Body of European Regulators for Electronic Communications

BEREC

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BEREC Report on the outcome of the public consultation on the draft BEREC Guide to the BEREC 5G Radar and 5G Radar

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Contents

Executive Summary

This report summarises the responses received to the public consultation on the draft BEREC Guide to the BEREC 5G Radar and 5G Radar set out in Document BoR (20) 110. BEREC received 12 contributions from the following stakeholders[1]:

1. 1&1;	7. ECTA;
2. 5G MAG;	8. ETNO-GSMA;
3. BREKO;	9. Huawei;
4. Darwin;	10. MVNO Europe;
5. Digital Europe;	11. SOS;
6. EBU;	12. TIM;

In general, stakeholders welcomed the opportunity to provide input on the draft BEREC Guide to the BEREC 5G Radar, and 5G Radar illustration itself. Stakeholders also supported BEREC's view that 5G is an important element of its strategic priority on promoting full connectivity. The definitive versions of respondents' submissions responses are set out on BEREC's website.

In particular, stakeholders were invited to respond to the following questions, and provide views on the twenty three main topics identified in the Radar[2]:

1. *Does the guide to the radar correctly reflect the issues – please give supporting reasons?*
2. *What are views on indicated priorities in particular for small cells at this point – please give supporting reasons?*
3. *Is there anything omitted from the radar, and why is it important that it should be included now?*

Having carefully considered the submissions, BEREC **does not make any substantive changes to the 5G Radar**. BEREC acknowledges some relevant developments have taken place but does not see a need to substantially modify the 5G Radar as a result of these. For example, since the consultation closed, BEREC and RSPG issued a joint statement on spectrum-related EMF issues[3], BEREC invited stakeholders to a dedicated virtual workshop on mobile infrastructure sharing[4], and awards of rights of use to radio spectrum have been ongoing in a number of Member States with 5G auctions concluding in Austria and

[1] One response from a stakeholder that provided no public version and one unclear response from a citizen could not be taken into consideration.

[2] For example the topics included in the draft 5G Radar were: Privacy, Security, new business models and value chains, Quality of Service, End user, Numbering, Roaming, Rollout, State aid, Convergence, EMF and Environment

[3] https://berec.europa.eu/eng/news_and_publications/whats_new/7667-berec-and-rspg-adopt-joint-position-paper-on-spectrum-related-emf-issues

[4] https://berec.europa.eu/eng/news_and_publications/whats_new/7671-berec-invites-stakeholders-to-express-interest-in-presenting-their-views-at-the-virtual-workshop-on-mobile-infrastructure-sharing

assignments progressing in France. This means that aspects of some of the radar topics prioritised by stakeholders are being addressed by BEREC and NRAs already.

One **additional topic**, however, is added to the 5G Radar on satellite communication, making the 5G Radar illustration more comprehensive. Satellite communications (space-to-earth and earth-to-space communications) are frequently associated with 5G connectivity use cases, and BEREC considers that there may be some benefit to adding it to the final radar. BEREC intends to continue to view the 5G Radar in a holistic manner noting that specific details of the topics will fluctuate in time as may their relevance to BEREC and NRAs. In summary, BEREC maintains the view that its 5G Radar will support NRAs anticipate potential impacts of 5G on regulation. Essentially the 5G Radar should be seen as a complement to the yearly Work Programme, and it could enable BEREC and NRAs to keep track of topics which do not make the final programme due to available resources and other priorities in a given year.

The following sections provide further comments, observations and summaries of the contributions received, as follows:

- **Chapter 1 Comments,** which sets out a summary of some of the high-level messages from stakeholders
- **Chapter 2 Suggested additional topic on Satellite communications**, which sets out some of stakeholders' suggestions for additional topics to be added to the radar
- **ANNEX** contains full set of comments received during the public consultation (lasted until 31st July 2020) on the **draft BEREC Guide on 5G Radar** followed by the BEREC response, which sets out a summary of the main views received on each chapter in the BoR (20) 110.

1. Comments

ECTA suggests to focus the radar on the areas where BEREC has its own mandate, and areas where NRAs can potentially act jointly based on their mandate, or where BEREC acts on new EU-level responsibilities. **Darwin** would like to see the EU legal acts that are involved in the radar: enacted ones or future planned ones.

ECTA and EBU emphasize the importance to allow inputs from the industry and the verticals to the regulatory process.

