

BEREC Common Position on Mobile Infrastructure Sharing

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Content

Executive Summary 2

1. Introduction	3
2. Background	5
2.1. Legal Framework	5
2.1.1. The objectives given by the European telecommunication regulatory framework.....	5
2.1.2. The legal instruments provided for achieving the objectives	6
2.1.3. Role of general competition law.....	8
2.2. Benefits and drawbacks related to sharing agreements.....	8
2.2.1. Potential benefits of infrastructure sharing.....	9
2.2.2. Potential drawbacks of infrastructure sharing	10
3. Common Position	11
3.1. Common position (CP1) on the typology of infrastructure sharing types.....	11
3.1.1. Passive sharing.....	12
3.1.2. Active sharing.....	12
3.1.3. Other sharing types.....	13
3.2. Important objectives and factors to consider when assessing mobile network infrastructure sharing agreement.....	13
3.2.1. Common position (CP2) on the main objectives to be pursued when.....	14
considering network sharing agreements.....	14
3.2.2. Common position (CP3) on the parameters to consider when assessing network sharing agreements in order to achieve/maintain the above mentioned objectives	15
4. Indicative analysis of different types of network sharing, according to the above mentioned objectives and parameters	18
4.1. Passive sharing.....	18
4.2. Active Sharing.....	19
4.3. Spectrum sharing.....	19
4.4. National roaming	20
4.5. Other situations where network sharing agreements could be possible, but in duly justified conditions	21
Appendix 1 - Role of general competition law	23
Appendix 2 - Acronyms	26

Executive Summary

This Common Position describes criteria which can be taken into account by NRAs in assessing mobile infrastructure sharing agreements where NRAs have competence to do so.

It is intended to provide NRAs, stakeholders and interested parties with information relating to the treatment of such agreements in Europe.

To this end, this document provides 'background information' relevant to the consideration of infrastructure sharing agreements which do not (on their own) constitute a Common Position. This includes information on relevant legal frameworks relating to the treatment of infrastructure sharing agreements and information on the potential benefits and drawbacks of infrastructure sharing agreements.

The Common Position itself consists of:

- common definitions of different infrastructure sharing types: passive sharing, co-location, site sharing, mast sharing, active sharing, RAN sharing, MORAN sharing, MOCN sharing, frequency (or spectrum) pooling, national/local roaming, core network sharing and backhaul sharing;
- common important objectives which NRAs should consider when assessing infrastructure sharing agreements (providing that it is within their competence to do so): effective competition, better connectivity and efficient use of spectrum;
- common factors which NRAs should consider when assessing infrastructure sharing agreements (providing that it is within their competence to do so): competitive market forces evolution, the feasible level of competition, type of sharing, shared information between the sharing parties and its impact on their ability to compete, reversibility and contractual implementation.

It should be noted that consideration of these factors, their relative importance to one another, and the relevance of potentially significant other factors not listed here are likely to be highly context specific. In all instances, therefore, assessing infrastructure sharing agreements will require evidence-based analysis on a case-by-case basis.

Finally, this document provides a description of potential treatment of specific infrastructure sharing types.

1. Introduction

The sharing of mobile network infrastructure is an established feature of many European mobile markets. Several markets have more than one such system in place, which generally come about either as a result of commercial negotiation between participating parties, or – less frequently – as a result of regulatory intervention by NRAs and/or competent authorities.

In appropriate circumstances (where they comply with competition law and subject to market context), network sharing agreements can bring benefits to end users.

A number of reports/positions on mobile network infrastructure sharing have already been published. BEREC itself has published two such documents:

- a) In June 2011, BEREC published, jointly with the RSPG, a report on mobile infrastructure sharing in Europe¹ ('the 2011 report'). This report described those sharing agreements which had been established at that time. It identified a number of potential benefits to infrastructure sharing (subject to market context). These are discussed in greater detail in this document.
- b) In June 2018, BEREC published a report which described features of mobile infrastructure sharing in European markets and provided an outline of some of the potential benefits and drawbacks of such arrangements ('the June 2018 report').² The report was based on responses from thirty European NRAs. That report demonstrated that the majority of infrastructure sharing agreements in Europe are the result of commercial negotiation, rather than regulatory intervention and their impacts on the market are context-specific.

This document is intended to build on BEREC's previous work on mobile infrastructure sharing by identifying and describing factors to be considered by NRAs when assessing any infrastructure sharing agreement, where they have competence to do so. Therefore, the remit of this common position is limited to NRAs acting under the electronic communication legislation.

It is intended to provide:

1. NRAs with a common non-exhaustive list of criteria for consideration in those situations where they assess network sharing;
2. information to stakeholders with an interest in infrastructure sharing agreements in Europe;
3. a contribution to a consistent application of the EU telecommunications rules in the context of infrastructure sharing, while taking into account the difference in national circumstances among EU Member States;

¹ BoR (11) 26: https://bereg.europa.eu/eng/document_register/subject_matter/bereg/reports/224-bereg-rspgreport-on-infrastructure-and-spectrum-sharing-in-mobilewireless-networks

² BoR (18) 116 https://bereg.europa.eu/eng/document_register/subject_matter/bereg/reports/8164-bereg-reporton-infrastructure-sharing

4. updated observations relating to the potential risks and benefits of infrastructure sharing.

It is to be noted that market context is likely to be highly significant in any assessment of infrastructure sharing agreements.

This document is organized in the following way:

1. Background information on mobile infrastructure sharing agreements relevant to the Common Position. This includes:
 - (a) An overview of the legal framework relevant to the assessment of infrastructure sharing agreements;
 - (b) Some of the potential benefits and drawbacks of such agreements;
2. Common Position about mobile network infrastructure sharing:
 - (a) A typology of different infrastructure sharing types;
 - (b) Important objectives
 - (c) Factors most likely to be relevant when assessing mobile network infrastructure sharing agreements;
3. An example assessment of different types of network sharing using factors defined in the Common Position.

2. Background

This background section first provides an overview of the legal framework applicable to mobile network infrastructure sharing agreements. It then identifies some benefits and drawbacks that can stem from such sharing agreements.

2.1. Legal Framework

The legal framework enables competent authorities – in limited and respectively specific situations - to restrict or to impose infrastructure sharing. Thus, this subsection describes the current and the new legal framework which applies to infrastructure sharing agreements. In doing so, both the European electronic communications framework adopted in 2002 amended in 2009 and the new European electronic communication code are considered. Directive (EU) 2018/1972 of the European Parliament and of the Council of 11 December 2018 establishing the European Electronic Communications Code (hereinafter- the Code) entered into force on 20 December 2018. This Directive establishes a harmonised framework for the regulation of electronic communications networks (hereinafter- ECN), ECS, associated facilities and associated services and certain aspects of terminal equipment. It also repeals Directives 2002/19/EC, 2002/20/EC, 2002/21/EC, 2002/22/EC as of 21 December 2020. Member States shall implement into its national law this Directive by 21 December 2020.

