification of the transposition measures. The Commission is still examining the completeness of transposition measures notified by four Member States, and two Member States have yet to notify their full transposition.

Concerning EU legislative sectoral novelties, in February last year the Commission put forward the Connectivity package with a view to fostering the deployment of advanced Gigabit

networks in order to support the digital transition of the European economy and society. This reflects the EU's digital transition targets for 2030, the Digital Decade Policy Programme (DDPP)[17].

BEREC contributed to the Commission's initiative by releasing in May its Opinion on the draft Gigabit Recommendation – replacing the 2010 NGA Recommendation and the 2013 non-discrimination and costing methodology Recommendation - and an analysis of the legislative proposals for a Gigabit Infrastructure Act, which is to replace the broadband Cost Reduction Directive. BEREC also contributed to the Commission's exploratory consultation on the future of the telecom sector and its infrastructure.

The draft Gigabit Infrastructure Act has the aim of simplifying administrative procedures for network deployment and facilitating the coordination of deployment of the physical infrastructure. The Gigabit Recommendation, adopted by the Commission on 6 February 2024, provides NRAs with guidelines on access remedies for SMP operators to guarantee competition together with investment in gigabit networks.

Continuing on BEREC's technical contributions to sectoral legislative and policy initiatives, BEREC provided valuable input to the European Commission's Draft implementing decision by setting out key performance indicators for the above-mentioned DDPP.

The DDPP redefines *inter alia* the scope of the traditional Commission's fact-finding report by taking stock of the national implementation of the electronic communications' regulatory framework. In addition to the traditional indicators on telecom markets, the DDPP includes indicators on the digital dimension, thus reflecting the increasing relevance of digital issues and the consequential shift in the Commission's data collection exercise from regulated electronic communications markets to digital matters and the associated targets set out in the DDPP.

Meanwhile, activities have been launched to review the functioning of Regulation 2018/1971 establishing the Body of European Regulators for Electronic Communications (BEREC) and the Agency for Support for BEREC (BEREC Office).

In this respect and in 2023, BEREC has been contributing to the assessment of the performance of BEREC and the BEREC Office that the European Commission is due to release pursuant to Article 48 of the BEREC Regulation. BEREC has launched an internal collection of the NRAs' experiences on the EECC implementation and functioning, in view of the analysis that the Commission is to carry out by 21 December 2025, pursuant to Article 122 EECC.

2023 was also marked by the introduction new EU legislation entering into force at the end of 2022 and introducing wide-ranging rules on online digital players. BEREC contributed to this

[17] Decision (EU) 2022/2481 of the European Parliament and of the Council establishing the Digital Decade Policy Programme 2030

process through its studies, reports and input to public consultations on the digital ecosystem. In relation to this, BEREC was invited to participate in the High-Level Group on the Digital Markets Act, envisaged by Regulation 2022/1925 on contestable and fair markets in the digital sector (Article 40) and set up by Commission Decision C (2023) 1833 final of 23.3.2023. The Group, which provides the Commission with advice and expertise to ensure a consistent and future-proof implementation of the DMA, is composed of 30 representatives from BEREC, the European Data Protection Supervisor (EDPS) and European Data Protection Board (EDPB), the European Competition Network (ECN), the Consumer Protection Cooperation Network (CPC Network), and the European Regulatory Group of Audiovisual Media Regulators (ERGA).

5. Developments related to the Openness of the Internet

In 2023, BEREC continued its work on assessing the IP interconnection ecosystem and is in the process of preparing the 'Report on the IP Interconnection Ecosystem' which will be released for public consultation in 2024. In this context, BEREC carried out a comprehensive data collection exercise among European internet access service providers in autumn 2023 with quantitative and qualitative questions. In addition, BEREC held a series of internal workshops, involving various stakeholders.

BEREC published its Annual Report on the implementation of the Open Internet Regulation (OIR) in October 2023, covering the period from 1 May 2022 to 30 April 2023. This report provides an overview of the activities of the NRAs in the course of implementing the OIR and the associated BEREC OI Guidelines. In this context, BEREC also closely examined the implementation of the OIR in light of the decisions of the European Court of Justice in September 2021 and the updated BEREC OI Guidelines in June 2022 accordingly.

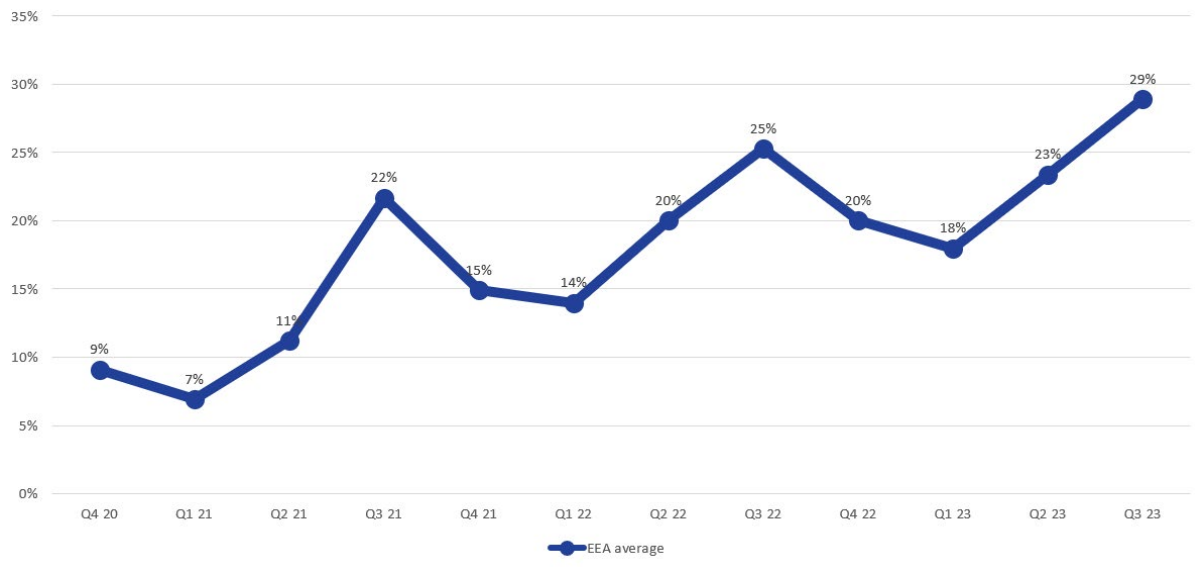
As in previous years, BEREC provided a forum for NRAs to share information and to facilitate the consistent application of the OIR on all topics related to the OIR.

In 2023, BEREC members continued to exchange experiences on Internet Access Services (IAS) quality measurement tools, in order to develop these further. The relevant working group provided a forum for the exchange of best practices.

6. International roaming developments

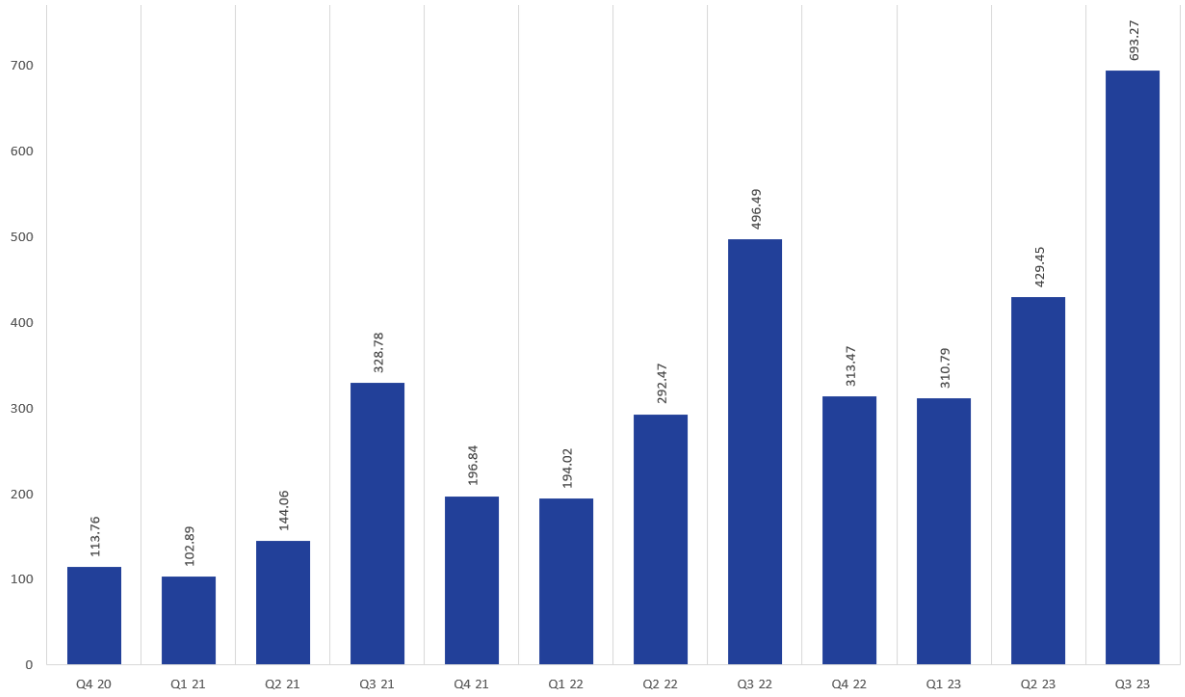
Roaming charges in the European Union and the European Economic Area (EEA) became a thing of the past on 15 June 2017. When the Roaming Regulation (Regulation (EU) 2015/2120, published in the Official Journal of 26 November 2015, amending Regulation (EU) No 531/2012) entered into force, it allowed consumers to use their mobile phones anywhere in the EU, just as in their home country, without any additional surcharges ('Roam Like at Home' – RLAH). Only in exceptional cases may operators levy a surcharge for EU roaming. In July 2022, the new Roaming Regulation (EU) 2022/612 came into force. This regulation

contains RLAH provisions and additional provisions about QoS, transparency, emergency communications, VAS, etc. To assess the competitive developments and the impact of RLAH on the EU-wide roaming markets, BEREC regularly collects data from NRAs on the development of retail and wholesale charges for regulated voice, SMS and data roaming services. It also includes wholesale charges applied for balanced and unbalanced roaming traffic. BEREC must also collect data on wholesale roaming agreements that are not subject to the maximum wholesale roaming charges, and on the implementation, at wholesale level, of contractual measures to prevent permanent roaming or anomalous or abusive usage of wholesale roaming access for purposes other than roaming. On the basis of the data collected, BEREC reports regularly on the evolution of pricing and consumption patterns in the Member States for both domestic and roaming services, the evolution of actual wholesale roaming rates for unbalanced traffic between roaming providers, and the relationship between retail prices, wholesale charges and wholesale costs for roaming services. The new Regulation amended slightly the data collection provisions moving from biannual to annual data collection and includes additional indicators. The introduction of RLAH services, coupled with the growing demand for data services, has changed the international roaming market. A relevant outcome is that RLAH services have triggered a substantial increase in international roaming traffic. BEREC data collected for the latest BEREC Report confirms the full recovery of the roaming market in 2023 following the Covid-19 pandemic. The number of roaming subscribers has increased since 2022 and has reached pre-pandemic levels. However, the volume of roaming calls remains stable when compared to 2022 and is still lower than the pre-pandemic level.



Source: BEREC

For data roaming traffic, the volumes have increased since 2022 and are above the pre-pandemic period, but roaming data traffic is also impacted by the general trend of increased data consumption which occurs at domestic level as well.



Source: BEREC

7. Conclusions

Europe has set ambitious connectivity targets, as it reaches for full connectivity, i.e. gigabit connectivity for all and 5G in all populated areas. BEREC, as a key player in shaping the regulatory landscape, enables and underpins these aims by promoting the roll-out of high capacity networks, sustaining open digital markets, and fostering competition and innovation to achieve the goal of full connectivity for both households and businesses. In 2023, clear progress and substantial advances were made in this direction.

The use of Next Generation Access (NGA) networks and VHCNs are on the rise all the time. Mobile broadband is now widely used across Europe, 24 EU member states have a large majority of their population (>80%) using mobile broadband. At the same time, national differences still exist, affected by geographical, historical and tax system variations from one country to another. However, the ongoing harmonisation of regulatory practices is making progress and paving the way to the realisation of the single European digital market. Regulations such as the Open Internet Regulation and Roaming Regulation underscore the

tangible contributions of the single European digital market to the well-being of businesses and individuals across Europe.

PART B: Annual Report on BEREC activities in 2023

Annual Report on BEREC activities in 2023, in accordance with Article 22 of Regulation (EU) No 2018/1971 of the European Parliament and of the Council of 11 December 2018 establishing the Body of European Regulators for Electronic Communications (BEREC) and the Agency for Support for BEREC (BEREC Office)

1. Introduction

In this Annual Report, the activities of the Body of European Regulators for Electronic Communications (BEREC) in 2023 are presented in accordance with Article 22 of the BEREC Regulation. The Report focuses on the workstreams and priorities set out in the BEREC Work Programme 2023 and reports on progress made therein during the year. All activities were mainly carried out by BEREC Working Groups (WGs) and ad hoc WGs. The final documents on the various activities (among them BEREC Guidelines, Opinions, Reports, and others) have been published after being approved by BEREC's Board of Regulators. The objectives of BEREC's work in 2023 were aligned with the BEREC 2021–2025 Strategy, the three high-level priorities (promoting full connectivity, supporting sustainable and open digital markets, empowering end-users), and the priorities set for institutional and international cooperation. In addition to the three high-level priorities, facilitating the successful implementation and consistent application in all areas of the European Electronic Communications Code (EECC), the Open Internet regulation and the Roaming Regulation, are important horizontal principles within the strategic framework. A key policy objective is to ensure that VHCNs and 5G services are available in a timely manner. In this regard, BEREC worked intensively on several essential tasks that have been entrusted to BEREC by the co-legislators. In addition, BEREC provided guidance to the co-legislators and the European Commission on a number of initiatives such as the three actions related to gigabit connectivity. In 2023, much of the BEREC work shifted from providing Guidelines on implementing the EECC to assessing future technological and market developments within the scope of electronic communications and the digital ecosystem. Through its cooperation with other competent institutions and stakeholders, BEREC continuously ensures that future network technologies meet their connectivity targets in line with European values and interests (for example, in relation to (cyber)security, the protection of end users, and environmental sustainability challenges). In 2023, BEREC contributed to the implementation of the Digital Markets Act on the basis of technical advice to the EC on some of the relevant legal provisions.

2. Work Programme 2023

2.1. Strategic priority 1: Promoting full connectivity

2.1.1. BEREC Report on the regulatory treatment of business services (carry-over)

Business services consisting of, or based on, electronic communications services are a key element for ensuring that EU companies and public administrations can benefit from the digital economy. They allow for better provision of new innovative services for citizens and increase productivity and competition in a globalised world.

Building on the replies to a comprehensive questionnaire sent to all BEREC members in June 2022, and input from a workshop with stakeholder associations organised in October 2022, the Report presents the regulatory treatment of wholesale inputs used for retail business services throughout Europe. Regarding SMP regulation, the Report presents a snapshot of the markets in which wholesale products used for business services are regulated, including their geographical scope, the remedies applied, and insights on markets and market definition. When applicable, the Report addresses symmetric regulation applied in the context of business users. It highlights some good practices used by NRAs to encourage effective and sustainable competition, and investment and innovation in relation to business services. The draft Report was released for public consultation between December 2022 and February 2023. The final Report was published in June 2023.

The conclusions of the Report show that typically business markets are still, broadly speaking, concentrated in Europe, and warrant ex-ante regulation, at least partially, in most of the Member States[18]. However, the External Study accompanying this report[19] shows that customer satisfaction in the business markets is typically high, but lower for larger customers.

Document:

BoR (23) 88: BEREC Report on the outcome of the public consultation of the draft BEREC Report on the regulatory treatment of business services

BoR (23) 89: BEREC Report on the regulatory treatment of business services

[18] Regulation is imposed in relation to mostly the wholesale dedicated capacity markets (mk 2 of the 2020 Recommendation on relevant markets susceptible to ex-ante regulation), but also on the wholesale local access provided at a fixed location (mk 1 of the 2020 Recommendation on relevant markets susceptible to ex-ante regulation) or the wholesale central access provided at a fixed location for mass-market products (mk 3b of the 2014 Recommendation on relevant markets susceptible to ex-ante regulation).

[19] BoR (22) 184, External Study on Communication Services for Businesses in Europe: Status Quo and Future Trends, 12.12.2022, see: https://www.berec.europa.eu/en/document-categories/berec/others/external-study-on-communication-services-for-businesses-in-europe-status-quo-and-future-trends

2.1.2. BEREC Report on practices and challenges of the phasing out of 2G and 3G

Newer generations of mobile communications (4G and 5G) brought improvements to existing services. The newer services (and newer variants of the older services) can be used if end-user devices, home networks, and visited networks support this type of service. In many cases, when a (newer) service is not fully supported and setting up such a service is not possible, standards and settings provide for backward compatibility with older mobile technologies, such as 2G and 3G. When 2G and 3G networks are phased out, no fall-back will be possible anymore. Additionally, many older devices and services that do not support 4G and beyond will not be supported anymore. Examples of these include legacy mobile phones and even some early smartphones, older M2M devices such as smart electricity meters, and built-in eCall functionalities in cars.