SOS mentions the importance of terrestrial broadcasting. According to SOS spectrum needs to be made available for it, especially since half of the UHF-TV spectrum has been auctioned off in recent years for mobile telephony and is no longer available for broadcasting or the cultural industries.

Darwin also contends that matters like harmonisation of radio spectrum, exposure to EMF and trust building in the society, roaming (national and international) as well as interoperability are of extreme importance for the project (and others alike). Obviously, cyber security is a

paramount theme that affects all aspects of Connected and Autonomous Vehicle (CAVs) development and implementation: network security, vehicle security, data transfer.

Importantly, the earlier these matters are harmonised and clarified, the higher chances of finalising use cases and business models which make the roll out of 5G valid and practical.

All initiatives facilitating network planning (expansion) and permits to place small cells, are beneficial for CAVs. Network densification is a crucial point in this use case. Darwin would like to emphasise the need of 5G coverage mapping, including volumetric 3D maps.

BEREC would like to refer to the Guide where it is explained that the Radar does not show projects, but developments that lead to issues that may require regulatory attention. Whether these developments will actually lead to projects included in the BEREC Work Programme depends on priorities, or through legal acts that give BEREC a specific task. Roaming is an example where the development of new regulation (in this case the review of the regulation) gives BEREC a task and an opportunity to anticipate where and how 5G deployment and development may have an impact on roaming. An example of an area where other authorities have more powers is privacy. Hence the developments in this area have a lower priority (‘relevance’ on the radar). If BEREC would undertake any project in this area it would be very likely in coordination or cooperation with those authorities.

BEREC emphasizes that it values the input from stakeholders and therefore will continue asking their involvement.

BEREC acknowledges the importance of harmonisation and the benefit of addressing regulatory uncertainty in a timely fashion (such as around the key topics similar to those identified by Darwin). The radar is developed to help BEREC and NRAs to plan addressing those requirements according to their occurrence and urgency.

2. Suggested additional topic on satellite communications

According to **Darwin,** satellite communication (satcom) should be included in the radar. The expansion of the broadband coverage will be realised not only via terrestrial network. The satcom is the focal point in the project and has been regarded as a crucial component in 5G deployment to reach previously inaccessible areas.

3GPP Release 16 covers satellite communication for 5G. The seamless integration of Terrestrial Networks and Non-Terrestrial-Networks using 5G NR has been included in the list of features for 3GPP Release 17, expected to reach 'Functional Freeze' and 'End Date' milestones by September 2021 and December 2021, respectively. (See: https://www.3gpp.org/specifications/67-releases)

These efforts were supported by the European Space Agency and the European Commission (EC). According to Darwin, the incorporation of the satcom in the radar would bring several new legal matters, for example, satellite licensing, and access to satellite communication, collaborations between MNOs and sat operators.

BEREC recognises the complementary role that satcom could have in relation to 5G. BEREC has observed the developments in satcom communications generally, and is aware of how it could help enabling telecommunication providers and network vendors to accelerate 5G deployment in all geographies and at the same time create new and growing market opportunities for satcom industry stakeholders.

Given other priorities, such as those identified during the finalisation of Work Programme 2021, BEREC adds this topic to the 5G Radar with low relevance compared to the other topics that have ongoing work streams. BEREC intends to keep this under review and will modify the relevance of this topic if specific satcom issues and work streams for BEREC arise in the future.

ANNEX

This Annex contains full set of comments received during the public consultation on the **draft BEREC Guide on 5G Radar** followed by the BEREC response.

1. Comments on the Stepwise Introduction of 5G

EBU - It may be useful to clarify that, while the stepwise introduction is enabled through the 3GPP standardization process, the three phases described in this document will not occur sequentially and not simultaneously in all networks. It is likely that the 'phase one' and 'phase two' networks will coexist, whereas the 'phase three' services will be introduced gradually across networks.

BEREC: BEREC agrees with this point. The text of the Guide has been adapted on this point.

According to **TIM** substantial investments in the core already need to be done in phase 1. Without identifying what will be exactly phase 1 and phase 2. **BEREC** is of the opinion that the current core can handle eMBB.