First, the objectives and powers of competent authorities (being the NRA or another authority³) in the telecommunications-specific legal framework relevant for infrastructure sharing agreements are described.

Secondly, the legal instruments provided for achieving the general objectives are addressed.

Thirdly, the role of general competition law relating to infrastructure sharing agreements in Europe is briefly described. General competition law applies to all infrastructure sharing agreements. National law is not described in this document but it may provide for specific provisions applicable to infrastructure sharing agreements in the Member States concerned.

2.1.1. The objectives given by the European telecommunication regulatory framework

Under the European electronic communications framework adopted in 2002 and amended in 2009 (Directives 2002/19/EC, 2002/20/EC, 2002/21/EC, 2002/22/EC), competent authorities have several objectives, including:

- a) Promote competition;
- b) Contribute to the development of the internal market, and;
- c) Promote the interests of the citizens of the European Union.⁴

³ Depending on national law, the competences could be on the NRA or on another authority.

⁴ Article 8, Directive 2002/21/EC on a common regulatory framework for electronic communications networks and services as amended by Directive 2009/140/EC and Regulation 544/2009 (known as the Framework Directive)

The Code repeats the existing three primary general objectives of promoting competition, the internal market and end-user interests. The Code⁵ also includes the additional objective of connectivity and access to very high capacity networks and emphasises that competition includes efficient infrastructure-based competition.

One of the regulatory principles embedded in the Code is to promote efficient investment and innovation in new and enhanced infrastructures. This includes ensuring that any access obligation takes appropriate account of the risk incurred by the investing undertakings. It also includes permitting various cooperative arrangements between investors and parties seeking access to diversify the risk of investment, whilst ensuring that competition in the market and the principle of non-discrimination are preserved.

Independently of the Code, the Broadband Cost Reduction Directive has the objective to reduce the cost for deployment and to promote the joint use of physical infrastructure.⁶

2.1.2. The legal instruments provided for achieving the objectives

To achieve these objectives, the European electronic communications framework adopted in 2002 and amended in 2009 (Directives 2002/19/EC, 2002/20/EC, 2002/21/EC, 2002/22/EC) granted competent authorities several regulatory instruments, including:

- (i) Competent authorities may attach conditions to spectrum usage rights in order to achieve the objectives of regulation on a non-discriminatory, proportionate and transparent basis. For example, they may attach conditions on coverage and/or quality.⁷ This may concern active as well as passive sharing.
- (ii) Competent authorities might impose passive sharing if the establishment of the passive infrastructure was based on rights of way.⁸ This solely concerns passive sharing.
- (iii) Competent authorities shall ensure that competition is not distorted by any transfer or accumulation of rights of use of radio frequencies.⁹ In such a case, the competent authority may prohibit any transfer or impose conditions. Thus, for any spectrum pooling that requires a transfer of rights of use, the related transfer of rights requires approval by the competent authority and may be prohibited or conditions might be imposed. This primarily concerns active sharing.

The broadband cost reduction directive also requires MNOs to give access to their physical infrastructure. Competent authorities have to resolve disputes arisen between operators and may impose a price for access.

⁵ Article 3 EECC.

⁶ Broadband Cost Reduction Directive – Directive 2014/61/EU of the European Parliament and of the Council of 15 May 2014 on measures to reduce the cost of deploying high-speed electronic communications networks.

⁷ See Article 6.1 Authorisation Directive. Furthermore, Article 5 of the Decision No 243/2012/EU of the European Parliament and the Council of 14 March 2012 establishing a multiannual radio spectrum policy programme, foresees the possibility for Member states to adopt measures such as conditions on rights of use for national or regional roaming.

⁸ Article 12 of the Framework Directive.

⁹ Article 5.6 Authorisation Directive

Under the Code, the instruments available with respect to infrastructure sharing are the following:

- a) According to Article 47, competent authorities shall attach conditions to individual rights of use of radio spectrum to ensure optimal and the most effective and efficient use of radio spectrum and promoting coverage. In particular, competent authorities may provide for the following possibilities (a) to share passive or active infrastructure which relies on radio spectrum, or radio spectrum, (b) to enter into commercial roaming access agreements and (c) to jointly roll-out. Of particular importance here is the effective and efficient use of the spectrum, the promotion of coverage and the rapid deployment of networks (especially in less densely populated areas). In this regards, competent authorities shall not prevent the sharing of radio spectrum in the conditions attached to the rights of use for radio spectrum. Implementation by undertakings of conditions attached pursuant to this paragraph shall remain subject to competition law. This instrument may concern passive as well as active sharing.
- b) According to Article 52 and – if applicable – Article 51, competent authorities shall promote effective competition and avoid distortions of competition in the internal market when deciding to grant, amend or renew rights of use for radio spectrum. To pursue this objective, competent authorities shall take appropriate measures. For the assessment of the necessity of such measures, competent authorities shall take the approach of market analysis into account. This may also concern infrastructure sharing under the appropriate conditions. For example, roaming might be imposed for entry assistance.
- c) According to Article 44, competent authorities may impose sharing in order to protect the environment, public health, public security or to meet town- and country- planning objectives if the establishment of the infrastructure was based on rights of way.
- d) According to Article 61.4, competent authorities will have the power to impose obligations either to share passive infrastructure and or to conclude localised roaming agreements. These obligations would be imposed only under the following conditions: First, passive sharing or localized roaming must be directly necessary for the local provision of services which rely on the use of radio spectrum. Second, no viable and similar alternative means of access to end-users is made available to any undertaking on fair and reasonable terms and conditions. Third, the possibility to impose sharing is clearly provided for when granting the rights of use for radio spectrum. Fourth, market-driven deployment of infrastructure for the provision of networks or services which rely on the use of radio spectrum is subject to insurmountable economic or physical obstacles and therefore access to networks or services by end-users is severely deficient or absent. In those circumstances where access and sharing of passive infrastructure does not suffice to address the situation, sharing of active infrastructure may be imposed. Upon failure of commercial negotiations, competent authorities shall resolve the dispute with a binding decision.¹⁰

Sharing implemented under such conditions shall remain subject to competition law. To summarize, the most important new instruments in the Code are:

¹⁰ See Article 26 for the relevant procedure.