This Report gives an overview of the challenges and opportunities arising from the 2G/3G phaseout, and examples of related practices in several countries. It also briefly highlights impacts of the 2G/3G phaseout and provides some insight on what some NRAs consider to be the main impacts.

The 2G/3G phaseout involves many stakeholders from many different domains, such as users (including vulnerable users and roamers), network operators (including virtual operators), vendors, device and other manufacturers, competent national or European authorities, and standardisation bodies. BEREC regards the phasing out 2G and 3G as a multi-stakeholder and multi-faceted issue. The Report provides a high-level analysis of some of the main issues faced by different stakeholders or groups of stakeholders, and the main focus is on the potential impacts on end users and stakeholder analysis.

The Report highlights that sharing experiences, lessons learned, and adopting common approaches will have positive effects on successfully phasing out 2G and 3G mobile technologies in markets, while maximising the service continuity of high impact services that still rely on 2G and 3G technology. As the impact on stakeholders is not always adequately communicated / understood because of the different stages of progress in different markets, stakeholder engagement is a fundamental tool in preparing for mobile technology phase-outs.

In addition, BEREC points out that 2G and 3G phase-out is likely to be on the agenda of stakeholders for some time to come, so that it might be a topic which BEREC has to re-visit with the benefit of further information on the practical experience of the Member States.

BEREC is satisfied that this Report has contributed significantly to advancing stakeholder engagement on this topic and looks forward to engaging with all its stakeholders, including in particular end users and vulnerable end users, to assist the smooth phase out of 2G and 3G mobile technologies.

Document:

BoR (23) 204: BEREC Report on practices and challenges of the phasing out of 2G and 3G

2.1.3. BEREC internal workshop on the migration to VHCN and copper switch-off with a focus on the needs of the end users

Electronic communications network operators are rolling out fibre closer to end users and the importance of the copper-based access network is declining. Therefore, NRAs are increasingly confronted by SMP operators wanting to decommission legacy copper-based access networks and close main distribution frames (MDFs), for example. In such cases, the NRAs have to apply the provisions of Article 81 EECC[20], and closely heed the forthcoming European Commission Gigabit Connectivity Recommendation.

Migration to very high capacity networks and copper switch-off is an important ongoing process, affecting in particular end users and, therefore, BEREC examined this topic at an internal workshop on 7 September 2023 in Brussels.

The workshop focused on three topics: (i) migration to very high capacity networks and copper switch-off with a focus on the needs of the end-users; (ii) update on the rules set by the NRAs for the migration process and copper switch-off; and (iii) the increase of wholesale copper access prices during the transition period.

During the first part of the workshop, NRA representatives from five countries presented their market situation as well as the state of play regarding copper switch-off. Sweden, Norway and Spain are among the very few examples of European countries where the copper switch-off process is already very advanced, while in Slovenia and Luxembourg this process is still in the early stages. The experiences show that many aspects have to be considered to ensure smooth migration. For end users, they particularly need: (i) sufficient, reliable and timely information; (ii) the availability of an appropriate alternative end-user service in time; and (iii) to know whether they will be forcibly switched-off, if they do not migrate voluntarily before the switch-off date.

NRAs inform and guide end users through their website, but they also use many additional channels of communication. The presentations showed that the availability of an appropriate alternative end-user service is particularly challenging for remote end users in rural areas where fibre-based end-user services are not available, and in countries or regions where due to topographical reasons even wireless coverage is difficult. The importance of forced migration differs in the presented countries. While Norway excludes the possibility of forced migration, the other case studies foresaw a role for forced migration. If forced migration is a reality, it is important that (nearly) all end users migrate to an alternative service before the switch-off date. The presentations showed that, in the countries where the switch-off process

[20] Directive 2018/1972/EC, see: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018L1972

is already well advanced (Sweden, Norway, and Spain), NRAs observe or monitor the migration process to detect and address end-user issues already at an early stage.

In the second part of the workshop, the NRAs of Italy and Greece gave an update on the rules that they have set for the migration process and copper switch-off since the publication of the above-mentioned BEREC Report in June 2022, including their rules on the schedule of the decommissioning process. In the presentation of the Italian NRA, the substitution matrix already implemented in Italy was of particular interest, as NRAs should establish a substitution matrix according to the forthcoming European Commission Gigabit Connectivity Recommendation.

In the third part of the workshop, the European Commission gave an overview of the section on migration in the forthcoming European Commission Gigabit Connectivity Recommendation., The focus was on the 'Increase of wholesale copper access prices during the transition period', which is a measure foreseen in this Recommendation as an option. This was followed by the presentations of the NRAs of Belgium and France. The Belgian NRA presented its view on this measure based on theoretical considerations and based on country-specific circumstances. In its view and for the Belgian situation, the possible negative side-effects outweigh any potential positive effects and, therefore, it sees no reason to implement this measure in Belgium. The French NRA on the other hand already issued a public consultation on a new market 1 analysis decision which proposes to lift the wholesale pricing obligation on copper in a later phase of the migration and switch-off process, namely six months after the commercial closure and where the final switch-off date is scheduled within a period of two years. This is a result of the geographic modulation of the pricing remedy, intended to take account of the expected evolution in the competition over the period (2024-2028) of the new market 1 analysis decision.

In its future work, BEREC will continue to monitor the progress of managing the copper network switch-off, by examining the progress made by the NRAs and the lessons learned in order to best prepare for the copper switch-off phase, when a significant or large part of the copper access network will be switched off.

The Summary report on the outcome of the BEREC internal workshop on the migration to very high capacity networks and copper switch-off with a focus on the needs of the end users was adopted at Plenary 4 2023 and published on 12 December 2023.

Document:

BoR (23) 205: Summary report on the outcome of the BEREC internal workshop on the migration to very high capacity networks and copper switch-off with a focus on the needs of the end users

2.1.4. Update of criterion 4 of the BEREC Guidelines on very high capacity networks (carry-over)

BEREC updated its Guidelines on very high capacity networks with regard to the performance thresholds of mobile networks (criterion 4).

According to Article 82 EECC, the BEREC Guidelines on very high capacity networks provide guidance to NRAs 'on the criteria that a network is to fulfil in order to be considered a very high capacity network, in particular in terms of down- and uplink bandwidth, resilience, error-related parameters, and latency and its variation'. The Guidelines contribute to the harmonisation of the definition of the term 'very high capacity network' in the EU, and NRAs shall take into utmost account. BEREC published the first version of these Guidelines in 2020 and stated therein that any network which fulfils one (or more) of four criteria is a very high capacity network (BoR (20) 165, paragraph 18). However, at that time, it was not yet possible to take 5G fully into account, as it had not yet reached mature deployment and significant penetration. Therefore, in this new version of the Guidelines, BEREC has updated criterion 4 (on performance thresholds for wireless network) based on data collected from 5G mobile network operators, whereas the other three criteria remain unchanged. Criterion 4 is updated as follows:

Criterion 4: Any network providing a wireless connection which is capable of delivering, under usual peak-time conditions, services to end users with the following quality of service (**performance thresholds 2**). The performance thresholds 2 refers to outdoor locations only and to the average values within the relevant coverage area.

Quality of service parameter	Wireless (criterion 4)
Downlink data rate	≥ 350 Mbps
Uplink data rate	≥ 50 Mbps
IP packet error ratio (Y.1540)	≤ 0.01%
IP packet loss ratio (Y.1540)	≤ 0.01%
Round-trip IP packet delay (RFC 2681)	≤ 18 ms
IP packet delay variation (RFC 3393)	≤ 5 ms
IP service availability (Y.1540)	≥ 99.9% per year

The draft update of criterion 4 of the Guidelines on very high capacity networks was approved for public consultation at Plenary 1 2023. The period of the public consultation was from 15 March to 28 April 2023, and BEREC received six responses from stakeholders. The final update of criterion 4 of the Guidelines on very high capacity networks and a report on the outcome of the public consultation were adopted at Plenary 3 2023 and published on 10 October 2023.

According to Article 82 EECC, BEREC shall update the Guidelines by 31 December 2025, and regularly thereafter. In its future work, BEREC will update criterion 3 (performance thresholds for fixed networks) based on data from fixed network operators.

Document:

BoR (23) 163: BEREC Report on the outcome of the public consultation regarding the draft BEREC Guidelines on Very High Capacity Networks

BoR (23) 164: BEREC Guidelines on Very High Capacity Networks

2.1.5. BEREC external workshop on secure and reliable connectivity in Europe from low earth orbit satellite fleets

On 13 April 2023, BEREC hosted an external workshop on secure and reliable connectivity from low earth orbit ('LEO') satellite fleets. The purpose of the workshop was to develop an understanding of direct-to-device connectivity and relevant regulatory issues that might arise, and to identify market access challenges and opportunities that may arise concerning the development of satellite direct-to-device connectivity.

The final agenda included eight expert presentations from an equipment vendor, a mobile network operator ('MNO'), and several satellite operators ('SNOs', including some from the LEO subset of satellite industry). The workshop was well attended by 179 participants. The audience mainly included experts and senior policy/decision-makers in the NRAs and other competent authorities, and representatives of vendors, terrestrial and satellite communication companies, advisory/consultancy firms, regulatory intelligence providers, associations, organisations, etc.

It is clear that the 3GPP standardisation of non-terrestrial networks ('NTNs') has played a major role in providing a good basis for increasing options to close the connectivity divide from space, and satcom is a complement to terrestrial and can close coverage gaps in hard-to-reach areas. The initial satellite-to-device services include emergency services, text services, and IoT services. When additional LEO satellites are launched more capacity will be available and services will be extended with voice and data connectivity at locations with no coverage of fixed or mobile terrestrial networks.

All participants from the satellite industry referred in their presentations to future innovations and new launches / satellite upgrades, and thus anticipate the arrival of many more new and more powerful direct-to-device services / use cases which will likely be supported by increasing satellite capacities.

Two main approaches to providing direct-to-device connectivity between satellites and end user devices clearly emerged from the presentations, namely:

- Using dedicated radio spectrum resources allocated to the mobile satellite service ('MSS') in accordance with the ITU's Radio Regulations[21], or
- Sharing radio spectrum resources whose primary allocation under the Radio Regulations is for mobile services (and therefore has been assigned by the regulators to terrestrial mobile communications). This approach has yet to be fully defined, although as a proof of concept it has been demonstrated. One element of the approach depends on an SNO-MNO agreement about how the rights to use the respective terrestrial radio spectrum bands identified for International Mobile Telecommunications ('IMT') can be used, most likely on a non-interference non-protected basis. To date, no applications have been received by regulators in Europe, as some authorisations set out rights of use for terrestrial systems only.

Document:

BoR (23) 112: Summary report: BEREC workshop on secure and reliable connectivity from LEO satellite fleets, 13 April 2023

2.1.6. BEREC Report on the authorization and related frameworks for international connectivity infrastructures

The Ministerial European Data Gateways Declaration, adopted by most European Union Member States in March 2021, highlights that Europe's digital sovereignty and global competitiveness depend on strong and secure internal and external connectivity and that leveraging both dimensions are a precondition for the European Union to become «the most attractive, most secure and most dynamic data-agile economy in the world». In this report, BEREC aims to identify the general authorisation and related frameworks for international submarine connectivity, the possible solutions for promoting investment in this sector and strengthening the European Union's geostrategic position. For this purpose, this report: a) briefly describes the activities involved in the deployment and operation of submarine cable systems (Part 2); b) outlines the applicability of the electronic communications regulatory framework to international submarine cable systems and the powers and experience of national regulatory authorities in this field (Part 3); c) identifies other national administrative authorisation procedures applicable to international submarine cable systems (Part 4); d) gathers information on initiatives taken at European and national level to promote international submarine connectivity (Part 5).

BEREC also organised: a) on 21 September 2023, a virtual workshop on international submarine connectivity in the European Union, where private stakeholders shared their views on the current state of play of the international submarine connectivity business in the

[21] See also 3GPP standardisation of NTN is focusing on MSS/FSS spectrum allocations and the Radio Regulations (itu.int)

European Union, with a focus on the dynamics following the entry of new actors, the challenges faced in the installation and operation of submarine cables and the expectations regarding the evolution of the European and national regulatory framework, institutional organisation and public policies in this area; b) on 4 October 2023, in Funchal (Madeira), Portugal, an internal workshop on international connectivity during the biennial four-lateral summit between BEREC, the Eastern Partnership Electronic Communications Regulators Network (EaPeReg), the European Mediterranean Regulators Group (EMERG) and the Latin American Forum of Telecommunications Regulators (REGULATEL).

The draft report was adopted by the BoR on 6 December 2023, and it was published for public consultation. The final adoption of the report is expected in 2024.

Document:

BoR (23) 214: Draft BEREC Report on the general authorization and related frameworks for international submarine connectivity

2.1.7. Support for reinforcing the EU's Cybersecurity Capabilities

In the Nevers Call to Reinforce the EU's Cybersecurity Capabilities, the ministers in charge of telecommunications urged the EU and its Member States to ensure the cybersecurity and resilience of Europe's communication infrastructures and networks. In addition, they invited the relevant authorities, such as BEREC, the EU Agency for Cybersecurity (ENISA) and the Network & Information Security (NIS) Cooperation Group, along with the European Commission, to formulate recommendations, based on a risk assessment, to the Member States and the European Commission to reinforce the resilience of the communication networks and infrastructures within the EU, including the implementation of the 5G Toolbox.

The European Commission and ENISA set up a multi-stakeholder process to follow-up on the Nevers Call. The process was similar to the development of the 5G Toolbox. The NIS Cooperation Group work-stream for 5G took the leading role. BEREC has been closely involved in reviewing drafts/deliverables, and providing input on the related requests.

BEREC in 2023 conducted a comprehensive survey across European markets with the aim of gaining insights into the current state of resilience and cybersecurity in electronic communications networks. This survey, in the form of questionnaires, targeted both National Regulatory Authorities (NRAs) and operators, both fixed and mobile. From the NRAs' perspective, it explored issues such as dependencies on other infrastructures, specifically focusing on the legal and regulatory aspects of emergency power supply equipment in networks across European countries. The backup times for emergency power supplies were also examined. The survey collected data on national strategies for Internet Exchange Points (IXPs) aimed at enhancing internet infrastructure resilience. The survey explored the operators' views on emergency power supply equipment and network resilience. It investigated customer dependency on a single connection or provider as well as national

roaming agreements in case of emergency situations. Subsea cables and satellite communication networks were also part of the survey. Lastly, the survey gathered data about the expectations of operators, and National Regulatory Authorities (NRAs) regarding the implementation of the NIS-2 Directive and integration into the cybersecurity processes.

This Report presents valuable insights on the state of cybersecurity and resilience in European electronic communications networks, and identifies some areas for further additional investigation and potential improvement.

Based on answers to the Surveys, the Report presents the main findings on the dependencies of electronic communications on other infrastructures and technological challenges of new technology implementations. The Report presents some open issues and areas of possible future work on topics such as power supply in emergency situations, energy consumption reduction, the role of IXPs in strengthening national resilience, CPE cybersecurity-related issues, and the transposition of the NIS-2 Directive.

Document:

BoR (23) 213: BEREC Report on the Current Cybersecurity Challenges and Dependencies in Electronic Communications Networks

2.1.8. Report on BEREC's activities to support initiatives for secure 5G networks

In their Joint Communication to the European Parliament and the Council on the EU's Cybersecurity Strategy for the Digital Decade, the European Commission and the High Representative of the Union for Foreign Affairs and Security Policy have proposed a set of key objectives for the next steps in the cybersecurity of 5G networks. The exchange of information and best practices on the implementation of the 5G Toolbox strategic measures related to suppliers is one of the areas included in the first key objective to ensure convergent national approaches for effective risk mitigation across the EU.

Continuous knowledge building and cooperation amongst stakeholders are the focus of the second key objective. The third key objective is to promote supply chain resilience.

In 2023, BEREC continued providing support to the European Commission, NIS Cooperation Group and ENISA to help achieving the three key objectives in the cybersecurity of 5G networks.

The further work on the 5G Toolbox implementation has been coordinated with other institutions involved in the process of achieving secure 5G networks.

BEREC has provided its support to the European Commission and NIS Cooperation Group for the implementation of the recommendations of the ECA.

In 2023, BEREC adopted the BEREC Report on Secure 5G Networks. The Report was based on the survey conducted by BEREC. The objective was to understand the present status of the resilience and security in electronic communications networks. The survey, prepared by BEREC in collaboration with ENISA, the Commission, and the NIS CG, comprised two questionnaires—one for National Regulatory Authorities (NRAs) and one for operators.

In the Report the results are presented of the analysis of the replies received from the participating NRAs and operators, mainly within the EU, but also from a small number of non-EU countries working on the security of 5G networks. A list of the countries that replied and the questionnaires are included in the Annexes of the Report. The main findings of the Report are that 5G rollout is in its early phase, especially 5G SA and slicing; the majority of operators expect 5G non-SA Core to be in service for at least five more years; the majority of operators think that the current standards (e.g. 3GPP/ETSI, ISO, GSMA) and guidance (e.g. ENISA) available for dual-core security are comprehensive and adequate; in the cloud based 5G SA core, the Access and Mobility Function (AMF) is considered as the network function with the highest level of risk, and the multivendor strategy is progressing; almost half of the operators have not encountered significant interoperability issues; the highest security risk factor identified is the Isolation of Virtual Network Functions (VNF); the majority of operators did not need to change their equipment vendor following a (national) decision on the 5G Toolbox, however a significant minority had done this or are expecting to do so in the future; there is no cost substitution framework in place in Member states; almost half of the operators will adopt a replacement strategy by keeping the current vendor. The Report also listed a number of issues for further investigation.