According to **EBU** suitable spectrum for 5G has already been identified (e.g. the 5G Pioneer bands identified by RSPG), which will help to achieve substantially higher capacity than 4G-LTE. Furthermore, CEPT has reviewed other frequency bands that are currently used for mobile communications with a view of making them suitable for 5G. Following WRC 2019, almost 15 GHz of spectrum in total is already identified for mobile communications. It is likely that this will give sufficient spectrum for 5G deployments. Additionally, the RSPG has already started the work on assessing long term needs for additional spectrum for 5G. Further changes to spectrum allocated to other services should at least await the outcome of that review. Furthermore, regulation could facilitate sharing of frequency bands between 4G and 5G networks. Nonetheless, it is equally important to invest in the network infrastructure, in particular for coverage improvement (e.g. in rural areas) and Quality of Service (QoS) assurance (e.g. for applications that require high-reliability and/or high-throughput). Without such investments new frequency bands will not be enough for 5G networks to provide high capacity and wide service availability. The expected performance boost of 5G is likely to be the result of very balanced orchestration of efficient spectrum usage, network densification and sophisticated technologies such as massive MIMO, rather than concentrating on making available more and more spectrum.

Both **ECTA** and **TIM** comment on the quote from the DotEcon/Axon study on Implications of 5G Deployment on Future Business Models" commissioned by BEREC, where it describes *that existing technologies such as NB-IoT, Lora, SigFox etc. could be used to meet the connectivity demand for some M2M and IoT devices and could possibly complement the RLAN solutions such as Wi-Fi. An important insight is that it is not necessarily 5G which will enable all the customers demand. Different radio technologies, such as 5G, 4G, NB-IoT, will likely be used for the communications need in a "5G-context" for a customer. Hence, this will be an important aspect when analyzing the study cases in order to identify the regulatory challenges.* According to **ECTA** Lora, Sigfox, Wi-Fi, etc. are relevant, but the use of these technologies is mostly not intended or expected to substitute for nation-wide 3GPP

standardized 5G networks. NRAs/BEREC should nevertheless keep a close eye on the coverage and performance (and QoS), and market relevance, of these alternative technologies. BEREC and NRAs should not draw disproportionate conclusions. BEREC and NRAs should be realistic about the impact of these technologies on markets. As BEREC recognizes, 5G should not be seen in isolation, especially as in the context of IoT, LTE-M, NB-IoT; Even technology generations all the way back to 2G GPRS will remain relevant for many years to come to support low bandwidth mobile data/IoT. **TIM** comments that NB-IoT is part of 3GPP "5G" standard (as being recognized by ITU-R as part of IMT 2020). Lora and SigFox, as proprietary connectivity technologies, not harmonized with international standards, they can hardly be compared with 5G, a standardized technological platform encompassing both core network and several radio accesses (including NB-IoT) and enabling a multitude of scenarios.

Digital Europe considers that enhanced Wi-Fi connectivity complements 5G and that 5G/4G/Wi-Fi/unlicensed LTE will work together, both licensed and unlicensed spectrum will be needed. Indeed, enabling the development of enhanced Wi-Fi by providing it with sufficient and appropriate spectrum resources will help improve the experience of connectivity and be important to key 5G use cases such as online education, home office and video streaming. In addition, the expansion of the Wi-Fi ecosystem will complement and extend the digital innovation supported by 5G.

BEREC agrees with stakeholders that the referred technologies don't substitute 5G. BEREC, as did DotEcon/Axon in a study for use-cases, merely concludes that "*An important insight is that it is not necessarily 5G which will enable all the customers demand."* BEREC is aware that disproportionate conclusions should indeed not be drawn.

2. Comments on the topics of the BEREC Guide to the 5G Radar

2.1. Privacy (sections 1 and 2)

Private information as cost	End-users may not understand the impact of sharing their private information in terms of the data economy in 5G.	Gigabit speeds and other enhanced capabilities may increase user's ability to generate or disseminate private information and to generate more private information on the web.
Sharing of end-user data between different actors	Increased data exchange between parties in the 5G eco system.	Smart city use cases increase (harvesting data from different uses). Data processing actors in the 5G value chain develop but may not have a direct relationship with end users and therefore unable to request data processing consent directly.

According to **Darwin** data protection should be prioritised higher and dealt with earlier than anticipated by BEREC. The project Darwin will be collecting data from CAVs and the importance of data privacy and data protection has been recognised in the early stages of the project. Close collaboration and joint efforts of BEREC, EDPB and DPAs would be welcome, not only for establishing data protection policies but also for tailoring cyber security measures to the system.