1. The Code introduces new powers to impose passive or even active sharing under exceptional circumstances. For imposing obligations, the Code clearly indicates that passive sharing is the preferred solution and active sharing or even roaming shall only be relied on if passive sharing does not suffice.
2. The Code enables competent authorities to impose passive sharing based on public interest grounds.
3. The Code imposes strict conditions and requires a detailed assessment before sharing can be imposed on operators.

2.1.3. Role of general competition law

Depending on the competences held by them, certain NRAs may also review cases according to competition law which serves to address and remove concerns in relation to agreement, concerted practices or unilateral behaviour which restrict or distort competition in the relevant market. However, in general national competition authorities and national courts are responsible for ex-post monitoring¹¹ and enforcing competition law.

In some situations NRAs – within their specific competences in the respective Member State – might be obliged to apply competition law based principles when adopting decisions on the basis of the relevant sector legislation.¹² In those cases their assessments are required to be based on the same methodologies as under competition law, reflecting the applicable jurisprudence of the Court of Justice of the European Union and taking into account, to the extent relevant, the Commission's decisional practice in the enforcement of the European competition rules. In practice, it cannot be excluded that parallel procedures under *ex ante* regulation and EU competition law may apply with respect to different types of competition problem(s) identified on the relevant market(s).

The appendix details some elements and considerations from competition law which are likely to apply to existing/potential mobile infrastructure sharing agreements.

In any case, the remit of this common position is limited to NRAs acting under the electronic communications legislation.

2.2. Benefits and drawbacks related to sharing agreements

This section details the potential benefits and drawbacks resulting from infrastructure sharing agreements. All outcomes resulting from infrastructure sharing agreements will depend on the wider structure and dynamics of a given market. Nonetheless, it is possible to identify potential benefits and drawbacks associated with infrastructure sharing agreements in general terms.

The potential benefits and drawbacks were identified at a high level in the June 2018 BEREC report, which simply described potential benefits and drawbacks identified by NRAs. Similarly, benefits and drawbacks (labelled 'challenges') were identified in the 2011 report. In this section, common benefits/drawbacks are identified by grouping the individual items identified

¹¹ Additionally, competition authorities are responsible for ex-ante monitoring within the framework of merger control.

¹² See recital 124 of the Code. Principles of competition law have to be applied when formulating conditions attached that may impact the viability of infrastructure sharing.

by NRAs into seven different groups (four different benefits types, three different drawback types). The exact nature and impact of these benefits/drawbacks will depend on the type of sharing agreement and the market context.

These benefits and drawbacks are described separately. Nevertheless, they are not necessarily distinct, in the sense that there might be an association between the presence of one factor with the presence of another one. Demonstrating a causal relationship between factors would require a detailed, quantified analysis of the relationship between them. It is, therefore, beyond the scope of this paper.

2.2.1. Potential benefits of infrastructure sharing

The potential benefits of infrastructure sharing have been observed in many markets. The June 2018 report briefly described the common benefits that are collected from the NRA answers to the BEREK infrastructure sharing questionnaire. This position paper elaborates these benefits in more detail by grouping them into different categories. The first two categories listed below also match the observations reported in the 2011 report.

Benefit 1: cost reduction

Cost reduction is a driver for operators to engage in infrastructure sharing. Where NRAs have available estimates, there is a general view that sharing can save costs. As the saving potentials are highly context and network design dependent, the reported saving percentages vary. NRAs also indicate that active sharing (which typically includes passive sharing) can achieve greater savings than passive sharing. The cost saving is likely to differ depending on technology type (i.e. 4G vs. 3G), the location where the sharing takes place (i.e. city centre vs. rural areas), and the timing when the sharing is implemented (i.e. greenfield vs. network consolidation). Some NRAs indicated that operators need to have sufficient incentive to pass at least part of these savings to consumers, for instance by reducing prices and/or by improving network coverage and quality of service. In this context, an issue of relevance is whether the costs savings realized are fixed costs or variable costs, with the latter being more likely to be passed on to consumers in the form of price reduction or quality improvement.

Benefit 2: improved efficiency (with respect to administrative costs and efficient use of spectrum)

The 2011 report identified improved efficiency as a potential benefit of infrastructure sharing, in particular frequency re-use to allow spectrum users to exploit under-used spectrum and promote a more efficient use of resources.

This potential benefit clearly remains relevant for current infrastructure sharing agreements, given that spectrum is a finite resource. In addition to technology-related efficiency gains (i.e. spectrum, capacity) which were the focus of the 2011 report, administrative efficiency improvements (i.e. reducing the costs and efforts related to obtaining necessary documentation to set the network) were mentioned by a large number of NRAs as a potential efficiency-related benefit of sharing.

Benefit 3: enhancing consumer choice

The 2011 report noted that infrastructure sharing agreements can provide benefits to end users as long as they are not detrimental to competition. This remains the case. In addition,

there is some anecdotal evidence from NRA experiences that infrastructure sharing has allowed the preservation of service-based competition in certain geographic areas. The reason for this is that it allows operators to operate or remain operating in areas where otherwise it would have been too burdensome and inefficient to individually deploy a network. As noted above, this will be highly market and context specific, and infrastructure sharing might also lead to competition concerns.

Benefit 4: public interest

The 2011 report briefly mentioned the environmental and health protection as a potential benefit to infrastructure sharing agreements. The results reported by NRAs in 2018 questionnaire demonstrate that these environmental benefits are not everywhere the same and the variety depends in general on each area type. For example, these benefits may be particularly relevant in areas where outstanding landscape needs to be protected (such as monuments and national parks) and in areas where operators can contribute to town/country planning during the establishment of network infrastructure. As another example, sharing might also decrease energy consumption, thereby lowering the carbon footprint of the electronic communications sector and contributing to the fight against climate change.

2.2.2. Potential drawbacks of infrastructure sharing

Potential drawbacks associated with infrastructure sharing were identified by NRAs in a smaller number of markets compared with potential benefits.

The 2011 report and the June 2018 report both described in simple terms the common drawbacks associated with infrastructure sharing agreements that were identified by NRAs. This position paper elaborates this analysis by grouping potential drawbacks into three different categories relating to competition, coordination and network resilience.

Drawback 1: Reduced incentives to invest/ability to compete

Sharing agreements can negatively impact incentives for participants to invest in their own infrastructure, as any gains in service offering (relating, for example, to coverage, network quality etc.) resulting from a new investment are likely to be shared with other parties involved. The degree to which other parties benefit from this will necessarily depend on the sharing agreement type. – It is noted that it is possible to design sharing agreements where such effects are alleviated to some extent (for example by requiring a set decision making process or using key performance indicators to ensure continued investment).