Document:
BoR (23) 180: BEREC Report Secure 5G Networks

2.1.9. BEREC Report on competition amongst multiple operators of NGA-networks in the same geographical region (carry-over)

The BEREC Report on competition amongst multiple operators of NGA-networks in the same geographical region builds on BEREC's previous work on the subject, namely a Common Position on geographical aspects of market analysis (for both market definition and remedies) in 2014 and a report on the application of this Common Position in 2018. Regional operators of VHCN / NGA networks play an increasingly important role on the broadband market in many countries and they may use different business strategies, e.g. to differentiate (or not) prices across their networks. The 2023 Report focuses on the competition amongst multiple operators of NGA networks in the same geographical area and the outcome of this competition, namely retail prices and product diversification. The Report is based on data collected from 31 NRAs that participated in BEREC's work in April 2022 and the objectives are: (i) to examine the extent to which multiple NGA networks are present in the same geographical area, the resulting impact on retail prices and retail product characteristics, and

(ii) to analyse the impact this had on the market for wholesale local access provided at a fixed location,[22] considering both cases where market definition and/or remedies have been geographically differentiated and where this is not the case.

Presence of multiple NGA networks in the same geographical area

The number of NGA networks present in the same geographical area differs significantly and the area covered by two NGA networks is in many countries 11-50% homes passed (HP), the area covered by three NGA networks is in most countries 0-25% HP and the area covered by more than three NGA networks is in most countries 0-10% HP. Differences in retail prices and/or retail product characteristics between geographical areas have been investigated by 18 countries and only three of them found differences in retail prices and one in retail product characteristics. The main reasons for these differences in retail prices and/or retail product characteristics do not show any clear trend and vary between the three countries (e.g. competition between networks, the underlying technology, variation of wholesale prices). The reasons why seven countries have not investigated the differences in retail prices and/or product characteristics between geographical areas are as follows. In four countries, these differences were not considered to be relevant (e.g. retail prices differ only in the case of one operator for a limited time, regional operators) and four countries had another added reason (i.e. small country, difficulties to collect data).

Analysis of the market for wholesale local access provided at a fixed location (Market 1/2020 resp. Market 3a/2014)

In four countries/participants, this market analysis resulted in a deregulation of the market and one country never regulated this market. The outcome of the geographic analysis of the other countries is as follows: in six countries NRAs defined sub-national geographical markets, in one of them a geographic differentiation of remedies in a sub-national geographic market was implemented. In four other countries, a geographic differentiation of remedies in a national market was applied and 16 countries did not adopt any geographic differentiation.

The main reasons for the geographic differentiation of market definition and/or remedies in the countries where there are geographic differences in the coverage of alternative networks (e.g. cable or fibre), geographic differences in retail market shares of the incumbent, geographic differences in wholesale market shares of the incumbent, population density (economies of scale), and geographic differences resulting from commercial wholesale offers of alternative operators.

The main reasons why the 16 countries did not decide to geographically differentiate the market definition and/or remedies are because the presence of multiple NGA networks did not sufficiently alter the competition stakes, or because the geographic area(s) where multiple NGA networks are available is still small and negligible.

[22] Market 1/2020 resp. market 3a/2014

The draft BEREC Report on competition amongst multiple operators of NGA networks in the same geographic region was approved for public consultation at Plenary 4 2022. The public consultation ran from 13 December to 27 January 2023, and BEREC received seven replies from stakeholders. The final BEREC Report on competition amongst multiple operators of NGA networks in the same geographic region and a report on the outcome of the public consultation were adopted at Plenary 2 2023 and published on 13 June 2023.

Document:

BoR (23) 86: BEREC Report on the outcome of the public consultation on the draft BEREC Report on competition amongst multiple operators of NGA networks in the same geographical region

BoR (23) 87: BEREC Report on competition amongst multiple operators of NGA networks in the same geographical region

2.1.10. BEREC study on the evolution of the competition dynamics of tower and access infrastructure companies not directly providing retail services

Details of this study are in section 1.2.2 in Part A.

Document:

BoR (23) 177: Workshop Report - Study on the evolution of the competition dynamics of tower and access infrastructure companies not directly providing retail services

BoR (23) 206: External study on the evolution of the competition dynamics of tower and access infrastructure companies not directly providing retail services

2.2. Strategic priority 2: Thriving sustainable and open digital markets

2.2.1. BEREC Report on interoperability for Number-Independent Interpersonal Communication Services (NI-ICS) (carry-over)

Number-Independent Interpersonal Communication Services (NI-ICS) typically include messaging, video-conferencing and e-mail services. Their use has drastically increased over the past years and NI-ICS have now become a crucial means of communication for a variety of different users throughout Europe.

Most NI-ICS exhibit very strong proprietary network effects and the market for messaging services appears to be significantly concentrated around very few players. In order to extend and share these network effects among several providers, and thus facilitate market contestability, interoperability obligations for specific NI-ICS providers are included under Article 7 of the Digital Markets Act (DMA) and, with a focus on ensuring end-to-end connectivity, under Article 61(2) of the European Electronic Communications Code (EECC).

In this Report, BEREC explores and analyses: i) the objectives, the scope and the 'triggers' of interoperability obligations under the DMA and the EECC, ii) the potential technical approaches and the implementation challenges to be taken into account when applying these measures, as well as iii) the interplay between the two regulatory frameworks (DMA & EECC).

The Draft Report was published for public consultation between 13 December 2022 and 3 February 2023, and BEREC received positive feedback and useful insights for improving the Report.

The European Commission can consult BEREC to check whether the technical details and general terms and conditions published in the gatekeeper's reference offer to ensure interoperability, comply with Article 7 (Recital 64 of the DMA). In this context, BEREC provides advice and recommendations to the European Commission on the effective implementation and enforcement of this measure.

Document:

BoR (23) 92: BEREC Report on the interoperability of Number-Independent Interpersonal Communication Services (NI-ICS)

2.2.2. BEREC's role in supporting sustainable and open digital markets

In order to ensure coherence and effective complementarity in the implementation of the Digital Markets Act (DMA) and of other sectoral regulations applying to the gatekeepers, a dedicated High-Level Group (HLG) was created under the DMA. In this HLG, BEREC and other European bodies and networks assist the European Commission by providing advice, expertise and recommendations on the implementation or enforcement of the DMA.

BEREC participated in and contributed in the two meetings of the DMA HLG that took place in 2023.

BEREC also continued to monitor and analyse the developments of digital markets and the impact and effects of practices implemented by large online digital platforms.

2.2.3. BEREC Report on Indicators to measure the environmental impact of electronic communications networks and services (carry-over)

The previous work done by BEREC highlighted that there is a need to identify the relevant indicators to better identify the above-mentioned environmental impact. A common measurement methodology across Member States and potential ways of gathering information, both from a legal and practical perspective, will be discussed. BEREC has to align itself with the Commission's expectations in this area, in particular in relation to the circular economy and energy efficiency solutions in the lifecycle of broadband networks and electronic communications services.

Exploring the range of indicators would inform public authorities and raise end users' awareness of the environmental impact of the ECNs/ECSs. In addition, it would empower citizens and Member States alike with the data needed to assess and responsibly choose electronic communications networks and services.

Accordingly, this work stream on indicators focused on:

1. Identifying the main categories of environmental impact of electronic communications identified by stakeholders (industry players, academics, associations, and public decision-makers).

2. Providing an overview of existing initiatives by NRAs and other competent authorities on relevant sustainability indicators to categorise ICT environmental impacts.

It was necessary to map the existing indicators chosen and supported to monitor their impact on the industry, and identify the main standards used, and the views of operators on the most useful indicators for their own needs in the context of their business activities. To deepen its expertise, in 2022, BEREC engaged with other relevant players on the sustainability of ECNs and indicators for measuring it. BEREC launched a call for input from relevant stakeholders (operators, service providers, end-user associations, environmental organisations, etc.) to identify which indicators they deem feasible and useful for the purposes of evaluating the environmental impact of ECNs/ECSs and for setting an assessment methodology. Technical workshops were organised to complement a questionnaire on existing indicators that was sent to relevant partner organisations and other stakeholders in the sector. In 2023, the results of stakeholders' input and the group's analysis of the issues were presented in a report to be used for BEREC's future work and its opinions. After public consultation, the Report was adopted by the BoR.

Document:

BoR (23) 166: BEREC Report on Sustainability Indicators for Electronic Communications Networks and Services

2.2.4. BEREC Report on the entry of large content and application providers into the markets for electronic communications networks and services

In the last few decades, large content and application providers (CAPs) have become prominent actors in the internet ecosystem and have been investing increasingly in their own infrastructures and providing services closely related to electronic communications networks (ECN) and electronic communications services (ECS), or directly qualifying as such.

Building on the conclusions of the BEREC Report on the Internet Ecosystem (BoR (22) 167), this Report gives an overview of the impact of large CAPs on the markets for ECN and ECS in Europe, by presenting their strategies, business models, and relations with traditional ECN/ECS providers in terms of competition, cooperation and interdependence.

In order to better analyse the implications of the CAPs' presence and strategies in ECS/ECN markets, three case studies focusing on CDNs, submarine cables and internet relay services[23] were carried out. Moreover, the report highlights some potential restrictions that may be imposed by operating systems providers on ECN/ECS operators.

For this report, BEREC circulated a detailed questionnaire to the nine major CAPs, on the basis of Article 20(1) of the EECC.

In order to gather relevant feedback and insight, BEREC organised a workshop on 21 September 2023 on international submarine connectivity in the European Union[24]. At the workshop, private stakeholders (both traditional ECN/ECS providers and large CAPs) and the European Commission shared their views on the current state of play of the international submarine connectivity business in the European Union. The workshop focused on the dynamics following the entry of new actors, the challenges faced, and the expectations on the evolution of the European and national regulatory framework, institutional organisation and public policies in this area. In addition, BEREC organised internal workshops to gather specific insight from selected stakeholders on a range of topics addressed in this Report.

This Report is a carry-over deliverable to 2024. The public consultation foreseen after Plenary 1, 2024. The final Report is to be approved at Plenary 3, 2024.

2.2.5. BEREC Report on M2M and permanent roaming

Regulation (EU) 2022/612 (the 'Roaming Regulation') makes particular reference to M2M services (in recitals 14 and 21) and introduces new monitoring requirements. For the report on this topic, BEREC plans to analyse M2M services that enable roaming for 'periodic

[23] Services providing enhanced privacy features like tracking prevention (e.g. regarding IP-Addresses and DNS) or prevention of precise location determination. Such services include e.g. Apple iCloud Private Relay, Google One VPN or Microsoft Edge Secure Network.

[24] BEREC Workshop on international submarine connectivity in the EU, see: https://www.berec.europa.eu/en/events/berec-events-2023/berec-workshop-on-international-submarine-connectivity-in-the-eu

travelling' but also that rely on permanent roaming. BEREC will investigate potential obstacles for operators to negotiate (permanent) roaming agreements, whether they enable permanent roaming in their network for the provision of such services, and what pricing schemes are applied. A call for input was launched end of 2023 and beginning of 2024. The input received and information from the BEREC Roaming Data Report will be used to carry out the analysis which will be ready for public consultation in June 2024.

2.2.6. Report on the impact of Artificial Intelligence (AI) solutions in the telecommunications sector on regulation

In the BEREC Report on the impact of Artificial Intelligence (AI) solutions in the telecommunications sector on regulation, BEREC identifies the developments in the application of AI solutions in relation to the provision of ECN/ECS in selected use cases and the potential impact on regulation of those use cases. Additionally, the Report contributes to raising further awareness on the different use cases and the potential benefits and risks of the application of AI in the sector.

Although most artificial intelligence (AI) systems in the telecommunications sector are still in the development phase, AI is expected to play an important role in the sector in the mid-term. AI may bring significant benefits for the sector. AI technologies promise considerable savings in terms of costs and can help automate complex and/or repetitive processes to optimize network operations, improve customer service, detect new business opportunities, and support the expansion and densification of network infrastructure and devices in communication networks. Furthermore, the appropriate use of AI can promote energy efficiency in networks, which contributes to positive environmental impact in addition to cost-savings associated with lower energy consumption. At the same time, AI entails a number of risks related to the availability of unbiased and reliable data, liability in case of error due to the complexity of AI ecosystems, ensuring transparent decision-making, privacy, and cybersecurity implications.

Many of these changes to networks driven or enabled by AI systems are linked to network virtualization. Other developments could potentially impact on what networks do, how networks function, or manage network resources while assuring the Quality of Experience required by users.

In the Report, BEREC refers to six AI use case areas in telecommunications: Network and Capacity Planning and Upgrades; Channel Modelling, Prediction and Propagation; Dynamic Spectrum Sharing; Quality of Service Optimization and Traffic Classification; Security Optimization and Threat Detection and Fraud Detection and Prevention.

Finally, the Report describes the possible uses of AI solutions by NRAs. AI systems could be used by public administrations such as NRAs, to improve processes related to policy-making, to public service delivery and the internal management of public authorities. Whilst some NRAs have studied the use of AI in the telecommunications industry, so far, few have explored how AI could be put to good use in the internal processes of the NRAs.

Document:

BoR (23) 93: BEREC Report on the impact of Artificial Intelligence (AI) solutions in the telecommunications sector on regulation

BoR (23) 94: BEREC Report on the outcome of the public consultation on the draft BEREC Report on the challenges and benefits of the impact of Artificial Intelligence (AI) solutions in the telecommunications sector (including use cases)

2.2.7. BEREC Report on the Internet Protocol (IP) Interconnection ecosystem (carry-over)

The debate around the IP interconnection was revitalised in 2021/2022 and has gained momentum. In 2017, BEREC updated its study on the IP interconnection market (BoR (17) 1841). After over five years, BEREC recognised the necessity to assess the current state of the market and re-evaluate its earlier findings.

In this context, BEREC is in the process of preparing a 'Report on the IP Interconnection Ecosystem' (see BEREC Work Programme 2023, section 2.8). the Report contains a reassessment of the conclusions drawn in 2017 and an evaluation of the current status, and the market developments since the previous report. This includes examining relationships between different parties, the use of paid peering, and content delivery networks (CDNs).

The focus of the Report is the period from early 2017 to autumn 2023, and there will be a prospective analysis of trends until 2030 to the extent of the existing objective data. Additionally, it will include an update of legal references, such as references to the EECC.

To inform its analysis, BEREC organised twelve internal workshops in September and October 2023 for various stakeholders. The primary purpose was to gain better insight into the selected topics and understand the different stakeholder positions.

In the same context, BEREC prepared a quantitative questionnaire (with a few qualitative questions on the IP interconnection). The questionnaire was distributed by the NRAs on behalf of BEREC to market players in their respective countries and to the RIPE Network Coordination Centre. Over a pre-defined period of one month, more than 170 replies were received, containing data sets of traffic measurements.

In 2024, BEREC will continue its work on this Report which will then be the subject of a public consultation.

2.2.8. Input to the European Commission regarding potential CAPs' contribution to network investments (carry-over)

On 23 February 2023, the EC published an exploratory consultation to gather views on the potential developments of the electronic communications sector and its infrastructure, as part of a connectivity package comprised of the Gigabit Recommendation and the Gigabit

Infrastructure Act. The specific aim of the consultation was to gather views on the changing technological and market landscape and how these changes might impact the electronic communications sector. It focused also on the types of infrastructure and scale of investment needed by Europe to lead the digital transformation in the coming years.

BEREC contributed to the consultation on the 19 May and its input was based on the coordinated work of almost all its Working Groups (WGs), as the questionnaire in the consultation raised different issues that required the involvement of a wide range of experts. The reply was prepared on the basis of the collective experience and expertise of all NRAs and on previously published BEREC reports.

In its reply, BEREC noted that ECN/S developments are not only taking place in the last mile segment. Network architectures are also evolving, and the internet of tomorrow will likely require additional infrastructure investments to support upcoming developments (e.g. investments in cloud and edge nodes) and the increasing importance of cybersecurity. Moreover, significant additional investments will be required to meet the EU's Digital Decade policy programme (DDPP) targets and objectives by 2030. Those investments may be impacted by several diverse factors, including economic, financial, technical and competition-related ones. Despite the increasing potential for traditional ECN/S providers to expand their portfolio to include digital and IT services, BEREC is of the view that residential and business ECN/S will continue to be the main source of revenue for ECN/S providers in the coming years. BEREC regards competition as the key driver of investment, and ex-ante regulation is essential in this respect.

In its reply, BEREC indicated that Universal Service (US) is a safety net for ensuring access to an adequate broadband service at an affordable price. To eliminate the digital divide, especially in rural areas, multiple Union options, such as Recovery and Resilience Facility (RRF) funds, Cohesion Funds, as well as national regulatory tools may be used. Therefore, BEREC contends that public intervention should be clearly regarded as a subsidiary instrument. Contribution to such a fund should depend on defined goals and how this would function would have to be assessed in detail.