DIGITAL EUROPE comments that this domain is clearly outside of BEREC's remit and is already dealt with by a large number of institutions and stakeholders, like the national DPA and the EDPB. Also, it sees no specific angle to assess the privacy situation specifically for 5G networks or services. Hence, DIGITAL EUROPE appreciates that BEREC qualifies this topic as being of low importance or entirely deleted from the BEREC 5G radar.

EBU agrees that protection of personal data in 5G is an important issue which is already dealt with in the GDPR, ePrivacy Directive, and the related decisions adopted by the Article 29 Working Party or the EDPB and participating NRAs. EBU agrees with the relevance thresholds set for BEREC. However, these issues might need to be addressed before 5G networks are rolled out.

ETNO-GSMA agrees with BEREC's assessment that relevance of this topic to BEREC should remain low and limited. New issues or new models for the collection and processing of personal data – that may arise through the implementation of 5G technology - are already sufficiently addressed by the horizontal regulatory data protection framework which encourages organizations (including mobile operators) to identify and mitigate risks of harm to individuals taking the context of processing into account.

TIM agrees with BEREC's assessment that the issue is of low relevance. Regarding the sharing of end-user data between different actors, it is premature to envisage actions on this

issue. New tools are being assessed by the EC to increase data exchange between parties and the role of BEREC in this new framework is yet unclear.

BEREC response

Whilst protection of personal data is an issue of major significance, most stakeholders agree with BEREC's assessment that privacy protection is sufficiently covered by EDPB and DPA authorities, under the horizontal application of GDPR and e-privacy regulation, and therefore of low relevance for BEREC and NRAs.

BEREC deems 5G related data privacy concerns that might arise when rolling-out specialized 5G use cases -such as CAV connectivity-, will be sufficiently addressed by the joint collaboration between EDPB and DPA authorities with the corresponding stakeholder organisations. Accordingly, BEREC keeps attaching a low relevance to this topic for the time being and remains at the disposal of the relevant regulatory authorities.

With respect to timing, BEREC admits that privacy concerns may arise before 5G networks are rolled out. However, most of them will probably deal with specialized services requiring the Ultra Reliable Low Latency Communications (URLLC) and massive Machine Type Communications (mMTC) enhanced capabilities of 5G technology, that will likely be available at a later stage (phase 3) of 5G network roll-out. Hence, 2024 timing indicated in the radar would reasonably reflect when BEREC and NRAs should be prepared to cope with data protection.

2.2. Network and application security (section 3)

Cybersecurity: higher sensitivity and dependency on 5G networks.	Any vulnerability in 5G networks or applications running over 5G networks could be exploited, potentially causing serious damage to critical infrastructures and services (e.g. smart city, industry automation, e-health, logistics) and affecting the economies and societies of the EU. In the IoT environment, the growing number of connected devices enabled by 5G will increase the entry points for possible network security attacks.

BREKO fully agrees with BEREC on the fact that 5G networks and applications running over 5G networks are vulnerable to exploitation. In order to limit serious damage to critical infra-structure and services, BREKO suggests focusing on decentralized and fixed networks, which are less susceptible to external interventions and the potential damage in the event of a successful cyber-attack can be limited, because it does not entirely depend on a single network. Therefore, BREKO concurs with BEREC's assessment regarding the timing of 2021, however, disagrees on its relevance, giving a medium rating.

DIGITAL EUROPE greatly values BEREC's expressed interest to have a closer collaboration with ENISA leading the certification and assurance work. DIGITALEUROPE also appreciates BEREC's role to assist in the development process within the NIS Cooperation Group and the

EC throughout the implementation of the 5G Toolbox, gathering information in the domain of telecoms and sharing BEREC's experience on the electronic communications market matters.

ETNO-GSMA and **TIM** support BEREC's aims to pursue this strategically important topic. While avoiding duplicating activities that are already carried out by the EC and ENISA, it is important for BEREC to closely cooperate and liaise with these authorities by providing them with the expertise and knowledge on the specific telecom matters, where needed.

BEREC response

All stakeholders support BEREC's collaboration with the NIS Cooperation Group (composed of Member States, the EC and ENISA) in the implementation of the 5G cybersecurity toolbox, and agree with the high relevance and early timing proposed in the radar. Only one stakeholder proposes to decrease the relevance threshold to medium, given the contribution of decentralized and fixed networks to mitigate 5G networks cybersecurity risks.