At the same time, network operators participating in sharing agreement are likely to have a reduced ability to compete independently in particular regarding coverage, but with independent core networks the provisioning of services could be largely in competition. This potential drawback is likely to be particularly pronounced in active sharing agreements, as this, for example, limits the ability to independently replace active equipment. Of course, the ability to compete at levels outside shared architecture might remain to some extent.

This reduction in incentives and ability to compete for those parties involved in a network sharing agreement means that end user choice – both between different infrastructure providers and between different service offerings – might be reduced. The range of problems relating to investment incentives/ability to compete were identified by both the 2011 and June 2018 reports. The degree to which these concerns impact dynamics in a given market will

depend on context. It is possible, for example, for an infrastructure sharing agreement to provide a greater incentive for investment in a network, as they can reduce the costs to operators of offering coverage in a wide area (compared with when an operator is required to rollout an entire network on its own).

Drawback 2: Requirement for increased coordination between participants

Sharing agreements will necessarily require greater coordination between participants which will need to share at least some information to collaborate on network deployment. This presents an obvious risk relating to tacit collusion as well as potential breaches of competition law (dealt with in section 2.1 of this report) which must be addressed by participating parties.

More broadly, sharing agreements might lead to delays in deployment, as joint-decision making processes can add a layer of bureaucracy to the already complex process and potentially reduced incentives of network deployment. Extensive planning coordination can lead to delays at both the 'strategic' level (relating to network design and network evolution) and the 'operational level' (relating to the actual deployment of the network). Loading a host network site with active equipment from different network operators (which is typical of some passive sharing agreements), for example, might load a site in such a way that installation of new equipment modules related to the introduction of new technologies might be more difficult. The extent and impact of this drawback type is likely to depend on sharing type and network design.

Linked to this, consolidating two previously distinct networks following an infrastructure sharing agreement is likely to involve costs to network operators (relating, for example, to site removal, dismantling of superfluous equipment etc.) Often, this will be offset by efficiency gains resulting from the new infrastructure sharing agreement, but it does present a potential risk to parties with their own networks entering into such agreements.

Drawback 3: Reduced network resilience due to increased demand on host networks/sites

Shared infrastructure might reduce the overall resilience of mobile networks in a given geographic location. This is because fewer independent mobile networks will reduce the ability for end users to switch to alternative network operators when their own host network is unavailable (for example, when needing to contact emergency services). Similarly, network problems (e.g. RAN SW errors) can have a higher impact (affecting a greater number of end users over a wider areas) in situations where the RAN is shared. Again, this drawback needs to be balanced against the risk of no network whatsoever being deployed in the absence of a network sharing agreement.

3. Common Position

3.1. Common position (CP1) on the typology of infrastructure sharing types

The term 'mobile (or wireless) network infrastructure sharing' is used in Europe to denote different types of arrangement whereby two or more operators share some network or infrastructure elements to deliver services. Currently, there are no established criteria used to

denote different types of infrastructure sharing (although a number of stakeholders, including the 3GPP¹³, the GSMA¹⁴ and the OECD¹⁵ have provided a description of the different sharing types which can be seen on the market).

For the purposes of promoting common understanding between NRAs on sharing, BEREC is of the common position that NRAs should use the following definitions for inter-European discussions.

These definitions are primarily retrospective and do not preclude the emergence of any new types of sharing agreements not described here which might emerge in future.

3.1.1. Passive sharing

Passive sharing is the common use by two or more operators of passive elements of their respective networks. Passive elements are those which are not able to process or convert telecommunication signals in any way and which are not integrated parts of the system dedicated specifically to the conveyance of signals. Passive elements are sometimes referred to as ‘unpowered components’ as these elements usually do not require a power supply. This is however not always the case. For instance, air conditioning for cooling equipment might be considered a passive element, but usually requires an external power supply. Passive sharing can encompass the sharing of passive backhaul elements.

Co-location is a form of passive sharing where the operators share the same location (such as compound, base station sites, rooftops, etc.) for the construction of the base stations. It could be limited to a common access to the location. It could also include the use of common masts and other mounting/supporting constructions or cabinets including related installations (such as air conditioning, power supply etc.).

Site sharing is a form of co-location where two or more operators agree to deploy their masts or other supporting constructions in the same location. Typically, each operator provides own mast, backhaul, cabinets and active equipment.

Mast sharing is a form of co-location where two or more operators agree to use the same mast or other supporting construction. Generally, each operator provides own backhaul, cabinets and active equipment.

3.1.2. Active sharing

Active sharing is the common use by two or more operators of active elements of their respective networks. Active elements are those which are able to generate, process, amplify and control signals. Examples of active elements are very diverse and include many different types of electronic equipment (hardware and software) capable of various functions (transmitters, receivers, amplifiers, decoders etc.). While antennas have been traditionally classified as passive elements, technology advance has led to a paradigm shift to active antenna systems (AAS), which are considered a key enabler for 5G networks. Such antennas

¹³ See: 3GPP TS 23.251 version 14.1.0 Release 14

¹⁴ <https://www.gsma.com/publicpolicy/wp-content/uploads/2012/09/Mobile-Infrastructure-sharing.pdf>

¹⁵ [https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/ICCP/CISP\(2014\)2/FINAL&docLanguage=En](https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/ICCP/CISP(2014)2/FINAL&docLanguage=En)

(or antenna arrays) can also be considered as active when equipped with radio frequency units such as amplifiers and signal processing elements. Furthermore, 5G, including virtualization technology, may enable new forms of network sharing, in particular for building common network slices tailored to specific services.

RAN sharing is a form of active sharing where two or more operators agree to use the same access network equipment, including base station active equipment and possibly the antenna. Each operator uses its own core network. This type of active sharing itself can typically be split into two types, depending on whether operators share the same spectrum or not:

- **Multi-Operator Radio Access Network (MORAN) sharing** is a form of RAN sharing where only equipment is shared (i.e. not spectrum). The end-users of each operator access the services of their respective MNO with the frequencies of their respective MNO.
- **Multi Operator Core Network (MOCN) sharing** is a form of RAN sharing where all elements of the radio access network, including spectrum, are shared. The end-users of each operator can access the services of their respective MNO through all the frequencies that are shared in the access network. The frequencies can be provided by one or several operators that are part of the sharing. When the frequencies of several operators are used, it is called **MOCN with frequency (or spectrum) pooling**.

National/local roaming is a form of active sharing where one operator uses the mobile service of another operator within the same country for the purpose of providing services to its end users.

3.1.3. Other sharing types

Core Network sharing is a form of sharing where operators agree to share elements of their core network, either on a standalone basis or in addition to sharing elements of their access network(s). Core network sharing can be limited to data transmission ring which connects the core network components and can extend to components themselves (such as switching centre with HLR, billing platforms and value-added services (VAS)).