BEREC expressed the opinion that there are no technical or regulatory obstacles to providing EU services as the regulatory and/or commercial options currently available are fit-for-purpose and would also allow pan-EU offers to be made. The reasons why ECN/S providers choose not to provide pan-EU offers are largely commercial rather than because of any technical or regulatory barriers. In addition, BEREC does not see any clear obstacles to cross-border consolidation for VHCN as the main driver of the scale of activity is not grounded in technical, legal and/or administrative 'impediments'. Moreover, radio spectrum is a scarce natural resource with many competing uses and must therefore be managed effectively and used efficiently to maximise benefits to society. BEREC believes that integration can be supported through existing tools.

In Section 4 of its reply, on 'Fair contribution by all digital players', BEREC noted that the entire internet ecosystem should be included when considering policy options. BEREC takes the

stance that any regulatory intervention requires proper justification and it is currently not aware of structural interconnection problems from growing volumes of traffic attributed to CAPs, but further analysis will be conducted in its upcoming report on the IP-interconnection market. BEREC has expressed reservations about mandatory financial contributions from CAPs to Internet Service Protocols (ISPs) in the form of a 'sending party network pays' (SPNP) regime. Other forms of contribution mechanisms (e.g. a funding mechanism) may raise concerns, but any such proposal would have to be examined in detail.

Document:

BoR (23) 131: BEREC input to the EC's exploratory consultation on the future of the electronics communications sector and its infrastructure

2.2.9. Implementation of the Open Internet Regulation (OIR) and the BEREC Open Internet (OI) Guidelines

BEREC published its Annual Report on the implementation of the OIR in October 2023, for the period 1 May 2022 to 30 April 2023. This Report provides an overview of the activities of the NRAs in the course of implementing the OIR, and related BEREC OI Guidelines. In this iteration of the Report, BEREC closely examines the implementation of the OIR in light of the rulings of the European Court of Justice in September 2021 and the updated BEREC OI Guidelines in June 2022 (BoR (22) 81[25]). The Report shows that NRAs have actively implemented the OIR, the monitoring of activities continues, and interaction with the ISPs evolves every year. To prepare this report, BEREC gathered information from 28 NRAs via an internal questionnaire.

Throughout 2023, BEREC also provided a forum for NRAs to share information so as to facilitate the consistent application of the OIR.

Document:

BoR (23) 162: BEREC Report on the implementation of the Open Internet Regulation

[25] BoR (22) 81, BEREC Guidelines on the Implementation of the Open Internet Regulation, 09.06.2022, see: https://www.berec.europa.eu/en/document-categories/berec/regulatory-best-practices/guidelines/berec-guidelines-on-the-implementation-of-the-open-internet-regulation-0, and BoR (22) 81, BEREC Guidelines on the Implementation of the Open Internet Regulation - Comparison document 2022 vs 2020, 14.06.2022, see: https://www.berec.europa.eu/en/document-categories/berec/regulatory-best-practices/guidelines/berec-guidelines-on-the-implementation-of-the-open-internet-regulation-comparison-document-2022-vs-2020

2.2.10. Collaboration on internet access service measurement tools

In 2023, BEREC members continued to exchange experiences on IAS quality measurement tools in order to develop these further. The relevant working group provided a forum for the exchange of best practices.

2.2.11. BEREC workshop on the switching and interoperability of data processing services

On 28 April 2023, BEREC organised a workshop on the switching and interoperability of data processing services in the context of the proposal for a Regulation on harmonised rules on fair access to and use of data (the Data Act) proposed by the European Commission on the 23 February 2022. The workshop facilitated the sharing of the different views and perspectives of legislators, academia, users and the industry in order to i) gain a deeper understanding of the barriers to switching and interoperability faced by data processing service users, ii) identify solutions to reduce those barriers or possible lock-in effects taking into consideration their impact on security, data protection or innovation, iii) exchange on how the experience of switching of telecommunication services can be helpful for the elaboration and implementation of the Data Act, and iv) foster constructive dialogue with stakeholders and legislators for the finalisation and implementation of the Data Act provisions.

The takeaways from the workshop may be summarised as follows:

Cloud services landscape - most participants generally shared concerns about the high concentration and limited competition in the cloud services markets and welcomed the Data Act to facilitate users' choices and to eliminate the barriers and practices that may lead to their lock-in.

Interrelation between cloud and Electronic Communications Networks and Electronic Communications Services (ECN/ECS) - most participants underlined the interlink between cloud and Electronic Communication Networks and Electronic Communications Services (ECN/ECS). The representative of the EC drew attention to the close link between edge computing and electronic communications networks and electronic communications services (ECN/ECS).

Technical considerations: functional equivalence and interoperability - the EC explained that the Data Act will require functional equivalence for providers of an Infrastructure as a Service (IaaS), for the same service type and for the services/infrastructure under the control of the original IaaS provider. Providers of Platform and Software as a Service (PaaS, SaaS) would be required to make open interfaces available and to ensure the compatibility of these interfaces with standards or open interoperability specifications.

Financial (charges and costs) considerations - the Data Act proposal foresees the full removal of switching charges three years after the Regulation's entry into force. During the three-year transition period, providers would be allowed to charge reduced switching charges reflecting the costs incurred. However, stakeholders are divided on this approach.

Contractual considerations - the Data Act includes a maximum notice and a maximum transition period during which the switching process must be concluded, with exceptions for cases of proven technical unfeasibility.

Regulatory consistency – the EC highlighted that cloud computing is affected by various regulatory regimes, such as cybersecurity and data protection. This entails significant challenges for coherent enforcement of the regulations. For this reason, the Data Act proposal introduces a cooperation mechanism for effective enforcement, not only across borders but also across different regulatory fields.

Governance - the Data Act proposal calls on the Member States to designate competent authorities to enforce the Data Act. In this regard, the EC indicated that ECN/S regulators bring valuable experience to this context, especially in switching, and the closer connection of the cloud and ECN/S. The Data Act proposal lays the basis for a comprehensive enforcement regime with opportunities for BEREC members to play an important role.

Document:

BoR (23) 117: Workshop on the switching and interoperability of data processing services[26]

2.2.12. External study on the trends and policy / regulatory challenges of cloudification, virtualization and softwarization in telecommunications

Details about this study are available in section 1.2.1 of Part A above.

Document:

BoR (23) 208: External study on the trends and cloudification, virtualization, and softwarization in telecommunications

2.3. Strategic priority 3: Empowering end users

2.3.1. BEREC contribution to empowering end users through environmental transparency on digital products and services

BEREC considers end-users' awareness of environmental issues as critical for end-user empowerment and for ICT sustainability. Environmental information on digital products (including services) enlighten user choices in terms of their digital consumption. This data-

[26] See for more information on the workshop, including the workshop context paper and presentations: https://www.berec.europa.eu/en/events/berec-events-2023/berec-workshop-on-switching-and-interoperability-of-data-processing-services

driven approach to end-user empowerment could create positive incentives for digital players to support the deployment of greener digital solutions and limit the risk of greenwashing.

In 2023, BEREC led a fact-finding process to raise NRA knowledge of existing work and analysis of environmental transparency on ICT sustainability products and end-user empowerment. This work took the form of a review of the literature and existing EU regulation, a workshop on end-user' empowerment and ICT sustainability. It was attended by representatives of the Commission, consulting firms, BEUC and the European Environmental Bureau (EEB). In addition, there was an internal questionnaire for member NRA on their and other relevant stakeholder initiatives.

The main results of this work are presented in the draft BEREC Report on empowering end users through environmental transparency on digital products that was adopted by BoR in December and published for public consultation. The final report should be published in June 2024 when there will be a communication campaign on the environmental impact of end user digital devices.

Document:

BoR (23) 207: Draft BEREC Report on empowering end users through environmental transparency on digital products. To be approved in 2024.

2.3.2. BEREC Report on Member States' best practices to support the defining of adequate broadband Internet access service (carry-over)

In 2020, BEREC published the first report on Member States' best practices to support the defining of adequate broadband Internet Access Service (IAS) (document reference BoR (20) 99).

The Report set out:

- the policy principle - Article 84 of the EECC;
- relevant experience that BEREC could draw on and the experience of 9 Member States already using broadband USO;
- common principles for bandwidth, evaluation, eligibility designation mechanism, quality of service (QoS), compliance monitoring and affordability measures, universal service providers (USPs), and the kind of funding used by the MS with a broadband USO in place; and
- recommendations for future reports.

Article 84(1) EECC provides that Member States shall ensure that all consumers in their territories have access at an affordable price, in light of specific national conditions, to an

adequate broadband internet access service and to voice communications services, which are available, at the quality specified in their territories, including the underlying connection, at a fixed location.

Article 84(3) further provides that each Member State shall, in light of national conditions and the minimum bandwidth enjoyed by the majority of consumers within the territory of that Member State and taking into account the BEREC report on best practices, define the broadband internet access service for the purposes of paragraph 1 with a view to ensuring the bandwidth necessary for social and economic participation in society. The adequate broadband internet access service shall be capable of delivering the bandwidth necessary for supporting at least the minimum set of services set out in Annex V.

Article 84(3) of the EECC provides that: 'By 21 June 2020, BEREC shall, in order to contribute towards a consistent application of this Article, after consulting stakeholders and in close cooperation with the Commission, taking into account available Commission (Eurostat) data, draw up a report on Member States' best practices to support the defining of adequate broadband internet access service pursuant to the first subparagraph. That report shall be updated regularly to reflect technological advances and changes in consumer usage patterns'.

The review for the best practice report entailed gathering and analysing relevant information including:

- the continued suitability of the evaluation criteria consulted on in BoR (19) 260;
- relevant experiences to support MS in defining adequate broadband; and
- the minimum set of services that adequate broadband is capable of supporting.

The work commenced in Q4 2022 to ensure there is sufficient time to gather up to date information. BEREC has adopted a Draft report on Member State best practices to support the definition of adequate broadband Internet Access Service (IAS) for public consultation. After this public consultation, BEREC will adopt the Final Report at P1 2024.

Document:

BoR (23) 178: Draft BEREC Report on Member States' best practices to support the defining of adequate broadband internet access service

2.3.3. BEREC Report on comparison tools and accreditation (carry-over)

While a number of Member States have already put in place comparison tools and/or certification processes, BEREC has never collated information on this issue since the requirement was introduced that end users should have access free of charge to at least one independent comparison tool which enables them to compare and evaluate different offers under Article 103 EECC.

In order to ensure that a strategic view of best practices is taken in the Report, and to gather information from NRAs, the BEREC did the following:

- undertook a literature review;
- sought input from key stakeholders regarding any measures provided independently of those prescribed by the NRAs under other relevant consumer legislation e.g. European Accessibility Act; and
- worked collaboratively with experts from different working groups (EWGs) to ensure a broad view is reflected in the report.

The aim of this exercise was to offer insights on comparison tools that enable consumers (and other end users, if so required by Member States) to compare and evaluate IAS and publicly available NB-ICS, as set out in Article 103 EECC, and, where applicable, publicly available number-independent interpersonal communications services.

The Report has also collected data on the certification processes within each Member State that are, upon request, available to providers of a comparison tool and comply with Article 103 EECC.

BEREC adopted a Draft report on comparison tools and accreditation for public consultation. After the public consultation, BEREC adopted the Final Report.

Document:

BoR (23) 22: BEREC Report on comparison tools and accreditation

BoR (23) 23: BEREC Report on the outcome of the public consultation on the BEREC Report on comparison tools and accreditation

2.3.4. BEREC Guidelines detailing Quality of Service (QoS) parameters

Under Article 104 EECC, NRAs in coordination with other competent authorities may require providers of internet access services (IAS) and of publicly available interpersonal communications services (ICS) to publish comprehensive, comparable, reliable, user-friendly and up-to-date information for end users on the quality of their services and on measures taken to ensure equivalence in access for end users with disabilities.

NRAs in coordination with other competent authorities must also specify, taking utmost account of BEREC guidelines, the QoS parameters to be measured, the applicable measurement methods and the content, form and manner of the information to be published, including possible quality certification mechanisms.

In 2020, BEREC published the first Guidelines detailing QoS parameters (BoR (20) 53). The Guidelines stated that the process of undertaking a review will commence two years from the adoption and publication of the Guidelines by BEREC.

The purpose of this project was to prepare and publish the first review of the Guidelines detailing QoS parameters.

The project has addressed the constituent elements of the legislative task assigned to BEREC, including:

- the relevant QoS parameters in relation to ICS and IAS;
- the parameters relevant for end users with disabilities;
- the applicable measurement methods for QoS parameters including, where appropriate, the ETSI and ITU standards set out in Annex X to the EECC in relation to ICS and IAS respectively;
- the content and format of QoS information; and
- the quality certification mechanisms.

BEREC adopted a Draft Report on Guidelines detailing Quality of Service (QoS) parameters for public consultation. After this public consultation, BEREC will adopt the Final Report at P1 2024.

Document:
BoR (23) 179: Draft BEREC Guidelines detailing Quality of Service Parameters

2.3.5. Report on the workshop on the application of rights of end users in the EECC (carry-over)

With Article 123, the EECC introduces a specific review procedure on end-user rights, tasking BEREC with publishing an opinion on the market and technological developments regarding the different types of electronic communications services. This will inform the EC when the time comes for it to publish its report on the application of Title III of Part III ('End-user rights'), and submit a legislative proposal to amend that Title where it considers this to be necessary to ensure that the objectives set out in Article 3 ('General objectives') continue to be relevant.

The effectiveness of end user provisions may be affected by changes in the use of different ECS, their ability to ensure effective access to emergency services, and by consumers' use of communication services which is evolving over time also given the prevalence of digital platforms as a substitute for traditional ECS.

In this light, a joint workshop BEREC-BEUC was held to further investigate the ability of end users of all electronic communications services to make free and informed choices and to easily switch their provider of electronic communications services. Furthermore, there was an analysis of any market distortions or end-user harm arising in cases where those abilities are lacking.

In this workshop, there were discussions on the results of the BEREC monitoring in 2021 so as to highlight specific issues for in-depth analysis which can constitute the basis for future opinions.

Another workshop focus was on the impact of market and technology developments in the use of the different types of electronic communications service for disabled users.

This workshop was part of the BEREC regular monitoring tasks, as it is required to publish an opinion on monitoring every three years or, more frequently if at least two Member States make a reasoned request.

BEREC held a workshop with representatives from BEUC to discuss technological and market developments in the use of the different types of electronic communications services and on their impact on the application of the end-user rights in November 2022.

This workshop included discussions on:

- the opinion that BEREC gave in 2021 on the market and technological developments and on their impact on the application of rights in the EECC;
- relevant past and ongoing experience within the previous/current regulatory framework;
- topics that are identified as being more problematic by the stakeholders and some ideas for topics to be explored by BEREC whether immediately or in future work programmes;
- the impact of market and technology developments in the use of the different types of electronic communications service for disabled users.

BEREC set up a project team to draft the agenda and invite speakers for the workshop.

A Summary Report of the outcomes of the workshop has been prepared and has been submitted to P1 2023 for publication.

Document:

BoR (23) 25: BEREC Summary Report on the workshop on the application of rights of end users in the EECC

2.4. Cooperation with EU institutions and institutional groups

2.4.1. Implementation of BEREC's Medium-Term Strategy for relations with other institutions and international cooperation

The BEREC strategy 2021-2025 recognises the increasing convergence of issues in the field of electronic communications faced worldwide and the increasing global nature of electronic communication networks and electronic communications services. These trends mean that policies, legislation and regulation must be seen from a more global perspective. As stated in this Strategy, BEREC has benefited since its foundation from the cooperation of NRAs and other international regulatory networks, policymakers and institutions involved in communications also outside the EU. This cooperation has been systematised and strengthened in 2021 by BEREC's Medium-Term Strategy for international cooperation[27] ('IC MTS'). The IC MTS addresses the need to establish and maintain relationships with external parties for the execution of BEREC's tasks, and in evaluating BEREC's international commitments it explains in a detailed and transparent manner what type of cooperation and engagement could be envisaged with each of its international partners. In line with Article 35 of Regulation (EU) 2018/1971, the IC MTS is to be taken into account when drafting BEREC international activities in its multi-annual work programmes.

In 2023, BEREC organised the now traditional Four-lateral Summit with other network regulators with which it has signed MoUs, namely REGULATEL, EMERG and EaPeReg.[28] At this summit, the regulators discussed and shared their valuable experience on essential topics under the umbrella of international connectivity, such as satellite and sub-marine cable connectivity.

Throughout 2023, BEREC put special attention on the critical role of connectivity in Ukraine particularly in light of the ongoing invasion by Russia. BEREC supported NCEC, the Ukrainian telecom regulators, in the prolongation of voluntary measures for affordable connectivity for Ukrainian refugees[29], and by donating laptops[30].