In its Conclusions on Shaping Europe's Digital Future of June 2020, the Council emphasises the importance of safeguarding the integrity, security and resilience of critical infrastructures, electronic communications networks, services and terminal equipment and supports the need to ensure and implement a coordinated approach to mitigate the main risks, such as the ongoing joint work based on the EU toolbox on 5G cybersecurity and the secure 5G deployment in the EU.

Furthermore, the Council underlines that the COVID-19 pandemic has demonstrated the need for fast and ubiquitous connectivity and calls on the EC and the Member States to promote the roll-out of 5G networks, including through implementing on a timely basis the relevant measures in line with the 5G cybersecurity toolbox.

Hence, despite other very high capacity networks will coexist with 5G roll-out, contributing to limit the impact in case of security breach in the 5G networks, BEREC takes note of the Council conclusions and continues considering 5G cybersecurity highly relevant to BEREC and NRAs. Moreover, security has been highlighted in the BEREC strategy 2021-2025 (June 2020)[5].

BEREC notices that several stakeholders stress the importance of avoiding duplication of activities and reporting already carried out by the competent authorities. In this regard, BEREC plays a supporting role regarding 5G and cybersecurity, and closely cooperates with the NIS Cooperation Group and ENISA by contributing to the implementation of the toolbox.

2.3. New business opportunities (section 4)

5G has the potential to impact existing value chains.	5G technical developments and the increasing role of 5G across a range of industries have the potential to impact existing value chains and result in new business models beyond connectivity. They may influence both wholesale buyer and retail end-user choices in terms of providers (MNO,

[5] BoR (20) 108

	MVNO, WISP, other micro operators e.g. using a network slice) and / or fixed network operators.

ETNO-GSMA comments that the role of 5G in the digitization of wide sectors of the economy could result in changes in the value chain.

Both **ETNO-GSMA** and **DIGITAL EUROPE** comment that BEREC should ensure that all business models are equally treated, and no regulatory bias is favouring one business model or sector over the others. Digital Europe explains that for potential new business models to emerge, premature or excessive regulatory actions need to be minimized to allow innovation to happen. The assessment of bottlenecks or needs for wholesale access should not be 5G specific but should be assessed on a technology neutral basis. IoT and 5G driven innovations will to a very large extent be international applications that move seamlessly over national borders. The cross-border nature of these activities makes regulatory harmonization efforts by BEREC and other EU institutions particularly timely and relevant. Experience tells us that it is extremely difficult to predict what will be the major use cases of a new technology. Regulators can promote innovation by providing clear and consistent guidance.

In order to fully understand the new business models 5G will enable, **TIM** makes a distinction between services that will be developed on the internet and services provided through new 5G network functionalities. Agreements between the different players in the emerging 5G ecosystem should be left to commercial negotiations.

For 5G to be really transformational, according to **ECTA**, it cannot be expected to be about increased mobile download speeds on smartphones or other devices, but mostly about B2B/B2B2C/IoT use cases and Fixed-Wireless Access. The benefits of 5G will be materialized *only if* 5G is provided competitively in national markets. Europe will not be competitive globally if it does not support effectively competitive markets at national level inside the EU.

EBU considers media services as one of the drivers of adoption of 5G. Therefore media providers should be listed as verticals.

5G MAG adds to that arguing that it is likely that the distribution of media services in 5G and fibre networks will become an increasingly important means of reaching listeners and viewers and it is important that the regulatory and commercial structure of these networks continue to allow listeners and viewers open access to both public service and private media content.

BEREC response

As stated in the introduction to the guide, the purpose of the “5G Radar 2020 – 2026” is to help NRAs prioritise between projects to address the identified aspects. Hence, it will be up to the respective NRAs and BEREC to identify relevant studies and make more concrete proposals on future work regarding the different themes on the radar.

BEREC also notes the comment from TIM, and agrees that it will be important from a regulatory perspective to differentiate between services based on 5G functionalities and services which are primarily based on functionality on the internet. It is also a fact that

bottlenecks can emerge in different parts of the value chain, regardless of technology. Hence, a technology neutral approach is to be preferred when assessing the impacts.