Backhaul sharing is a form of sharing where one or more operators share backhaul elements. It is a form of passive sharing when the shared elements are passive, for example ducts and poles. It is a form of active sharing when it is the common use of network components for data transmission.

3.2. Important objectives and factors to consider when assessing mobile network infrastructure sharing agreement

Depending on the country, NRAs may have to assess sharing agreements between operators. Such situations may occur when:

1. the competent authority is preparing spectrum awards. In particular, when granting rights of use of spectrum, competent authorities/NRAs may include rules in the conditions attached to the rights of use. Those rules may in particular either aim at securing the effective and efficient use of spectrum, ensure the local provision of services or specifically address competition issues. This could correspond to the case where a competent authority assesses the possibility to introduce transitory roaming obligation in

order to host a new entrant operator. This could also be to introduce sharing obligations associated with ambitious coverage objectives. This list is not exhaustive. Competent authorities will clearly establish such conditions attached when granting rights of use of spectrum and inform and consult interested parties;

2. An entity (e.g. competition authority, ministry, operators, other) asks the NRA to do so;
3. An NRA has to settle a dispute;
4. The national law provides the NRA with the power to assess sharing agreement.

For such situations, BEREC is of the common position that NRAs should, having regard to the particular circumstances of each case, support future network sharing agreements that comply with the objectives of NRAs while remaining in any case subject to competition law. It is of the common position that the below objectives and factors are likely to be relevant to NRA consideration of infrastructure sharing agreements.

3.2.1. Common position (CP2) on the main objectives to be pursued when considering network sharing agreements

When NRAs are to assess sharing agreements, BEREC is of the common position that the NRAs should aim at achieving/maintaining at least the following regulatory objectives as provided in the legal framework:

1. **Effective competition:** this general objective could be achieved in different ways according to the situation.
 - a) **Efficient Infrastructure-based competition:** the European Electronic Communications Code explicitly mentions efficient infrastructure-based competition as an objective which competent authorities should pursue. Infrastructure -based competition ensures the independent ability and incentive to invest for individual operators. It involves stand-alone network roll-out but may also involve passive infrastructure sharing. The prospect of protecting or increasing profitable sales by offering customers greater benefit (e.g. by improved coverage) or a better-value offer due to efficiency enhancements drives investments and constitutes a central incentive for the build-up and expansion of mobile communications infrastructure. The larger an operator's market share is, the smaller is the incentive to make such investments in order to win additional customers from other competitors. And the lower the competitive pressure of others, the smaller is the incentive to retain the existing customers through investments and better offers. At the same time, joint rollout and joint operation of mobile communications infrastructure, as opposed to several independent infrastructures, might bring savings in many areas. In areas with low usage the benefits from network sharing in mobile communications are comparatively high.
 - b) **Service-based competition:** This relates to relatively direct competition in defining a specific offer with regard to price, quality of services, bandwidth, data volume and similar parameters. In fact, infrastructure-based competition is not always feasible. For example, a new entrant operator will initially not be able to compete solely based on its own infrastructure. Therefore, an entrant might rely on a temporary national roaming agreement, allowing market entry in technical and economic conditions that permit effective competition with existing operators. Another example is a project

bringing additional coverage that might not be economically profitable and thus feasible for an individual operator. Thus, infrastructure sharing and realizing economies of scale in a network sharing agreement might be indispensable to realize such a project at all.

Based on these considerations, NRAs should ensure effective competition between actors **for the end user's benefit**, when assessing sharing agreements.

2. Better connectivity

- a) service improvements in terms of coverage (digital land development) or quality of service (throughput, service continuity or other mission-critical performance parameters such as low latency and reliability, e.g. needed for connected and automated driving along highways)
- b) facilitate the development of IoT, machine type communication, network slicing for the next generation networks, management of legacy technology or services with a long lifecycle (such as GSM-based machine-type communications, including access to e-Call for cars), etc.
- c) reduction of cost of deployment for passive infrastructure of high speed electronic communications network (also in line with the broadband cost reduction directive)

3. Efficient use of spectrum

Spectrum rights of use are a scarce and essential input into the concentrated market for the provision of mobile services. Access to spectrum rights of use may be a barrier to entry and also to network expansion by MNOs. Many NRAs are legally required to ensure the effective and efficient use of spectrum, and this would necessarily apply when assessing sharing agreements between operators.

The assessment of the positive impact on effective competition, better connectivity and efficient use of spectrum should generally be considered based on a 'counterfactual analysis', i.e. in comparison with a situation where rollout is made without the proposed sharing, in order to determine the incremental positive impact that could not be achieved without sharing. This counterfactual analysis may be different if the NRA has imposed an obligation of passive sharing or may identify that one or more of the sharing partners would not be able to roll out on a standalone basis.

3.2.2. Common position (CP3) on the parameters to consider when assessing network sharing agreements in order to achieve/maintain the above mentioned objectives

When assessing network sharing projects in order to achieve or maintain the above mentioned objectives, NRAs have to consider a set of parameters. BEREC does not define an exhaustive list of parameters relevant for the assessment of all existing network sharing agreements. However, BEREC is of the common position that, inter alia, the following parameters are to be considered when assessing network sharing agreements in order to achieve/maintain the above mentioned objectives:

1. Competitive market forces evolution (including for the non-sharing parties and the market in general):

A sharing agreement is likely to have an impact on competition. This potential impact on competition requires careful examination. Especially, BEREC has identified several sub-parameters (like market shares, number of operators involved in the sharing, the technologies involved, the geographic scope and the time frame...) which are relevant for the assessment of the impact on competition. NRAs should at least refer to the below parameters when assessing the competitive market forces evolution:

- a) **Market shares/competitive forces:** Sharing agreements can change the market structure, especially if one of the sharing parties is already benefiting from a **strong position** in the market. A sharing agreement should not lead to a situation where any or all sharing party/parties is/are in a position to impose its/their commercial strategy on the market, independently of its competitors, and ultimately the market. Effective competition between MNOs needs to be ensured. The NRA should thus consider whether a proposed agreement negatively affects rivalry between the parties to the agreement and thus competition and/or creates entry or expansion barriers for other competitors on the market;
- b) **Number of operators involved in the sharing:** the above point implies that the number of operators involved in the sharing, as well as the number of operators that are not involved, is an important parameter. For example, a sharing agreement of three operators out of four in the market should be cautiously assessed, because a large part of the market could jointly decide on infrastructure decisions, without an external force that is sufficiently strong to challenge/disrupt and to competitively constrain the operators on the shared infrastructure;
- c) **The technologies involved** should also be considered (3G, 4G...), and whether all or only some of the technologies are included. The more a sharing agreement involves competitive technologies (4G, 5G...) that still require substantial investment, the more this sharing is critical;
- d) **The geographic scope:** BEREC is of the common position that the concerned area is likely to have a great impact on competition (detailed below as a specific point);
- e) **The time frame:** The impact on competition should be assessed in different time frames (i.e. short term and long term). For example, whether it is a temporary sharing agreement that aims at assisting entry of a new operator into the market, or a permanent sharing between the involved actors.