---

[27] BoR (21) 135, BEREC's Medium-Term Strategy for international cooperation for the period 2022-2025, 30.09.2021, see: https://berec.europa.eu/en/document-categories/berec/berec-strategies-and-work-programmes/berecs-medium-term-strategy-for-international-cooperation-for-the-period-2022-2025

[28] BEREC strengthens its collaboration with regulators worldwide, see: https://www.berec.europa.eu/en/news-publications/news-and-newsletters/berec-strengthens-its-collaboration-with-regulators-worldwide

[29] BEREC supports new statement signed that prolongs voluntary measures for affordable connectivity to Ukrainian refugees, see: https://www.berec.europa.eu/en/news-publications/news-and-newsletters/berec-supports-new-statement-signed-that-prolongs-voluntary-measures-for-affordable-connectivity-to-ukrainian-refugees

[30] Initiative on Laptops for Ukraine: the donated devices will be delivered to Ukraine soon, see: https://www.berec.europa.eu/en/news-publications/news-and-newsletters/initiative-on-laptops-for-ukraine-the-donated-devices-will-be-delivered-to-ukraine-soon

BEREC organised a study trip to South Korea, during which technological developments, such as advancements towards 6G, regulatory aspects and best practices in policy and regulatory activity were discussed with South Korean counterparts and leading industry market players[31].

Document:
BoR (23) 47: BEREC calendar of international activities and events in 2023

2.5. BEREC's other tasks

BEREC ad hoc work

2.5.1. Ad hoc input to the EU/NRAs

2.5.1.1. Working arrangements with regulatory authorities of third countries

Article 35(2) of the BEREC Regulation provides that the Board of Regulators, the Working Groups and the Management Board should be open to the participation of regulatory authorities of third countries with primary responsibility in the field of electronic communications, where those third countries have entered into agreements with the Union to that effect. For this purpose, BEREC and the BEREC Office shall establish, subject to prior approval by the Commission, working arrangements with the applying NRAs. The working arrangements shall be developed specifying, in particular, the nature, extent and manner in which the regulatory authorities of third countries participate without the right to vote in the work of BEREC and of the BEREC Office, including provisions relating to participation in the initiatives carried out by BEREC, financial contributions and staff to the BEREC Office. The judgment of the Court of Justice of 17 January 2023 has set that the competence to define working agreements lies with BEREC/BEREC Office, and not with the Commission. The draft working arrangements shall be submitted to the EC for approval, according to Article 35(1). In line with the BEREC Regulation and the judgement of the Court of Justice, the Board of Regulators approved the renewal of working arrangements with six NRAs at Plenary 2 in 2023.

In 2023, BEREC was approached by two NRAs wishing to join BEREC without voting rights. Therefore, BEREC decided, in close cooperation with the EC, to define a procedure and objective criteria for handling requests to work with BEREC and the BEREC Office from third

[31]BEREC study trip to South Korea, see: https://www.berec.europa.eu/en/news-publications/news-and-newsletters/berec-study-trip-to-south-korea

country NRAs. BEREC prepared the procedure in 2023 for the BoR to adopt it at the beginning of 2024.

Document:

BoR (23) 99: Working arrangements concerning participation of the National Regulatory Authority of the Republic of Albania in the Body of European Regulators for Electronic Communications and the Agency for Support for BEREC

BoR (23) 100: Working arrangements concerning participation of the National Regulatory Authority of Bosnia and Herzegovina in the Body of European Regulators for Electronic Communications and the Agency for Support for BEREC.

BoR (23) 101: Working arrangements concerning participation of the National Regulatory Authority of Kosovo* in the Body of European Regulators for Electronic Communications and the Agency for Support for BEREC.

BoR (23) 102: Working arrangements concerning participation of the National Regulatory Authority of the Republic of Montenegro in the Body of European Regulators for Electronic Communications and the Agency for Support for BEREC.

BoR (23) 103: Working arrangements concerning participation of the National Regulatory Authority of the Republic of North Macedonia in the Body of European Regulators for Electronic Communications and the Agency for Support for BEREC.

BoR (23) 104: Working arrangements concerning participation of the National Regulatory Authority of the Republic of Serbia in the Body of European Regulators for Electronic Communications and the Agency for Support for BEREC.

2.5.1.2. BEREC Opinion on the review of the Access Recommendations

The draft Gigabit Recommendation that replaces the 2010 NGA Recommendation (2010/572/EU) and the 2013 NDCM Recommendation (2013/466/EU) was sent by the European Commission to BEREC on 23 February 2023 with a request for its opinion. **The BEREC Opinion was sent to the Commission and published on 5 May 2023**.

BEREC's concerns and suggestions

With a view to improving the draft Recommendation, the BEREC experts raised some concerns, and provided comments and proposals for amendments to the draft Recommendation in its Opinion.

BEREC expressed its appreciation for the European Commission's work in promoting gigabit connectivity – a cornerstone of the EU Digital Strategy and one of the objectives of the EECC. BEREC noted that the draft Recommendation should take into account all other objectives of Article 3 EECC, namely, the promotion of sustainable competition, the contribution to the

development of the internal market and the protection of the interests of end users. BEREC pointed out that some terms of the draft Gigabit Recommendation do not seem to be fully in line with the provisions of the EECC, and this puts at risk the delicate balance achieved in the Code. BEREC takes therefore the view that the highly detailed provisions of the draft Gigabit Recommendation risk unduly limiting the discretion given to NRAs under the EECC.

Generally, BEREC is concerned that the draft Gigabit Recommendation lowers the bar for an effective retail price constraint to an extent that risks a premature deregulation where regulation is still required.

With regard to the section on 'Adequately rewarding the investment risk', BEREC urges the Commission to clearly separate the two issues of dealing with the temporary increase of inflation when calculating the weighted average cost of capital (WACC) and estimating a very high capacity networks (VHCN) risk premium for new investment network projects.

The main comments and concerns raised by BEREC by section are as follows:

Aim and Scope

BEREC expressed concerns about putting different types of agreements (commercial agreements, co-investment, commitments) on the same level as it goes against the EECC. In fact, in the proposed draft there is no 'hierarchy' of agreements, whereas, according to the EECC, there is a hierarchy.

Non-discrimination obligation

BEREC, in principle agreed with the EC's approach. Nevertheless, BEREC disagreed that wholesale only operators would in principle have no incentive to discriminate between downstream providers.

SMP regulation of Civil Engineering Infra (CEI)

- BEREC called for efficient costs instead of full costs as the basis for setting the access prices to newly built CEI. Full costs remain the basis, further changes are needed in the text to enforce this solution.
- BEREC requested a relatively lower bar for access to CEI to become the only access remedy (i.e. the extensive CEI should not necessarily reach end users' premises). The possibility to reach end-user premises was mentioned as a key enabling factor of infrastructure-based competition.

Pricing flexibility

- BEREC requested less stringent wording for the NRAs to allow pricing flexibility, in line with Article 74(1) paragraph 3 EECC ('will *consider* not imposing or maintaining regulated wholesale access prices on VHCN wholesale inputs […]' instead of 'should not impose of maintain […]').

- BEREC considered (i) prospective infrastructure-based competition, and (ii) viable deployment of alternative networks, two of the conditions for allowing pricing flexibility, and, at the same time, it was concerned that the Commission proposed considering the non-imposition of regulated wholesale access prices on VHCNs when infrastructure competition is only 'emerging', 'prospective'.

Pricing regulation when flexibility is not possible

- BEREC supported keeping the same approach for costing methodology – (BU-LRIC+), while proposing some additional adjustments.

WACC

- BEREC proposed to delete the so-called 'sensitivity check' for the WACC as it contradicts the predictability and stability objectives of the WACC Notice. In addition, BEREC pointed out that the two issues of dealing with the temporary increase of inflation and estimating a very high capacity networks (VHCN) risk premium for new investment network projects have to be dealt with separately.

Transitional Period

Finally, as NRAs need sufficient time to adjust their regulatory framework, BEREC in its Opinion requested that the draft Gigabit Recommendation anticipates an appropriate transitional period before its complete application. In the BEREC Opinion, the BEREC experts affirm that at least all open proceedings will be finished based on the Next Generation access networks (NGA) and the Non-discrimination and costing methodologies (NDCM) Recommendations.

Document:
BoR (23) 83: BEREC Opinion on the draft Gigabit Recommendation

2.5.1.3. BEREC analysis of the EC legislative proposal for a Gigabit Infrastructure Act

On 23 February 2023, the European Commission published its legislative proposal for a Gigabit Infrastructure Act (GIA) which aims to facilitate and stimulate the roll-out of very high capacity networks (VHCNs) so that such networks can be rolled out faster and at a lower cost. The GIA will repeal the Broadband Cost Reduction Directive (BCRD) of 2014.

BEREC analysed the Commission proposal in detail and adopted its analysis of the EC legislative proposal for a Gigabit Infrastructure Act on 16 May 2023.

BEREC overall welcomes this EC initiative. BEREC regards it as an important building block to achieve the 2030 connectivity targets and hopes that it can be further improved based on the suggestions in this analysis. In terms of previous related work, BEREC has carried out

projects on the implementation of the BCRD in 2017 and 2019 and published its opinion on the revision of the BCRD in March 2021. BEREC's analysis of the proposed GIA is particularly important, as the tasks of the dispute settlement body (DSB) and the single information point (SIP), two central elements of the GIA, are done by the NRAs in nearly all Member States (DSB), or about half of the Member States (SIP). Moreover, there is an interdependence between the provisions of the GIA and the relevant provisions of ex-ante regulation under the EECC, (SMP regulation, symmetric regulation Article 61(3)), which also lies within the responsibility of NRAs.

In its analysis, BEREC clearly highlights which provisions and aspects of the proposal are welcomed, it provides suggestions for changes or amendments where BEREC considers that the EC proposal could be improved and in some instances it advocates for the deletion of certain provisions in the proposal.

Document:

BoR (23) 120: BEREC analysis of the EC legislative proposal for a Gigabit Infrastructure Act

2.5.1.4. Input to the EC Draft Implementing Decision on KPIs to measure the progress towards the DDPP targets

The European Commission has been asking for feedback on a draft act in the form of an implementing decision with the purpose of 'setting out key performance indicators to measure the progress towards the digital targets set out in Article 4(1) of Decision (EU) 2022/2481 of the European Parliament and of the Council', in short 'the 2030 Digital Decade policy programme'.

In general, BEREC is of the view that some of the proposed definitions of the KPIs are not consistent with the definitions of the EECC and, consequently, are not in line with the relevant BEREC Guidelines based on the EECC. Such inconsistencies could cause issues for NRAs and more broadly for the market participants. In order to avoid these, BEREC requested the Commission to define the KPIs in a technological neutral and forward-looking manner and it made proposals for improvement in its contribution to the call for feedback.

The Commission set out in its Implementing Decision of 30 June 2023, the various KPIs to measure the progress towards the DDPP targets. The 5G coverage KPI was set 'regardless to the spectrum band' as BEREC and others requested. The Commission also set up a subgroup (for Member States) to discuss additional aspects. In particular, it will discuss an additional KPI to measure 5G coverage.

Document:

BoR (23) 50: BEREC's feedback to the European Commission's draft implementing decision setting out key performance indicators for the Digital Decade Policy Programme 2030

2.5.2. Peer review process

BEREC and the Radio Spectrum Policy Group (RSPG) agreed on working arrangements on 13 June 2019 (see also BoR (19) 100). The arrangements set out cooperation methods for BEREC's participation in the Peer Review Forum. This was done with regard to the requirements of Article 35 of the EECC. The cooperation methods are as follows:

- to use the Peer Review Forum as an instrument of peer learning; to promote the view that the Peer Review Forum is the best way forward as it convenes national NRAs and other competent authorities with expertise on comparative or competitive selection procedures pursuant to the electronic communications' regulatory framework;
- to cooperate in the implementation of the Peer Review Forum;
- to appoint liaison officers in both BEREC and the RSPG to strengthen the relationship between the two bodies and to facilitate the implementation of this arrangement. The Wireless Network Evolution co-Chairs are BEREC's liaison officers.

The Peer Review Forum is convened by the RSPG only when required. The responsibilities for adopting and publishing reports on Peer Review are set out in Article 35(7) and (9) of the EECC, and these fall to RSPG to deliver also having regard to the RSPG Rules of Procedure. BEREC experts participated in three Peer Review Forums in 2023: Sweden (February, 2023), Slovakia (September, 2023) and Austria (October, 2023).

2.5.3. BEREC Monitoring of the Joint Statement agreed between Ukraine and EU Operators

As a result of the ongoing war against Ukraine, following Russia's invasion of Ukraine on 24 February 2022, BEREC has closely followed the telecommunications sector's response to the crisis and welcomed the measures that have been provided by EU operators voluntarily. A Joint Statement between the European Economic Area[32] (EEA) and Ukrainian (UA) operators has been signed for introducing a stable framework to help people fleeing the war in Ukraine stay in touch with family and friends back home and maintain access to information. BEREC and the Ukrainian National Regulatory Authority, the NCEC, were tasked to monitor the implementation of the agreed measures and in this respect they have launched a third data collection round in 2023.

[32] EU countries plus Iceland, Liechtenstein and Norway

In total, 7 UA operators and 20 EEA groups and operators signed the Joint Statement. This Report includes data from 25 NRAs (24 BEREC members or participants without voting rights plus the UA Regulatory Authority NCEC) who collected data from operators. In particular, 52 mobile and 33 fixed EEA operators. The NCEC has received data from four mobile operators and three fixed operators.

According to the data received, the termination rates charged to EEA operators which signed the Joint Statement are significantly lower than for EEA operators who have not signed the Joint Statement[33]. With regard to termination rates paid and charged by UA operators, it shows that UA operators charge higher average prices than they have to pay.

The average wholesale roaming payments and the average wholesale roaming revenues of UA operators per minute, SMS and GB were significantly lower in case of EEA operators which signed the Joint Statement compared to the non-signatories.

Document:

BoR (23) 119: BEREC Analysis Monitoring of the Joint Statement agreed between Ukraine and EU Operators

2.5.4. Facilitation of the agreement on retail price caps among operators to reduce roaming charges when travelling between the European Union and Moldova

According to a Joint Declaration of 30 May 2023, signed by EU/EEA and Moldovan operators, facilitated by the Commission and the Moldovan authorities, roaming charges become more affordable when travelling to both regions, and the new tariffs which are in place as of 1 January 2024. The Joint Declaration is voluntary and remains open for the EU/EEA and Moldovan operators to sign at any time. The Joint Declaration applies until 31 December 2025 and can be renewed after that date.

On 22 September 2024, an important step towards the implementation of the Joint Statement was taken to ensure lower charges for roaming between the European Union and Moldova. At a signing ceremony organised by BEREC and with the participation of the European Commission and the Moldovan Authorities, the signatories of the Joint Declaration of 30 May 2023, further agreed on upper retail price caps for data and calls when roaming in both regions.

Under the Joint Declaration, BEREC is appointed as an independent third party to ensure its implementation. Consequently, the co-Chairs of the BEREC Expert Working Group on Roaming since June 2023 have assisted participating operators in defining upper price caps

[33] The questionnaire targeted the operators that have signed the Joint Statement. In some cases, EEA operators which have not signed the Joint Statement provided data on a voluntary basis, this is not included in our analysis but there is a reference to it in the general comparison in the Executive Summary.

for retail voice and data services when roaming in Moldova and in the EU. This process was supported by the Moldovan national regulatory authority, ANRCETI.

Document:
BoR (23) 161: Press release - BEREC facilitates agreement on retail price caps among operators to reduce roaming charges when travelling between the European Union and Moldova

BEREC's other tasks under EU legislation

2.5.5. International Roaming Benchmark Data and Monitoring Report

According to Article 21 of the Roaming Regulation, BEREC must regularly monitor the retail and wholesale roaming prices for voice, SMS and data services, and the volume and revenue generated by mobile operators across the Member States. Moreover, BEREC must report regularly on the development of pricing and consumption patterns in the Member States for both domestic and roaming services, and on the development of actual wholesale roaming rates for unbalanced traffic between roaming providers. These benchmark data reports are widely acknowledged by the relevant stakeholders and are used by the Commission to review the effectiveness of the Roaming Regulation. BEREC published its 29th Benchmark Report in March 2023.The report also includes an Annex about international roaming in the Western Balkans.

Document:
BoR (23) 61: 29th BEREC International Roaming Benchmark Data and Monitoring Report

2.5.6. BEREC input to the Commission on the Review of the Intra-EU[34] Communications Regulation

In order to support the European Commission's assessment of the effects of the existing measures on intra-EU communications as required by recital 53 of the Roaming Regulation, BEREC prepared an Opinion on the impact of the measures imposed by drawing on data collected for the Intra-EU Communications Reports. BEREC's analysis shows that the Intra-EU Communication obligations support the reduction of the average revenue per unit for regulated intra-EU communication services for both mobile and fixed services.

[34] The Regulation applies to the EEA. Therefore, although the term intra-EU is used in the document (using the terminology of the legislation), it includes intra-EEA communication services.

Document:

BoR (23) 44: BEREC Opinion on the Review of Intra-EU Communications Regulation

2.5.7. BEREC input to the Commission on the Review of the Commission Implementing Regulation on the Fair Use Policy and Sustainability of the Roaming Regulation

In reply to the European Commission's (EC) request for expert views on the Commission Implementing Regulation 2016/2286 (hereinafter 'CIR'), BEREC analysed the data collected for the roaming data report (formerly, IR BMK and Transparency and Comparability Reports) and the stakeholder replies to a call for input in November and December 2022. Based on these analyses, BEREC observes that the Fair Use Policy (FUP) mechanisms foreseen by the CIR have been used by MNOs and MVNOs alike to prevent anomalous usage of regulated roaming services. BEREC also made some observations about the effectiveness and the popularity of the various FUP measures and about the use of the derogation procedure foreseen for roaming.