BEREC also agrees with Digital Europe that it is extremely difficult to predict what will be the major use cases of a new technology, and the importance to avoid that regulatory measures may favour one business model and disfavour another.

In a functioning market, agreements between market players are based on commercial negotiations. However, regulatory measures may be necessary as a response to market failures.

2.4. New bottlenecks, dominance and monopolies (section 5)

5G use cases may increase dependency on data for market access.	5G is a potential driver for IoT applications with more data produced, stored and analysed, which can lead to network effects creating or strengthening dominant players (such as digital platforms) who may have incentives to frustrate access / sharing of their proprietary data.

1&1 comments that against the background of the development of 5G networks and scarce spectrum resources, there is a high risk of further market concentration and bottlenecks within 5G. Where competition remains insufficient, ex ante regulation is needed to further promote effective competition. Thus wholesale access to networks will be more essential than ever. Mobile infrastructure sharing plays a key role regarding 5G deployment. 1&1 considers the BEREC timing of 2022 to be too late. The measure should start in 2021.

BREKO concurs with the statement that 5G use cases may increase dependency on data for market access, which may lead to network effects creating or strengthening dominant players. Thus, it is important to give network providers the necessary tools to safeguard the functioning of their infrastructure. This could be done by minimizing their liability associated with illegal third-party content, which would ultimately increase the trust in digital services. Furthermore, future legislation must also ensure fair market conditions, which support all market participants.

EBU agrees that there is a risk of new bottlenecks being created in the context of 5G, possibly leading to the creation of new gatekeepers. Timing should be 2021-2022, i.e. before market dominance could be established in 5G.

ETNO-GSMA believes that data sits at the heart of a virtuous circle of new products and services, based on 5G, IoT and Artificial Intelligence. This does not mean that only or primary providers of ECN and ECS will process these data. Neither does this mean that problems that require new policies or regulation would occur. Beyond 5G and IoT, ETNO-GSMA shares BEREC's concerns about dominant digital platforms that may more broadly stifle the internet

openness and curb competition in the digital economy. This important discussion should be kept separate from potential future issues around 5G and IoT.

TIM comments that dependence on data for market access is a potential bottleneck. However, the issue is not an effect of the development of the specific technology of 5G, as it is already there today and is rightly being addressed by the EC.

BEREC response

As stated above, in a functioning market, agreements between market players are based on commercial negotiations. However, regulatory measures may be necessary as a response to market failures. The competitive situation on the mobile market varies significantly between Member States. Whether ex ante regulation is needed is very much depending on the situation on the national markets, and will be up to the respective NRAs to assess. BERECs timing of 2022-2023 indicates when NRAs should be prepared to deal with this issue, which means that preparations have to be started in 2021 at the latest.

Regarding access to valuable data, and bottlenecks as a result of major players controlling data, the issue is already here today and is not specific for 5G, as TIM has noted. BEREC agrees that it is important to follow the direction taken by the EU and EC when addressing this issue.

The liability of network providers for being associated with illegal third party content is an issue which goes beyond BEREC's and most NRAs' mandate.

2.5. Creation of new wholesale markets (section 6)

5G could allow for new players to enter the market.	Industry automation use cases potentially increase the need for tailor-made 5G services by new micro-operators (plant wide operators, campus operators), thus creating new business models such as e.g. intermediaries that could provide wholesale access, bundle or repackage solutions for the specific industry or specific local sites with the necessary network operator.

EBU comments that regulation should ensure that new market entrants have access to 5G networks under fair, reasonable and non-discriminatory (FRAND) conditions.

ETNO-GSMA believes that voluntary wholesale agreements between mobile operators and new intermediaries are a possible welfare enhancing development that should not be prevented by BEREC or NRAs.

TIM urges caution against any premature action in the absence of concrete market problems. The agreements between mobile operators on one hand and new intermediaries on the other in the emerging 5G ecosystem should be left up to commercial negotiations.

BEREC response

The 5G technology gives new business opportunities with regard to wholesale services, e.g. by using network slicing. To what extent the supply of wholesale services will correspond to the demand from MVNOs and micro-operators on the market will depend on the business models of the MNOs in each Member State. The question of wholesale regulation is therefore closely connected to the functioning of the respective national markets, which will differ between Member States. Hence, it will be up to the NRAs to analyse and assess whether it is necessary to impose regulation to improve conditions on the national market.