2. Feasible level of competition:

Whether and to what extent infrastructure-based competition is feasible depends in many countries on geographical circumstances and thus on the areas concerned. Consequently, with respect to the geographic scope, the specificities of individual member states have to be taken into account. For example, infrastructure based competition might be feasible for the total area of some countries since the whole area is densely or moderately populated. The impact of the geography on the feasibility of infrastructure based competition might also depend on the frequency bands considered. Especially due to the specificities of the geographic and demographic factors, as a general rule, a case by case assessment of the area which must be examined is advisable.

- a) **Areas, where full infrastructure-based competition is reasonably feasible:** For example, deployments of own infrastructure often tend to be profitable for operators

in densely-populated areas since a large part of the demand can be addressed with a deployment over a limited area (i.e. the economies associated with population densities are high). In this context, the promotion of infrastructure-based competition is likely to be preferable because it encourages investment, innovation, and in the end effective competition for the benefit of customers;

- b) **Areas, where the feasibility of infrastructure-based competition is not pre-determined, requires a case-specific assessment:** For example, in moderately-populated areas, a level of infrastructure sharing could often bring benefits with regard to the regulatory objectives, but a lack of infrastructure-based competition leads to reduced incentives to invest and less innovation, and reduces the autonomy of actors, hampering effective competition between operators, both in the retail and wholesale markets;
- c) **Areas where infrastructure-based competition is not reasonably feasible:** For example, least densely-populated areas can often be seen as the most expensive areas in which to build and expand networks. Sharing enables deployment as well as operational cost reduction in such a way that it is indispensable to bring a minimum level of service quality to customers. In these areas, such a minimum level of service quality is infeasible with stand-alone deployments and thus infrastructure-based competition. With regard to coverage objectives, network sharing might be of particular relevance in isolated territories, where a careful consideration should be given to the sharing conditions in order to enable inclusion of other operators. Another example could be indoor coverage, subways, tunnels, particularly if property owners explicitly allow only one infrastructure.

However, within all areas, further consideration should be given to non-replicable sites or deployments. In that case, operators are confronted with such a scarcity of available sites or limited space or other essential inputs (such as power connection availability, power monitoring possibility, backhaul links, etc.) that they cannot individually deploy their parallel networks in order to supply the demand. Examples might be indoor deployments or significant deployments of small cells in specific situations (including in densely-populated areas). In these situations, infrastructure sharing could be objectively necessary for competition among MNOs, and competent authorities might – in those specific cases – even mandate sharing.

3. Type of sharing:

Different types of infrastructure sharing have a different impact. For example, passive sharing may be considered as having less impact on market and is easier to implement than active sharing which can substantially reduce infrastructure competition. Another example is that operators are less inclined to invest in infrastructure when they can use national/local roaming. However both types of sharing make sense depending on each specific case to be assessed by the NRA¹⁶.

4. Shared information between the sharing parties and its impact on their ability to compete:

Shared information between operators should generally be strictly limited to the level that is indispensable for the agreement itself and restricted to the persons necessary to the proper functioning of the shared network. The information exchange should not limit the sharing parties' ability and incentive to compete and invest. For example, if joint partners are

¹⁶ See also BoR (18) 116 BEREC Report on infrastructure sharing, chapter 4.

immediately informed of independent upgrade plans, one MNO's investment could immediately be matched by another MNO's investment. This reduces the incentive to invest and could potentially stop such upgrade plans, as there is not even a temporary competitive advantage and thus no customer gain from the partner MNO.

5. Reversibility and contractual implementation:

Sharing agreements are intrinsically inflexible, since they typically involve a commitment from the sharing parties in order to produce the expected benefits from sharing. But this rigidity should be kept to the indispensable level for the overall sharing agreement. For example, flexibility regarding upgrades, expansion or other additions of the shared network should be kept as far as possible. The reversibility of the agreement as well as the structure of the co-operation between the parties (a separate infrastructure company jointly owned, exchange of assets between the parties, wholesale arrangements, etc.) have strong implications on the rigidity of the agreement.

4. Indicative analysis of different types of network sharing, according to the above mentioned objectives and parameters

This section describes the assessment of some types of network sharing (cf. the typology of network sharing established in subsection 3.1) based on the above parameters. It does not prejudice future analysis to be conducted by NRA on future network sharing agreements¹⁷.

4.1. Passive sharing

In very general terms, passive sharing can be applicable to all area types with the following reasons:

- a) Passive agreements are less likely to have a negative impact on the differentiation capacity of operators, provided that each of the sharing parties keeps its operational freedom (e.g.: sharing parties should still have the possibility to deploy sites on a stand-alone basis);
- b) Passive sharing agreements are likely to facilitate speed of deployment/increased coverage;
- c) Passive sharing agreements are likely to facilitate environmental protection, since they allow for an efficient deployment by operators, reducing the number of sites to be deployed;
- d) Passive sharing agreements are likely to be cost-effective for operators.

¹⁷ As set out in BEREC's report on the consultation, which is published alongside this CP (see BoR (19) XX), BEREC considers that there is benefit in case by case assessment and the analysis of parameters will be context specific. BEREC's indicative analysis is high level in nature in order to provide NRAs with context on some of the types of relevant issues. BEREC encourages NRAs to continue to share information so that the indicative analysis can be supported by the latest information available to NRAs.

In conclusion, passive infrastructure sharing is encouraged across all the territory as long as there is no negative impact on effective competition.

4.2. Active Sharing

For active sharing agreements, the feasible level of competition that often relates to the geographic scope of the concerned area is likely to have a great impact, as described in the previous section (see point 2 in section 3.2.2):

- a) **Areas where full infrastructure-based competition is reasonably feasible:** In these areas, infrastructure-based competition is very likely more beneficial than active sharing. Depending on the specificities of the specific country, like competitive forces, the respective competent authority might limit active sharing for MNOs above a certain size. These areas will be very likely in the most densely populated ones.
- b) **Areas where the feasibility of infrastructure-based competition is not pre-determined and requires a case-specific assessment:** A certain degree of infrastructure-based competition in these areas is appropriate. As a consequence, in these areas, active sharing should be assessed on a case-by-case basis. These areas will be very likely in the moderately populated areas;
- c) **Areas where infrastructure based competition is not reasonably feasible (in particular, least densely-populated areas):** In these areas, a minimum level of service quality is infeasible with stand-alone deployments and thus infrastructure-based competition. With regard to coverage objectives, active network sharing might be of particular relevance in isolated territories, where a careful consideration should be given to the sharing conditions in order to enable sharing to include each operator.