Document:

BoR (23) 63: BEREC Opinion on the Commission Implementing Regulation (EU) 2016/2286 on Fair Use Policy and the Sustainability Mechanism

2.5.8. Intra-EU communications Benchmark Report

Under Article 5(a)(6) of Regulation (EU) 2015/2120 of the European Parliament and of the Council of 25 November 2015, as amended by Regulation (EU) 2018/1971 of the European Parliament and of the Council of 11 December 2018, NRAs must monitor market and price developments for regulated intra-EU communications and report to the European Commission. In October 2023, BEREC published its fourth intra-EU communications BEREC Benchmark Report, covering the period April 2022 to March 2023, which provides information on intra-EU communication services volumes, revenue and subscribers.

Document:

BoR (23) 167: 4th Intra-EU communications BEREC Benchmark Report (April 2022 – March 2023)

Monitoring quality, efficiency and sustainability

2.5.9. BEREC reflections on the features of NRA independence

Following the 2022 external study on independence, in May 2023 BEREC held an internal workshop on the features of NRA independence in order to explore the possibilities of further work in this area.

Internal document: BEREC Summary Report of the BEREC internal workshop on the features of NRA independence

2.5.10. BEREC Opinion on the functioning of BEREC and BEREC Office for the evaluation under Article 48 of the BEREC Regulation

Pursuant to Article 48 of the BEREC Regulation, the Commission must, by 21 December 2023 and every five years thereafter, carry out an annual evaluation in compliance with the Commission guidelines to assess BEREC's and the BEREC Office's performance with regard to their objectives, mandate, tasks and location. The evaluation must, in particular, address the potential need to modify the structure or mandate of BEREC and the BEREC Office, and the financial implications of any such modification. Depending on the results of the evaluation, the Commission may propose that the Regulation be amended or repealed accordingly.

The Commission shall report to the European Parliament, the Council and the BEREC Management Board on the findings of its evaluation and it must publish those findings. Given the relevance of the evaluation for BEREC and BEREC Office, BEREC provided support in this exercise with its own assessment and expressed its position in the form of a BEREC input to the Commission.

Such input focuses on the achievements of BEREC and BEREC Office as well as the challenges and opportunities that they face with the emerging technologies and changing business models, trends, and market dynamics in the communications sectors. In the document, BEREC recognises the effectiveness of its two-tier layout and the suitability of its operational structure, with the BEREC Office providing professional and administrative support to BEREC. BEREC affirms the progressive expansion of its traditional ECN/ECS scope towards the IT world. It further notes the broader view that BEREC has had to take on digital markets, beyond the traditional tasks in the electronic communications sector, including new tasks introduced by the EECC.

The input identifies possible areas for improvement, covering, inter alia, the limited harmonisation of tasks assigned to NRAs at national level, and the restricted availability of adequate resources allocated by the Member States to their NRAs to take up the new tasks while handling their ongoing tasks. BEREC highlights the importance of ensuring NRA independence as a prerequisite for high-quality regulation and for BEREC to work effectively. Among the areas for reflection, it highlights the quality of its collaboration with the European

Commission in the context of adopting legislative proposals, and the appropriate staffing and budget of the BEREC Office in accordance with the new tasks assigned to it.

Document:
BoR (23) 114: BEREC input to the European Commission on the functioning of BEREC and the BEREC Office for the evaluation under Article 48 of the BEREC Regulation

2.5.11. BEREC report on national experiences of the implementation of the EECC

In preparation for the review of the implementation of the EECC, under Article 122 EECC that the Commission must carry out by 21 December 2025 and considering the progress in national transposition activities, BEREC has started reviewing the national implementation status of the EECC throughout the Union. This will inform the extent to which the new electronic communications framework is enabling the achievement of the EECC's objectives and whether (a reasoned selection of) the framework's provisions are effective to that end.

In the year of reference, BEREC launched its internal reflections to identify the possible strengths and weaknesses of the EECC provisions in line with the sectoral goals. The assessment started with a workshop for NRAs on 25 September 2023, where preliminary views were exchanged on key areas for analysis. This will be followed by a public workshop in 2024 with the aim of exchanging views with stakeholders about how the EECC has been working to date.

Based on the workshops and the NRAs' experiences, BEREC will identify the key regulatory areas where the current framework functions well and where there could be further improvement.

2.5.12. Report on Regulatory Accounting in Practice 2023

The Regulatory Accounting (RA) Annual Report gives an overview of the main remedies imposed on SMP operators in relevant markets that are subject to ex-ante regulation. The specific focus is on the costing methodologies, applied in the corresponding price control schemes, as adopted by NRAs for single products.

This is the 19th RA Annual Report which summarises the findings of a detailed survey of regulatory accounting systems in the regulatory context in access markets across Europe. Information has been gathered from National Regulatory Authorities (NRAs) and covers the implementation of regulatory cost accounting methodologies in the national market situations. It shows the state of play in terms of remedies of market regulation, and it focuses on price control and the way in which it is defined in practice. The Report provides (i) data on the structural parameters of each country, (ii) the WACC methodologies applied by NRAs and the WACC values currently in force in relation to the implementation of the corresponding

European Commission WACC Notice on the calculation of the cost of capital for legacy infrastructure.

The Report provides an up-to-date factual report on the regulatory accounting frameworks implemented by NRAs and an assessment of the level of consistency achieved. Where possible, trends and comparisons with data collected in the past years are illustrated.

A focus of the Report is on the analysis of services in key wholesale markets: Wholesale Local Access (the former Market 3a/2014, now Market 1/2020), Wholesale Central Access (Market 3b/2014) and Wholesale high quality access (the former Market 4/2014, now Market 2/2020).

In line with earlier reports, it also provides information on the regulatory and competitive framework in each member state, such as the presence of a geographical regulation, the equivalence model applied, the application of a retail margin squeeze test, and the cable regulation. A brief analysis of symmetric remedies is included. The outcomes of the survey are reported in a simple descriptive form.

The Report also looks at annualisation methodologies provided by those NRAs that replied. As in the 2022 Report, the accounting information for specific products in Market 1, such as copper access (including LLU, SA, SLU), fibre access (FLLU, VULA), dark fibre access and duct access have been further analysed.

An evaluation of the implementation of the Recommendation 2013/466/EU on consistent non-discrimination obligations and costing methodologies is also reported (section 3.5). In this context some new elements related to BU models are reported.

Furthermore, as in the 2022 Report, in order to include factors that influence NRAs regulatory strategy, additional structural data (e.g. population, market and competitive structure, infrastructure) have been collected from the NRAs (chapter 4).

In chapter 5, the Report provides the results of an extended survey on the WACC parameters, mainly focusing on Market 1. The section on the WACC gives a summary of the main methodologies currently used by NRAs and the reasons behind the estimation of single parameters needed to evaluate the cost of capital under the CAP-M model. The main focus of the 2023 Report is on the adoption of the Commission Notice on the WACC.

Annex I contains figures/tables with further data on some of the analyses in the Report.

As can be seen from the results above, the Report confirms a trend towards a consistent application of regulatory accounting frameworks by NRAs. This also reflects a clear convergence of the application of the 2013 Recommendation on consistent non-discrimination obligations and costing methodologies. In 2024, the reporting will continue to examine the application of regulatory accounting to key access products (e.g. fibre) and will prepare an in-depth analysis of the methods and the national market situations in which they are applied. The focus of the report will be further adapted to include the EECC provisions that were to be transposed by Member States by 21 December 2020. This implies looking at how the NRAs apply the updated provisions to adequately deal with the developments in markets and technology.

Regarding the WACC calculation, the report data will continue to be collected based on the methodology and input parameters actually used by NRAs to estimate the rate of return on capital employed, and the impact of both on the result will be considered. Furthermore, the convergence of the WACC calculations through the application of the Commission WACC Notice will be monitored.

Document:

BoR (23) 139: BEREC Report on Regulatory Accounting in Practice 2023

2.5.13. BEREC Report on the calculation of the Weighted Average Cost of Capital (WACC) parameters according to the European Commission WACC Notice 2019

In this 4th[35] BEREC Report on the Weighted Average Cost of Capital (WACC) parameters, BEREC calculates the WACC parameters following the non-binding Commission's WACC Notice on the calculation of the cost of capital for legacy infrastructure. This is in the context of the Commission's review of national notifications in the EU electronic communications sector of 6 November 2019[36]. The cost of capital is the core element of any regulatory pricing decision that NRAs take. The Notice aims to ensure a consistent calculation of the WACC by NRAs thereby contributing to the development of the internal electronic communications market.

As the Commission's Notice has not changed, BEREC is following the same methodology (including 'technical choices') as in the 2022 Report for consistency.

[35] The three previous BEREC WACC parameters Reports are available on the BEREC website, www.berec.europa.eu, BEREC WACC parameters Report 2020 (BoR (20) 116); BEREC WACC parameters Report 2021 (BoR (21) 86); BEREC WACC parameters Report 2022 (BoR (22) 70).

[36] Commission publishes the Notice on the calculation of the cost of capital for legacy infrastructure, see: https://digital-strategy.ec.europa.eu/en/library/commission-publishes-notice-calculation-cost-capital-legacy-infrastructure

BEREC has applied the following three general principles:

- Follow the Notice as closely as possible, which mainly refers to the methodologies to be used for the estimations.
- Be transparent, by using publicly available data where possible, or using data which are widely used and accepted in the financial markets, and which identify the data sources used for the estimations.
- Explain every step of the calculation in a straightforward manner.

For each of the parameters of the WACC formula (using the Capital Asset Pricing Model (CAPM) approach) the Report sets out:

- the application of the methodologies according to the WACC Notice;
- the assumptions and choices made;
- the data and data sources used;
- the steps of the calculations; and
- the results.

By explaining precisely and transparently how the results were derived, NRAs will be able to follow the BEREC calculation steps from start to finish and to fully understand the logic of the calculation process so that they can replicate the results shown in the WACC parameters Report. This ensures that NRAs can trust that the results are reliable and were derived using state of the art professional standards, and follow the Notice as closely as possible by taking into account best regulatory practices where the Notice provides for NRA flexibility.

All the results were cross checked and verified to ensure that no methodological mistakes have been made, no questionable data have been used and no calculation errors have occurred, so that BEREC was able to exclude any systematic bias. Only after these checks were carried out, BEREC was satisfied that the results were correct and NRAs can rely on them.

A complexity aspect of the Notice and the WACC parameters Report is the calculation of an EU-wide ERP (equity risk premium). Based on the calculations described in section 6, BEREC determines that the appropriate value of the single EU-wide ERP is **5.92 % (AM).** As the same methodology was used in 2022, the increase from 5.70 % in 2022 to **5.92%** in 2023 is attributable to factual developments. The increased value between 2022 and 2023 is the eleventh most significant increase in the ERP since 1900 and the sixth most significant

increase since the 1960s. Overall, the increase of the ERP reflects the higher market volatility which is a consequence of the higher uncertainties of the economic environment.[37]

Since 2021, BEREC has drawn up a separate EU/EEA-ERP estimate for exclusive use by Nkom (Norway), ECOI (Iceland) and AK (Liechtenstein)[38].

The BEREC peer group comprises the same 15 companies as in 2022.

In section 7.2 (Taxes and inflation), BEREC has expanded on the temporarily increased inflation rate and how to deal with it within the framework of the Notice. In this respect, BEREC refers to its statements in the recent BEREC Opinion on the Draft Gigabit Recommendation (BoR (23) 83).

BEREC publishes the estimated WACC parameter values and the NRAs are expected to take these into account when carrying out their own calculations for their national regulatory decisions, although they do have some flexibility within this framework to take account of national specificities. BEREC has noted that over time most NRAs follow the Notice and use the BEREC parameter values in their national decisions.

For reference by NRAs, the Report was published before 1 July 2023 when the Commission applies it according to the Notice when reviewing NRA's notifications in the EU electronic communications sector.

BEREC has taken the utmost care to prepare this Report using the best knowledge and technical expertise of its members. Nevertheless, improvements may be necessary in future yearly updates as deemed appropriate.

Document:

BoR (23) 90: BEREC Report on WACC parameter calculations according to the European Commission's WACC Notice of 6th November 2019 (WACC parameters Report 2023)

[37] Cf. For a more detailed analysis section 6.5 below and the Credit Suisse Global Investment Returns Yearbook 2023 Summary Edition, see: https://www.credit-suisse.com/media/assets/corporate/docs/about-us/research/publications/credit-suisse-global-investment-returns-yearbook-2023-summary-edition.pdf

[38] As no data are available for Liechtenstein, the separate EU/EEA-ERP estimate includes only data for Norway and Iceland.

2.6. Stakeholder engagement

2.6.1. Stakeholder Forum

On 30 March 2023, BEREC held its annual Stakeholder Forum in Brussels, Belgium, focusing on topics relevant to the telecommunications market. The event kicked off with the 'Meet & Greet' sessions between the stakeholders and the BEREC Working Groups' Co-chairs. It was followed by a conference and concluded with the networking reception.

The 'Meet & Greet' sessions, successfully introduced over the last three years, are informal meetings that provide registered stakeholders with the opportunity to exchange ideas and discuss the sector's pertinent topics. During the conference, the incoming BEREC Chair, Tonko Obuljen (HAKOM, Croatia), presented the draft BEREC Work Programme 2024. Together with the BEREC Chair, Prof. Konstantinos Masselos (EETT, Greece), they discussed with the participants the current and future challenges in BEREC's work.

In the first Panel of the conference, there was a discussion on accessible future for end users with disabilities, while the second focused on the future of regulation in the digital era. A presentation of the EU Regulation on harmonised rules on fair access to and use of data (Data Act) was also given by Yvo Volman from DG CNECT. Participants had the opportunity to follow the discussions in-person and online, and ask questions throughout the event. The incoming BEREC Chair, Tonko Obuljen, assisted by the event's moderator, Philippe Defraigne (Cullen International), gave the closing remarks.

2.6.2. BEREC Annual Report

The Annual Report on developments in the electronic communications sector in 2022 has a foreword by Annemarie Sipkes (ACM, The Netherlands), BEREC Chair 2022, who emphasised the significance of providing meaningful connectivity in the face of global challenges. Against the backdrop of the Russian aggression in Ukraine, BEREC played an important role in facilitating voluntary agreements within the telecom industry by monitoring and analysing roaming patterns and addressing regulatory uncertainties to support Ukrainians abroad.

Apart from this, BEREC also delivered on a very ambitious work programme for 2022. This work programme centered on three strategic goals: promoting full connectivity, sustainable open digital markets, and empowering end users.

By emphasising that meaningful connectivity extends beyond mere connectivity, Ms Sipkes underlined the importance of the openness of the internet ecosystem. In this context, BEREC's study on the internet ecosystem lays the foundation for future work, aligned with Europe's efforts on establishing new rules for open digital markets. Ms Sipkes confirmed that, following the legislative process of the DMA, BEREC has focused on interoperability and data portability within the context of the DMA, DSA and the Data Act.

Ms Sipkes also highlighted BEREC's dedication to addressing the digital divide, making connectivity available, affordable, and accessible. Additionally, BEREC is focused on the green transition as well, issuing relevant output and engaging further with stakeholders and other regulators.

Acknowledging the collective effort behind BEREC's achievements, Ms Sipkes expressed gratitude to the various contributors, including the working group drafters, co-Chairs, the BEREC Office, CN members, and the Board of Regulators.

Document:

BoR (23) 109: BEREC Annual Report 2022

2.6.3. BEREC Communications Plan 2023

BEREC Communications Plan 2023 sets out the communications activities and projects planned for the year. The objective was to strengthen the perception of BEREC as an independent, European, forward-looking expert body, and support the overall strategic objectives of BEREC. These include promoting full connectivity, supporting sustainable and open digital markets, and empowering end users. This plan complements the BEREC External Communications Strategy, which sets out BEREC's overall approach to communications. The main project of the year was the development of the new BEREC website design and content that continues in 2024. Another project included evaluation of the impact and effectiveness of the BEREC public debriefings. An analysis was done based on a survey and internal brainstorming session, and a list of conclusions for improvements. A set of sustainability icons was produced to further the BEREC contribution to empowering end users through environmental transparency on digital products and services. Within the day-to-day communications activities, BEREC continued organising regular BEREC public events, such as public debriefings and the Stakeholder Forum, it published press releases and news items, produced audio-visual and digital content, ran social media campaigns, and kept up its communication with the media.

2.6.4. Developing the BEREC Work Programme 2024

The BEREC Work Programme 2024 was adopted in December 2023, and sets out the priority work areas that the Board of Regulators had identified for 2024. These areas may be complemented by other emerging topics of interest during the year. The objectives of the Work Programme are fully aligned with the BEREC 2021–2025 Strategy, keeping a close focus on the three high-level priorities (promoting full connectivity, supporting sustainable and open digital markets, and empowering end users) and the priorities set for institutional and international cooperation.

In 2024, BEREC is ready to encourage further implementation of the EECC at national level and to start assessing the national implementation status throughout the Union. Promoting full

connectivity for consumers and businesses remains a key priority for BEREC in 2024. In line with the European ambition to create a Europe fit for the digital age, BEREC will contribute by facilitating the roll-out of Very High Capacity Networks (VHCNs) and stimulating their contribution to closing the digital divide. Through its cooperation with other competent authorities and stakeholders, BEREC will also play its part in ensuring that future network technologies meet their connectivity targets in line with European values and societal needs, in relation to cybersecurity, safety and environmental challenges.

In 2024, BEREC will closely monitor a wide range of market developments, from managing the copper network switch off to the evolution of private and public 5G networks across Europe. Closing the digital divide entails more than just the roll-out of VHCNs. It also requires end users to have access that aligns with their needs. BEREC will empower end users by further enhancing transparency, working on defining an adequate broadband Internet access service, and giving guidance about Quality of Service parameters.

Open and sustainable European digital markets are a cornerstone of a Europe that is fit for the digital age. In line with both its strategic priority to support sustainable and open digital markets and its role within the European High-Level Group of Digital Regulators for the enforcement of the Digital Markets Act, BEREC will keep monitoring and analysing developments on the digital markets and the impact and effects of the practices of large online platforms. In 2024, BEREC will continue to monitor both the legislative process relating to fair access to and use of data, and the implementation of the enacted legal acts (the Data Act, the Digital Services Act (DSA)).

BEREC will also work on several essential tasks that have been entrusted to it by the co-legislators. These include a review of the Roaming Regulation, an Opinion on the national implementation and functioning of the general authorisation, and an Opinion on the technological developments and their impact on the application of end-user rights. Finally, BEREC will review its objectives for the period 2026-2030 in view of the latest and expected relevant market, technological and regulatory developments over the next five years.

Document:

BoR (23) 210: BEREC Work Programme 2024

Annex 1 – Meetings with the European institutions and other European Union bodies

A. Meetings with the European Commission

Dates/place	Event
23 January 2023, Brussels, Belgium	Meeting with DG CONNECT
22 February 2023, Virtual meeting	Meeting with DG CONNECT
12 May 2023, Brussels, Belgium	Meeting of the High Level Group for the Digital Markets Act
30 May 2023, Virtual meeting	Meeting with DG CONNECT
26 September 2023, Brussels, Belgium	DG COMP 14th ECN Telecoms Subgroup Meeting
26 September 2023, Brussels, Belgium	Meeting with DG CONNECT
27 November 2023, Brussels, Belgium	Meeting of the High Level Group for the Digital Markets Act
28 November 2023, Virtual meeting	Meeting with DG CONNECT

B. Meetings with the European Parliament/European Council

Dates/place	Event
21 March 2023, Brussels, Belgium	Workshop organised by MEPs and ISOC (The future of the connectivity: why sender-party-pays is not a solution)
19 June 2023, Brussels, Belgium	Meeting with the Council Working Party on Telecommunications and Information Society on the BEREC Analysis of the Gigabit Infrastructure Act
28 June 2023, Brussels, Belgium	Exchange of views with the ITRE Committee on the BEREC opinion on the draft European Commission Gigabit connectivity recommendation
12 October 2023, Brussels, Belgium	ITRE-BEREC annual Exchange of Views in Committee meeting
23-24 October 2023, Leon, Spain	Informal meeting of Telecommunications Ministers

C. Meetings and workshops with other EU bodies

Dates/place	Event
24 May 2023, Lisbon, Portugal	3rd ENISA Telecom and Digital Infrastructure Security Forum

19 June 2023, Brussels, Belgium	Meeting with the European Economic and Social Committee on the BEREC Analysis of the Gigabit Infrastructure Act

Annex 2 – Public debriefings and BEREC engagement with stakeholders

Dates/place	Event
15 March 2023, Virtual meeting	Public debriefing on the outcomes of the 54th BEREC ordinary meetings
30 March 2023, Belgium, Brussels	11th BEREC Stakeholder Forum
13 April 2023, Virtual meeting	BEREC Workshop on secure and reliable connectivity from LEO satellite fleets
28 April 2023, Virtual meeting	BEREC Workshop on Switching and interoperability of data processing services
14 June 2023, Virtual meeting	Public debriefing on the outcomes of the 55th BEREC ordinary meetings
20 June 2023, Virtual meeting	BEREC Market and Economic Analysis Working Group workshop on competition dynamics of tower and access infrastructure companies
21 September 2023, Virtual meeting	BEREC Workshop on international submarine connectivity in the EU
4 October 2023, Portugal, Madeira	Four-lateral BEREC, EaPeReg, REGULATEL and EMERG Summit
12 October 2023, Belgium, Brussels	Public debriefing on the outcomes of the 56th BEREC ordinary meetings
26 October 2023, Virtual meeting	BEREC Workshop on Internet of Things: perspectives and competition
14 December 2023, Virtual meeting	Public debriefing on the outcomes of the 57th BEREC ordinary meetings

Annex 3 – International events[39]

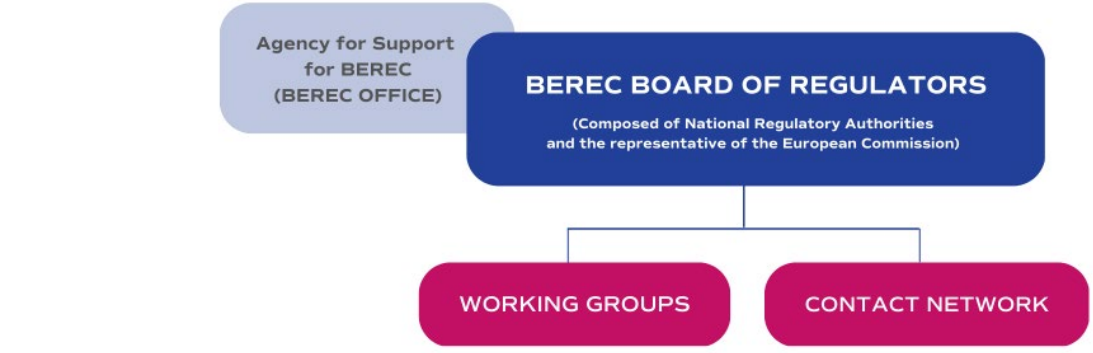
Dates/place	Event
12 January 2023, England, London	OFCOM conference ‘Net neutrality for an evolving internet’
25 January 2023, Virtual event	ICANN event on OTT fair share
26 February 2023, Spain, Barcelona	EIF-GSMA Roundtable ‘Connecting Europe to its 2030 Digital Decade Targets’
26 February 2023, Spain, Barcelona	Meeting with ETNO
27 February 2023, Spain, Barcelona	Meeting with Microsoft

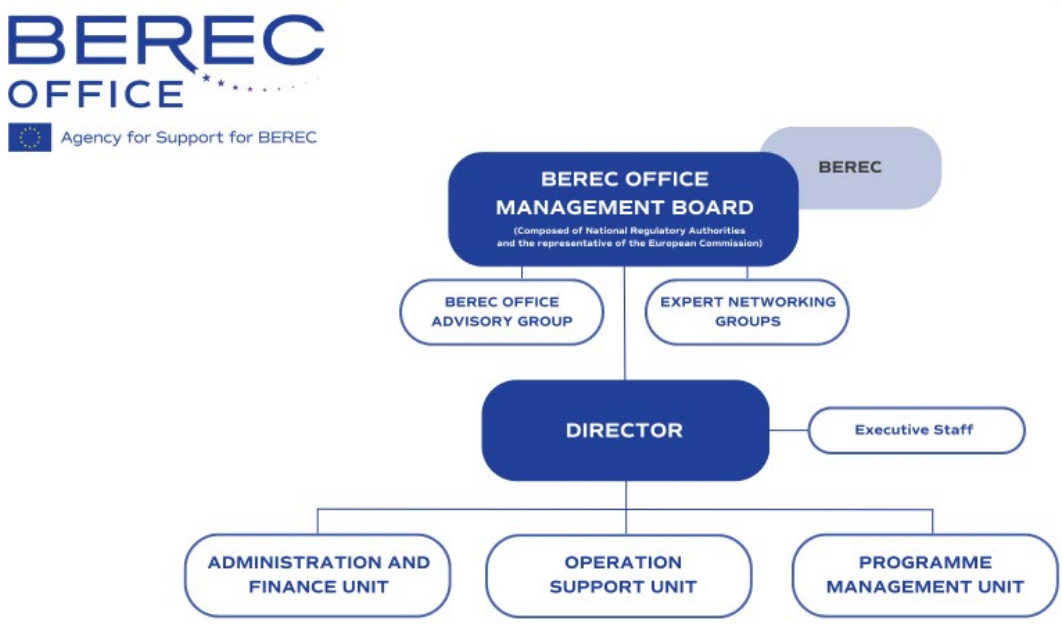
[39] For more information see: https://berec.europa.eu/en/berec/external-meetings-of-the-berec-chair-2023

27 February 2023, Spain, Barcelona	Meeting with Meta
27 February 2023, Spain, Barcelona	Meeting with Professor Kyung Sin Park
27 February 2023, Spain, Barcelona	GSMA-BEREC Roundtable
27 February 2023, Spain, Barcelona	Meeting with Federal Communications Commission (FCC)
28 February 2023, Spain, Barcelona	Meeting with GSMA
28 February 2023, Spain, Barcelona	Meeting with Telecom Regulatory Authority of India (TRAI)
28 February 2023, Spain, Barcelona	Meeting with Telefonica
28 February 2023, Spain, Barcelona	Ministerial Programme - Ask the Regulator
28 February 2023, Spain, Barcelona	GSMA Ministerial Programme 'Re-examining Mobile Market Structure'
28 February 2023, Spain, Barcelona	iDATE event '5G Accelerates Indoor Digitalization'
28 February 2023, Spain, Barcelona	Meeting with AT&T
28 February 2023, Spain, Barcelona	Meeting with Korea Internet Corporations Association
1 March 2023, Spain, Barcelona	Meeting with Huawei
1 March 2023, Spain, Barcelona	5G mmWave Summit
1 March 2023, Spain, Barcelona	MWC RoundTable 'Spectrum Needs for the Next Decade: Rural to City-Wide Capacity'
7 March 2023, Belgium, Brussels	Event organised by the Permanent Representation of the Netherlands to the EU 'The network fee: fixing a real problem or creating one?'
13 March 2023, Belgium, Brussels	European 5G Conference
21 March 2023, Belgium, Brussels	ISOC event 'The future of the connectivity: why sender-party-pays is not a solution'
21 March 2023, Belgium, Brussels	POLITICO event 'Telecoms drumbeat for the future of connectivity'
21 March 2023, Belgium, Brussels	Lisbon Council Working Lunch: Does Taxing Traffic Make Sense and Deliver Value?
22 March 2023, Belgium, Brussels	IIC Brussels Telecommunications & Media Forum 2023
2-7 April 2023, South Korea, Seoul and Daejeon	Study trip 2023
11 April 2023, Virtual event	NCEC first annual conference 'Regulator 3.0. Keeping Ukraine Connected'
17-19 April 2023, Uruguay, Montevideo	BEREC-Regulatel joint WG
19 April 2023, Spain, Madrid	FTTH Conference
3-4 May 2023, Bahrain, Manama	6G Global Summit
24 May 2023, Ireland, Dublin	EaPeReG 21st Plenary meeting
24 May 2023, Portugal, Lisbon	3rd ENISA Telecom and Digital Infrastructure Security Forum
5-6 June 2023, Egypt, Sharm el Sheikh	ITU Global Symposium of Regulators
19 June 2023, Belgium, Brussels	Meeting with the Council Working Party on Telecommunications and Information Society on the BEREC Analysis of the Gigabit Infrastructure Act

19 June 2023, Belgium, Brussels	Meeting with the European Economic and Social Committee on the BEREC Analysis of the Gigabit Infrastructure Act
21 June 2023, Belgium, Brussels	EU Digital Summit
22 June 2023, Belgium, Brussels	CISPE event: Telco 'fair share' and its potential implications for cloud and content delivery networks (CDNs)
28 June 2023, Belgium, Brussels	Exchange of views with the ITRE Committee on the BEREC opinion on the draft European Commission Gigabit connectivity recommendation
28 June 2023, Belgium, Brussels	Politico: Competitive Europe Summit
22-23 August 2023, Austria, Salzburg	24. Salzburger Telekom-Forum
28 August 2023, Virtual event	Caribbean Telecommunications Union : 3RD Meeting of Over-The-Top (OTT) services, BIG TECH Companies and Caribbean Operators
1 September 2023, Virtual event	ITI's Download on Tech Podcast Recording
7-8 September 2023, South Korea, Seoul	GSMA M360 APAC conference
13-14 September 2023, Belgium, Brussels	WIK conference: 'Is Europe fit for the Digital Age?'
20 September 2023, Virtual event	EURACTIV Virtual Conference "Gigabit Infrastructure Act: A global leadership opportunity for the EU"
21-22 September 2023, Belgium, Brussels	16th Seminar for National Judges and NRAs: Promoting Connectivity to Ensure a Fair and Competitive Digital Economy
26 September 2023, Virtual event	The NE(X)T Neutrality. An open debate on the future of the Internet and its infrastructures
26 September 2023, Belgium, Brussels	DG COMP 14th ECN Telecoms Subgroup Meeting
12 October 2023, Belgium, Brussels	ITRE-BEREC annual Exchange of Views in Committee meeting
16-17 October 2023, Germany, Cologne	International Regulators Forum
18-19 October 2023, Germany, Cologne	IIC Annual conference
18-19 October 2023, Latvia, Riga	5G Techritory 2023
23-24 October 2023, Spain, Leon	Informal meeting of Telecommunications Ministers
7 November 2023, Belgium, Brussels	Financial Times Tech & Politics Forum
9 November 2023, The Netherlands, Amsterdam	Dutch association for competition law event, panel 'The future of digital markets and competition supervision'
14 November 2023, Italy, Rome	Forum of Telecommunications 2023
4 December 2023, Belgium, Brussels	D9+ Stakeholder Forum
6-7 December 2023, La Paz, Bolivia	REGULATEL Plenary Assembly

Annex 4 – BEREC and the BEREC Office: organisational structure[40]





The work of BEREC is organised into Working Groups (WGs) which work on specific topics that are included in the BEREC Work Programme or that arise on an *ad hoc* basis, triggered by requests for advice or opinions from the EU institutions. The WGs are led by two co-Chairs from different NRAs, and relevant experts in the field.

[40] For more information see: https://www.berec.europa.eu/en/berec/organisational-charts

Annex 5 – BEREC Members and observers of the Board of Regulators (end of 2023)

List of the members and observers of the Board of Regulators established pursuant to Article 7 and Article 35(2) of Regulation (EU) 2018/1971 of the European Parliament and of the Council of 11 December 2018 establishing the Body of European Regulators for Electronic Communications (BEREC) and the Agency for Support for BEREC (BEREC Office).[41]

No	Country	Title	Name(s)	Surname(s)	Name of organisation	Member or observer
1.	Albania	Mr	Tomi	**Frasheri**	Electronic and Postal Communications Authority of Albania, AKEP	Observer
2.	Austria	Mr	Klaus	**Steinmaurer**	Austrian Regulatory Authority for Broadcasting and Telecommunications (RTR-GmbH)	Member
3.	Belgium	Mr	Michel	**Van Bellinghen**	Institut Belge des Postes et Télécommunications (IBPT / BIPT)	Member
4.	Bosnia and Herzegovina	Mr	Draško	**Milinović**	Communications Regulatory Agency of Bosnia and Herzegovina (RAK)	Observer
5.	Bulgaria	Mr	Ivan	**Dimitrov**	Communications Regulation Commission (CRC)	Member
6.	Croatia	Mr	Tonko	**Obuljen**	Croatian Regulatory Authority for Network Industries (HAKOM)	Member

[41] Composition of the Board of Regulators pursuant to Article 7 and Article 35(2) of Regulation (EU) 2018/1971, see: https://www.berec.europa.eu/en/berec/composition-of-the-board-of-regulators-pursuant-to-article-7-and-352-of-regulation-eu-20181971-1

7.	Cyprus	Mr	George	**Michaelides**	Office of the Commissioner of Telecommunications and Postal Regulation (OCECPR)	Member
8.	Czech Republic	Mr	Marek	**Ebert**	Czech Telecommunication Office (CTU)	Member
9.	Denmark	Ms	Katrine	**Windning**	Danish Business Authority (DBA)	Member
10.	Estonia	Ms	Kristi	**Talving**	Consumer Protection and Technical Regulatory Authority (ECPTRA)	Member
11.	Finland	Mr	Jarkko	**Saarimäki**	Finnish Communications Regulatory Authority (FICORA)	Member
12.	France	Mrs	Laure	**de La Raudiere**	Autorité de régulation des communications électroniques, des postes et de la distribution de la presse (ARCEP)	Member
13.	Germany	Mr	Wilhelm	**Eschweiler**	Federal Network Agency (BNetzA)	Member
14.	Greece	Mr	Konstantinos	**Masselos**	Hellenic Telecommunications and Post Commission (EETT)	Member
15.	Hungary	Mr	András	**Koltay**	National Media and Infocommunications Authority (NMHH)	Member
16.	Iceland	Mr	Hrafnkell	**Gislason**	Electronic Communications Office of Iceland (ECOI)	Observer
17.	Ireland	Mr	Robert	**Mourik**	Commission for Communications Regulation (COMREG)	Member
18.	Italy	Mr	Giacomo	**Lasorella**	Autorità per le Garanzie nelle Comunicazioni (AGCOM)	Member

19.	Kosovo[42]	Mr	Nazim	**Rahimi**	Regulatory Authority of Electronic and Postal Communications (ARKEP)	Observer
20.	Latvia	Ms	Alda	**Ozola**	Public Utilities Commission (SPRK)	Member
21.	Liechtenstein	Mr	Rainer	**Schnepfleitner**	Office for Communications / Amt für Kommunikation (AK)	Observer
22.	Lithuania	Ms	Jūratė	**Šovienė**	Communications Regulatory Authority (RRT)	Member
23.	Luxembourg	Mr	Luc	**Tapella**	Institut Luxembourgeois de Régulation (ILR)	Member
24.	Malta	Mr	Jesmond	**Bugeja**	Malta Communications Authority (MCA)	Member
25.	Montenegro	Mr	Branko	**Kovijanic**	Montenegro Agency for Electronic Communications and Postal Services (EKIP)	Observer
26.	North Macedonia	Mr	Jeton	**Akiku**	Agency for Electronic Communications (AEC)	Observer
27.	Norway	Mr	Pål Wien	**Espen**	Norwegian Communications Authority (NKOM)	Observer
28.	Poland	Mr	Jacek	**Oko**	Office of Electronic Communications (UKE)	Member
29.	Portugal	Mrs	Patrícia Silva	**Gonçalves**	Autoridade Nacional de Comunicações (ANACOM)	Member
30.	Romania	Mr	Valeriu	**Zgonea**	National Authority for Management and Regulation in Communications (ANCOM)	Member
31.	Serbia	Mr	Dragan	**Pejovic**	Regulatory Agency for Electronic Communications and Postal Services (RATEL)	Observer

[42] This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.