However, as described in the previous section (see point 2 in section 3.2.2), within all areas, consideration should be given to non-replicable sites or deployments. In these situations, active sharing could be objectively necessary for competition among MNOs, and competent authorities might – in those specific cases – even mandate active sharing, if it is motivated in order to facilitate service based competition.

4.3. Spectrum pooling

As mentioned before, spectrum pooling is a form of MOCN sharing where the frequencies of several operators are used. It consists in a common exploitation of frequencies among several operators: the end users of these operators can access the services of their respective MNO through all the frequencies that are shared in the access network.

Such sharing may reduce the differentiation capacity of the sharing parties.

However, in areas where infrastructure competition is not feasible, spectrum pooling could answer to the coverage objective, providing better services with higher bandwidth (bitrate). In line with Article 61.4 of the Code, in case where localized roaming is imposed, the accesses might be required to share the spectrum with the access obligated party.

Thus, spectrum pooling should be carefully assessed on a case by case basis, for example by taking into account the spectrum portfolio of each operator and whether infrastructure based competition is feasible or not in the area concerned.

Hence, when spectrum pooling conditions are defined by competent authorities, it should be ensured that such conditions:

- a) include both technical and operational conditions related to the use of the spectrum, as well as conditions relating to the rights and obligations of the users of shared spectrum;
- b) are defined in a fair, transparent and non-discriminatory manner, in accordance with predefined criteria;
- c) take into account national specificities that depend on the type of existing spectrum users;
- d) take careful consideration of the possibility of effective monitoring and control of the compliance with the conditions for shared use of radio spectrum.

Moreover, in most Member States spectrum pooling (which might require variation of the terms of a licence if not foreseen initially) will require approval by the respective competent authority/NRA.

4.4. National roaming

The present analysis considers roaming agreement between two competing operators on a market. It excludes MVNO, international roaming and roaming that is mandatory by law to ensure high availability and resilience for public authorities (see 2a in section 4.5 below). Roaming is purely asymmetric since the hosted operator fully depends on the equipment deployed by the host operator and its spectrum.

Roaming is very likely to restrict the differentiation capacity of the roaming operator on several major parameters, such as coverage and quality of service (which are those of the host operator). The conditions applied on the wholesale market on the roaming operator restrict its ability to define its service at the retail level.

In consequence, subject to a case-by-case analysis, roaming is likely to not be in line with the objectives of infrastructure-based competition for the end user's benefit (including investment, innovation and competition between actors) and efficient spectrum management and usage.

Hence, **roaming for an undetermined time period could be envisaged only in those areas where infrastructure based competition is infeasible and** where investment incentive is very limited. In particular, roaming could strongly reduce the incentive to invest when central dimensions of competition are affected.

However, roaming could have significant positive effects in some specific cases, such as those detailed in the following point.

4.5. Other situations where network sharing agreements could be possible, but in duly justified conditions

This section identifies examples of cases that appear to be beyond the scope of the situations defined above, but still be in line with the defined common objectives.

1. Transitory provisions could be envisaged

Large active network sharing agreements could still be compatible with the objectives defined, if they aim at compensating an objective handicap, for example corresponding to a late entry to the market. But by construction, **these provisions could only be transitory**, and should be phased out with the disappearance of their initial motivation. This is the case of a temporary roaming agreement the latest entrant operator might rely on. That roaming agreement should not provide access to national roaming beyond what is necessary to allow the entrant to invest in its own network

2. Undetermined in time but targeted provisions could be envisaged

Some specific cases of sharing agreements of an undetermined time period could also be envisaged (excluding passive sharing which in most cases is likely positive even for longer durations) that could still be in line with the common objectives defined above. However, these provisions call for a specific and careful analysis. In some situations, active sharing between the mobile network operators is objectively necessary for ensuring effective competition. In view of the objective necessity, it is necessary to examine whether competitors can replicate the parts of the access network concerned in the foreseeable future in order to be able to exercise a competitive constraint on the market. Additionally, a respective demand for services must exist and the parts of the access network concerned must be essential for the provision of these services.

For instance, the following three potential provisions could be in this case:

a) Specific needs for high availability services

This could be the case to respond to some public authorities needs to benefit from high availability and resilience services, or time critical applications that would require a particular reliability level such as connected driving along highways.

In order to respond to these needs, network sharing could be relevant, but should be limited to a number of users only, and not generalised. These agreements should be assessed on a case-by-case basis, taking into account the impact on infrastructure-based competition.

b) Network sharing for coverage of complex areas

Large network deployment could imply coverage of complex areas, either because of the limited space or because of a particularly difficult access (e.g.: underground transport lines, sport centres, commercial malls...). In these cases, and subject to duly justified technical and economic conditions, a targeted recourse to sharing provisions could be relevant.

c) Network sharing for legacy technology

As new technologies emerge, it is likely (but not certain, in all geographical areas) that legacy technologies (such as 2G, 3G) will be used less frequently in the future by end users and operators. Continued operation of these technologies might, therefore, lead to higher

incremental costs while sales volumes decrease. Infrastructure sharing might offer a means of reducing costs for continued operation of these services by individual operators. Similarly, sharing agreements for legacy technologies might allow for more efficient spectrum use, as bands previously allocated to individual operators can be reallocated to new technologies (however, this would require approval from competent authorities/NRAs in many cases due to variations in spectrum licensing conditions).

Appendix 1 - Role of general competition law

This appendix details some elements and considerations from general competition law which are likely to apply to existing/potential mobile infrastructure sharing agreements.

A. Role of competition in mobile communications

Competitive pressure from other providers is the central element that drives mobile operators to permanently improve their offers, implement cost savings, make investments and pass on the cost savings and the additional benefit also to consumers. The prospect of protecting or increasing profitable sales by offering customers greater benefit (e.g. by improved coverage) or a better-value offer due to efficiency enhancements drives investments and constitutes a central incentive for the build-up and expansion of mobile communications infrastructure. The larger an operator's own market share is, the smaller is the incentive to make such investments in order to win additional customers from other competitors. And the lower the competitive pressure of others, the smaller is the incentive to improve the conditions of the existing customers through investments and better offers.

The assessment of competition requires taking into account different time dimensions. These different time dimensions might include:

- a) relatively direct and short-term competition in defining a specific offer with regard to price, quality of services, bandwidth, data volume and similar parameters;¹⁸
- b) medium-term decisions, for example, on the expansion of the mobile network or capacity, the increase in the degree of geographic coverage or the improvement of quality (such as increasing bandwidth or reliability); as well as
- c) long-term decisions on the entry into a market and the acquisition of spectrum.

B. The interaction between competition and economies of scale in cooperation

Independent mobile communications infrastructures allow making decisions on infrastructure independently of other MNOs. At the same time, joint rollout and joint operation of mobile communications infrastructure, as opposed to several independent infrastructures, might bring about savings in many areas. In areas with low usage the benefits from network sharing in mobile communications are comparatively high. In general, economies of scale are an important reason that mobile communications markets tend to include only a small number of participants – in particular, in medium and long-term infrastructure competition.

C. Cooperation agreements under general competition law

Cooperation agreements can lead to the development or strengthening of market power of individual operators, the cooperation partners or all market participants (e.g. collusion) in the short, medium or long term and may prevent or obstruct market entry or the expansion of competitors (including MVNOs).

¹⁸ Short-term competition also includes MVNOs.

According to Article 101 (1) TFEU, agreements that restrict competition are prohibited. Article 101 (3) TFEU provides an exemption to the prohibition of restrictive agreements. So, in a first step any agreement between MNOs has to be assessed in order to evaluate whether it has an anticompetitive object or any actual or potential restrictive effects on competition within the meaning of Article 101 (1) TFEU. In a second step – which only becomes relevant when an agreement is found to restrict competition – an assessment of restrictive and pro-competitive effects is done within the framework of Article 101 (3) TFEU. The burden of proof of compliance with the conditions of Article 101 (3) TFEU rests on the undertaking(s) invoking the benefit of this provision.

Article 101 TFEU is without prejudice to the application of Article 102 TFEU that prohibits the abuse of a dominant position.

National competition law may apply in parallel.

D. Restrictive effects on competition within the meaning of Article 101 (1) TFEU

The European Commission's guidelines on the application of Article 101 of the TFEU to horizontal co-operation agreements provide a framework for analysis that can be applied to the various forms of mobile network sharing envisaged above.¹⁹ When assessing whether an agreement in mobile communications restricts competition, particular attention should be paid to the following elements. This list is not exhaustive, and will depend on national and market circumstances:

- a) Short-term competition vis-à-vis consumers, in particular whether consumers are able to benefit from adequate choice after an infrastructure sharing agreement is in place.
- b) Medium and long-term competition, in particular the avoidance of irreversible investments (which might require, for example, one or both of the parties to abandon planned unilateral investments), maintenance of incentives to invest and the ability for autonomous decisions (regardless of existing cooperation arrangements), for example with regard to the development of new sites.
- c) The likelihood of coordination: the exchange of strategic information and/or a significant commonality of variable cost may increase the likelihood of coordination with respect to short-term competition and/or infrastructure investment

Any infrastructure sharing agreement between MNOs must be examined as to whether it limits the possibility for parties to compete against each other, and/or whether it limits independent decision-making. Furthermore, sharing agreements may also give rise to anticompetitive foreclosure concerns.

A sharing agreement is unlikely to lead to restrictive effects on competition if the parties to the agreement do not have market power in the market on which a restriction of competition is

¹⁹ Guidelines on the applicability of Article 101 of the Treaty on the Functioning of the European Union to horizontal co-operation agreements (2011/C 11/01), "Horizontal Guidelines, 2011"; See also: Communication from the Commission — Notice — Guidelines on the application of Article 81(3) of the Treaty (Text with EEA relevance), Official Journal C 101 , 27/04/2004 P. 0097 – 0118

assessed.²⁰ However, MNOs typically have market power in the corresponding mobile telecommunications markets that are typically highly concentrated. If these markets are affected, it is thus unlikely that restrictive effects can be excluded outright due to the lack of market power of any of the MNOs and a case-by-case assessment is called for.

In order to assess whether an agreement has restrictive effects on competition, the competition needs to be examined with and without the agreement in force and its alleged restrictive effects; and the two scenarios need to be compared. The existing infrastructure of each MNO that was in place prior to the agreement needs to be taken into account when assessing whether an MNO might be able to independently carry out the envisaged project or activity covered by the cooperation.

E. Assessment of infrastructure sharing agreements that are considered to be restrictive within the framework of Article 101 (3) TFEU

If an agreement includes a restriction of competition according to Article 101 (1) TFEU, an exemption according to Article 101 (3) TFEU may apply. To qualify for an exemption the cooperation agreement must fulfil the following four criteria set out in Article 101 (3) TFEU:

- a) efficiency gains;
- b) fair share for consumers;
- c) indispensability of the restrictions;
- d) no elimination of competition.

The derogation in Article 101 (3) TFEU applies only if these four conditions are cumulatively fulfilled.

Under the Guidelines on the application of Article 101 (3) TFEU an agreement which is restrictive of competition must, in order to benefit from the exemption, generate benefits for the production or distribution of goods or the promotion of technical or economic progress which are of such a character as to compensate for the agreement's disadvantages for competition. All efficiency claims must be substantiated to allow verification of: a) the nature of the claimed likelihood and magnitude of each claimed efficiency; b) the link between the agreement and the efficiencies; c) the likelihood and magnitude of each claimed efficiency; and (d) how and when each claimed efficiency would be achieved.²¹

The burden of proof under the provision of Article 101 (3) TFEU rests on the undertaking(s) invoking this provision. BEREC does not provide any guidance on whether the cumulative criteria of Article 101(3) TFEU are fulfilled.

²⁰ See para 168-173 or 186 of the Horizontal Guidelines, 2011 ²³
National competition law might be applicable in parallel.

²¹ Guidelines on the application of Article 101(3) TFEU²⁴,

Appendix 2 - Acronyms

Acronym	Definition
3GPP	The 3rd Generation Partnership Project
AAS	Active Antenna Systems
BEREC	Body of European Regulators for Electronic Communications
EU	European Union
GPRS	General Packet Radio Service
GSM	Global System for Mobile communications
GSMA	GSM Association
HLR	Home Location Register
MNO	Mobile Network Operator
MOCN	Multi Operator Core Network
MORAN	Multi-Operator Radio Access Network sharing
MVNO	Mobile Virtual Network Operator
NCA	National Competition Authority
NRA	National Regulatory Authority
OECD	Organisation for Economic Co-operation and Development
RAN	A radio access network
RSPG	Radio Spectrum Policy Group
TFEU	Treaty on the Functioning of the European Union
VAS	Value-Added Service