32.	Slovak Republic	Mr	Ivan	**Martak**	Regulatory Authority for Electronic Communications and Postal Services (RÚ)	Member
33.	Slovenia	Mr	Marko	**Mišmaš**	Agency for Communication Networks and Services of the Republic of Slovenia (AKOS)	Member
34.	Spain	Ms	Alejandra	**Iturriaga de Gandini**	Comisión Nacional de los Mercados y la Competencia **(**CNMC)	Member
35.	Sweden	Mr	Dan	**Sjöblom**	National Post and Telecommunications Agency (PTS)	Member
36.	The Netherlands	Ms	Annemarie	**Sipkes**	Authority for Consumers and Markets (ACM)	Member
37.	Ukraine	Ms	Liliia	**Malon**	National Commission for the State Regulation of Electronic Communications, Radio Frequency Spectrum and the Provision of Postal Services (NCEC)	Observer
38.		Mr	Roberto	**Viola**	European Commission	Observer

Annex 6 – Plenary meetings of the Board of Regulators (BoR) in 2023

Dates/place	Event	Agenda and Conclusions
9-10 March 2023, Virtual meeting	54th BEREC ordinary meetings	54th Plenary
9 May 2023, Virtual meeting	1st Extraordinary Plenary meeting	1st Extraordinary Plenary
8-9 June 2023, Montenegro, Budva	55th BEREC ordinary meetings	55th Plenary
4-6 October 2023, Portugal	56th BEREC ordinary meetings and a Four-lateral summit	56th Plenary
7-8 December 2023, Poland	57th BEREC ordinary meetings	57th Plenary

Annex 7 – Meetings of the Contact Network (CN) established prior to the Board of Regulators (BoR)

Dates/place	Event	Agenda and Conclusions
16-17 February 2023, Virtual meeting	1st BEREC Contact Network meeting	CN1
20 April 2023, Virtual meeting	1st Extraordinary Contact Network meeting	Extraordinary CN1
27 April 2023, Virtual meeting	2nd Extraordinary Contact Network meeting	Extraordinary CN2
11-12 May 2023, France, Paris	2nd BEREC Contact Network meeting	CN2
14-15 September 2023, Spain, Barcelona	3rd BEREC Contact Network meeting	CN3
16-17 November 2023, Romania	4th BEREC Contact Network meeting	CN4

Annex 8 – Publicly available documents approved by the BoR in 2023

A. BEREC Opinions

Document number	Description	Date
BoR (23) 49	BEREC Opinion on Phase II investigation pursuant to Article 32 of Directive (EU) 2018/1972 - Case CZ/2022/2421 Wholesale access and call origination on public mobile telephone networks in the Czech Republic	24 February 2023
BoR (23) 50	BEREC's feedback to the European Commission's draft implementing decision setting out key performance indicators for the Digital Decade Policy Programme 2030	09 March 2023
BoR (23) 44	BEREC Opinion on the Review of the Intra-EU Communications Regulation	09 March 2023
BoR (23) 63	BEREC Opinion on the Commission Implementing Regulation (EU) 2016/2286 on Fair Use Policy and the Sustainability mechanism	30 March 2023
BoR (23) 83	BEREC Opinion on the draft Gigabit Recommendation	05 May 2023

B. BEREC Reports

Document number	Description	Date
BoR (23) 25	Summary Report on the BEREC – BEUC Joint Workshop on the application of rights of end-users in the EECC	09 March 2023
BoR (23) 146	Draft BEREC Report on Sustainability Indicators for Electronic Communications Networks and Services	09 March 2023
BoR (23) 22	BEREC Report on Comparison Tools and Accreditation	09 March 2023
BoR (23) 61	29th BEREC International Roaming Benchmark Data and Monitoring Report	28 March 2023
BoR (23) 41	Study on wholesale mobile connectivity, trends and issues for emerging mobile technologies and deployments	13 April 2023
BoR (23) 131	BEREC input to the EC's exploratory consultation on the future of the electronics communications sector and its infrastructure	19 May 2023

BoR (23) 112	Summary report: BEREC workshop on secure and reliable connectivity from LEO satellite fleets, 13 April 2023	08 June 2023
BoR (23) 111	Draft BEREC Report on practices and challenges of the phasing out of 2G and 3G	08 June 2023
BoR (23) 89	BoR (23) 89 BEREC Report on the regulatory treatment of business services	08 June 2023
BoR (23) 90	BEREC Report on WACC parameter calculations according to the European Commission's WACC Notice of 6 November 2019 (WACC parameters Report 2023)	08 June 2023
BoR (23) 93	BEREC Report on the impact of Artificial Intelligence (AI) solutions in the telecommunications sector on regulation	08 June 2023
BoR (23) 117	BEREC Report on the Data Act Workshop (Workshop on Switching and Interoperability of Data Processing Services	08 June 2023
BoR (23) 118	BEREC Report on Study visit to south Korea 2023	08 June 2023
BoR (23) 92	BEREC report on interoperability of Number-Independent Interpersonal Communication Services (NI-ICS)	08 June 2023
BoR (23) 87	BEREC Report on competition amongst multiple operators of NGA-networks in the same geographical region	08 June 2023
BoR (23) 119	BEREC Analysis Monitoring of the Joint Statement agreed between Ukraine and EU Operators	08 June 2023
BoR (23) 114	BEREC input to the European Commission on the functioning of BEREC and the BEREC Office in view of the evaluation under Article 48 of the BEREC Regulation	04 September 2023
BoR (23) 177	Workshop Report - Study on the evolution of the competition dynamics of tower and access infrastructure companies not directly providing retail services; Draft BEREC Workshop summary report on study on the evaluation of infrastructure companies	05 October 2023
BoR (23) 178	Draft BEREC Report on Member States' best practices to support the defining of adequate broadband internet access service	05 October 2023
BoR (23) 180	BEREC Report on Secure 5G networks	05 October 2023
BoR (23) 162	BEREC Report on the implementation of the Open Internet Regulation	05 October 2023
BoR (23) 166	BEREC Report on Sustainability Indicators for Electronic Communications Networks and Services	05 October 2023
BoR (23) 167	4th Intra-EU communications BEREC Benchmark Report (April 2022 – March 2023)	05 October 2023
BoR (23) 208	External study on the trends and cloudification, virtualization, and softwarization in telecommunications	07 December 2023
BoR (23) 206	External study on the evolution of the competition dynamics of tower and access infrastructure companies not directly providing retail services	07 December 2023

BoR (23) 214	Draft BEREC Report on the general authorization and related frameworks for international submarine connectivity	07 December 2023
BoR (23) 207	Draft BEREC Report on empowering end-users through environmental transparency on digital products	07 December 2023
BoR (23) 196	BEREC Report on Regulatory Accounting in Practice 2023	07 December 2023
BoR (23) 213	BEREC Report on the Current Cybersecurity Challenges and Dependencies in Electronic Communications Networks	07 December 2023
BoR (23) 204	BEREC Report on practices and challenges of the phasing out of 2G and 3G	07 December 2023

C. BEREC public consultations

Document number	Description	Date
BoR (23) 23	BEREC Report on the outcome of the public consultation on the BEREC Report on Comparison Tools and Accreditation	09 March 2023
BoR (23) 88	BEREC Report on the PC outcome on business services	08 June 2023
BoR (23) 91	BEREC Report on the outcome of the public consultation on the Draft BEREC report on interoperability of NI-ICS	08 June 2023
BoR (23) 86	BEREC Report on the outcome of the public consultation on the draft BEREC Report on competition amongst multiple operators of NGA networks in the same geographical region	08 June 2023
BoR (23) 94	BEREC Report on the outcome of the public consultation on the draft BEREC Report on challenges and benefits of impact of Artificial Intelligence (AI) solutions in the telecommunications sector (including use cases)	08 June 2023
BoR (23) 163	BEREC Report on the outcome of the public consultation regarding the draft BEREC Guidelines on Very High Capacity Networks	05 October 2023
BoR (23) 165	BEREC Report on the outcome of the public consultation on the Draft BEREC Report on Sustainability Indicators for Electronic Communications Networks and Services	05 October 2023
BoR (23) 187	Press release - BEREC Work Programme 2024 launched for public consultation	12 October 2023
BoR (23) 209	Summary report on the outcomes of the public consultation on the draft BEREC Work Programme 2024	07 December 2023

BoR (23) 209	Summary report on the outcomes of the public consultation on the draft BEREC Work Programme 2024	07 December 2023
BoR (23) 203	Summary report on the outcome of the public consultation on the draft Report on practices and challenges of the phasing out of 2G and 3G	07 December 2023
BoR (23) 205	Summary report on the outcome of a BEREC internal workshop on the migration to very high capacity networks and copper switch-off with a focus on the needs of the end users	07 December 2023

D. Strategies, annual work programme and annual reports

Document number	Description	Date
BoR (23) 02	Outline BEREC Work Programme 2024	26 January 2023
BoR (23) 109	BEREC Annual Report 2022	08 June 2023
BoR (23) 176	Draft BEREC Work Programme 2024	05 October 2023
BoR (23) 210	BEREC Work Programme 2024	07 December 2023

E. Regulatory best practices (Common approaches/positions, Guidelines, Methodologies)

Document number	Description	Date
BoR (23) 42	Draft BEREC Guidelines on Very High Capacity Networks	09 March 2023
BoR (23) 164	BEREC Guidelines on Very High Capacity Networks (2023)	05 October 2023
BoR (23) 179	Draft BEREC Guidelines detailing Quality of Service Parameters	05 October 2023

F. Other documents

Document number	Description	Date
BoR (23) 09	Voting report on the Draft BEREC Proposal for BEREC participation to the DMA High-Level Group	25 January 2023
BoR (23) 11	Voting report on the Draft Outline BEREC Work Programme 2024	27 January 2023
BoR (23) 20	Voting report on the Draft proposal for election of additional BEREC Vice-Chair	10 February 2023

BoR (23) 52	Voting report on the Draft BEREC Opinion on Phase II case CZ-2022-2421	24 February 2023
BoR (23) 47	BEREC calendar of international activities and events in 2023	10 March 2023
BoR (23) 71	Voting report on the Draft 29th BEREC international Roaming Benchmark Data Report	29 March 2023
BoR (23) 75	Voting report on the Draft BEREC Opinion on the Commission Implementing Regulation (EU) 2016/2286 on Fair Use Policy and the Sustainability mechanism	30 March 2023
BoR (23) 80	Voting report on the Draft Study on wholesale mobile access connectivity, trends and issues for emerging mobile technologies and deployments	14 April 2023
BoR (23) 82	Voting report on the Draft BEREC Decision on the appointment of the Open Internet Working Group Co-Chair	26 April 2023
BoR (23) 123	Voting report on the Draft BEREC Opinion on the draft Gigabit Recommendation	05 May 2023
BoR (23) 125	Voting report on the Draft BEREC Analysis of the European Commission legislative proposal for a Gigabit Infrastructure Act	16 May 2023
BoR (23) 136	Voting report on the Draft BEREC input to the exploratory consultation on the future of the connectivity sector and its infrastructure	18 May 2023
BoR (23) 149	Voting report on Cybersecurity and resiliency of Europe's communications infrastructures and networks - Follow-up to the Nevers Call	15 June 2023
BoR (23) 157	Voting report on the Draft BEREC input to the European Commission on the functioning of BEREC and the BEREC Office in view of the evaluation under Article 48 of the BEREC Regulation	05 September 2023
BoR (23) 193	Voting report on the appointment of the Fixed Network Evolution Working Group Co-Chair	01 December 2023

Annex 9 – Board of Regulators electronic voting procedures

Subject	Comments round Date/link to documents	Voting round Date/link to documents
Draft BEREC Proposal for BEREC participation to the DMA High Level Group	17 January 2023	23 January 2023
Draft Outline BEREC Work Programme 2024	16 January 2023	24 January 2023
Draft proposal for election of an additional BEREC Vice-Chair	06 February 2023	08 February 2023
Draft BEREC Opinion on Phase II case CZ-2022-2421		23 February 2023
Draft 29th BEREC international Roaming Benchmark Data Report	21 March 2023	27 March 2023
Draft BEREC Opinion on the Commission Implementing Regulation (EU) 2016/2286 on fair use policy and the sustainability mechanism	23 March 2023	29 March 2023
Draft Study on wholesale mobile access connectivity, trends and issues for emerging mobile technologies and deployments	28 March 2023	04 April 2023
Draft BEREC Decision on the appointment of the Open Internet Working Group Co-Chair	18 April 2023	21 April 2023
Draft BEREC Opinion on the draft Gigabit Recommendation	27 April 2023	03 May 2023
Draft BEREC Analysis of the European Commission legislative proposal for a Gigabit Infrastructure Act	09 May 2023	15 May 2023
Draft BEREC input to the exploratory consultation on the future of the connectivity sector and its infrastructure	15 May 2023	17 May 2023
Cybersecurity and resiliency of Europe's communications infrastructures and networks - Follow-up to the Nevers Call	14 June 2023	14 June 2023
Draft BEREC input to the EC evaluation of the functioning of BEREC and BEREC Office	25 July 2023	31 August 2023
Draft Decision of the Board of Regulators on the appointment of the Co-chair of Fixed Network Evolution Working Group	22 November 2023	28 November 2023

Annex 10 – List of abbreviations/acronyms

BEREC: Body of European Regulators for Electronic Communications

BoR: Board of Regulators

BU: Bottom-up

CAPs: Content and Application Providers

CAPM: Capital Asset Pricing Model

CDN: Content Delivery Networks

CJEU: Court of Justice of the European Union

CSP: Communications service providers

DA: Digital Act

DESI: Digital Economy and Society Index

DMA: Digital Markets Act

DOCSIS: Data Over Cable Service Interface Specification

DSA: Digital Service Act

EaPeReg: Eastern Partnership Electronic Communications Regulators Network

EC: European Commission

ECS: Electronic Communications Services

ECN: Electronic Communications Networks

EEA: European Economic Area

EECC: European Electronic Communications Code

ENISA: European Union Agency for Network and Information Security

EoI: Equivalence of Inputs

ERP: Equity Risk Premium

ERGA: European Regulators Group for Audiovisual Media Services

ERT: Economic Replicability Test

EU: European Union

FCC: Federal Communications Commission (United States of America)

FDC: Fully-Distributed Costs

FTTB: Fibre-To-The-Building

FTTC: Fibre-To-The-Cabinet

FTTdp: Fibre-To-The-Distribution-Point

FTTH: Fibre-To-The-Home

FTTN: Fibre-To-The-Node

FTTP: Fibre-To-The-Premises

IAS: Internet Access Services

ICS: Interpersonal Communication Services

IP: Internet Protocol interconnection

ISP: Internet Service Provider

ITRE: European Parliamentary Committee on Industry, Research and Energy

ITU: International Telecommunications Union

LLU: Local Loop Unbundling

LTE: Long-Term Evolution

MNO: Mobile Network Operator

MoU: Memorandum of Understanding

MVNO: Mobile Virtual Network Operator

NCA: National Competition Authority

NGA: Next Generation Access

NI-ICS: Number-Independent Interpersonal Communication Services

NIS: Network and Information Systems

NRA: National Regulatory Authority

NTP: Network Termination Point

OCA: Other Competent Authority

QoS: Quality of Service

OTT: Over-the-top

REGULATEL: Latin American Forum of Telecommunications Regulators

RFR: Risk Free Rate

RSPG: Radio Spectrum Policy Group

SMP: Significant Market Power

SMS: Short Message Service

TD: Top-down

TRAI: Telecom Regulatory Authority of India

ULL: Unbundled Local Loop

VDSL: Very-High-Bit-Rate Digital Subscriber Line

VHCN: Very High Capacity Network

VPN: Virtual Private Network

VULA: Virtual Unbundled Local Access

WACC: Weighted Average Cost of Capital