2.6. Private local networks (section 7)

Introduction of private/local networks.	Many see an increase in revenue streams for operators to arise from the business-to-business segment where private/local networks will play an important role for certain verticals/sectors. Enhanced 5G features such as URLLC and network slicing could be applied to Private/Local networks.

EBU and 5G MAG expect that the most demanding applications in professional content production will be served by non-public 5G networks. Frequency bands should be made available for the local networks, whether permanent or temporary. **EBU** believes that in addition to the Open Internet Regulation specialized services may be subject to further specific regulation. Timing, therefore, may need to be advanced to 2021.

ETNO-GSMA refers to 5G features such as slicing that facilitate the provision of enhanced virtual private networks for example. ETNO-GSMA urges caution against any premature action in the absence of concrete market problems and evidence. Before considering any rules on spectrum set-aside for private/local networks, a detailed analysis on demands, costs and benefits should be done.

Spectrum set-asides may, according to **TIM**, easily lead to the fragmentation of both the awarded spectrum rights and the 5G market as a whole and more widely to an inefficient spectrum usage. Thanks to the 5G flexibility to properly configure network slices, MNOs have the potential to entirely satisfy tailored user needs both with respect to the quality and characteristics of the service and to the degree of autonomy required by each customer.

BEREC response

As set out above, the responses to this topic mainly focused on the spectrum availability aspect of private networks. There were diverging views about how private networks might develop in practice (e.g. using “set-aside” spectrum or dedicated network slices, etc.).

BEREC’s view on awards for spectrum rights of use remains as follows; that awards are prepared according to the specific context in the market at hand, and the rationales that drive competent authorities to make decisions regarding spectrum awards and licences are well documented.

BEREC observes, however, that on the basis that network slicing technology becomes commercially available in networks around 2021, then NRAs are likely to be considering this topic in advance of the timeframe set out in the 5G Radar. Nevertheless, BEREC's selection of the timeframe of 2022-2023 for the topic better reflects the time it may take for NRAs to share expertise on any regulatory issues which may arise. To date, it is not clear what would be the regulatory issues, if any, and therefore, and in line with the views of stakeholders, it would seem prudent to observe what market developments occur in practice.

In addition, BEREC is of the view that expert exchanges with other competent bodies, such as the Radio Spectrum Policy Group (RSPG), will best support sharing of information on appropriate market shaping aspect of spectrum assignments.

2.7. Network slicing and 5G wholesale markets (section 8)

Higher QoS-requirements might be implemented using 5G network slices.	Industry automation and other use cases (e-health, gaming…) with specific URLLC and bandwidth needs may increase the need to be able to differentiate services with different classes of quality of services which might be supported by the use of network slicing beyond other technical solutions. These use cases will have to follow Net Neutrality regulation.

In order to strengthen competition a forward-looking, pro-competitive regulatory framework is crucial to establish a fair and competitive market. According to **1&1** the 5G radar should be used to minimise legal uncertainties. BEREC can help to develop positions to support regulators, especially by addressing clear advice in order to ensure planning and investment security for all market participants. 1&1 is of the opinion that BEREC should examine the functioning of wholesale markets, as the wholesale dimension is suitable to correct market malfunctioning. Cooperation and the sharing of infrastructure are essential possibilities to optimize the network use. The 5G network expansion starts now. Therefore, the rules regarding cooperation must be defined immediately.

MVNO Europe also argues that wholesale access to 5G networks is needed, to stimulate innovation and competition for all types of end-users. Generalised wholesale access to 5G networks will enable existing MVNOs, and new entrants, on all types of existing and new markets, to come up with new ideas for better serving individual consumers, new business models, and to provide new services.

EBU supports the recent modifications made to the BEREC Guidelines on the Open Internet Regulation – which also apply in the 5G context. Furthermore, potential regulatory aspects of network slicing may have to be identified and addressed. Especially, access to slices should be enabled under FRAND conditions.

ECTA recognizes BEREC's indication that tailor-made services using a special slice of a 5G network may be confronted with challenges concerning switching or interoperability going forward, as a potential competition problem. Therefore, this aspect should be put under careful

monitoring and brought forward (2021, not 2022). Enabling 5G network slicing to work for specific use cases cannot be delayed by regulatory impediments.

Since network slices are not yet a commercial reality, **ETNO-GSMA** on the other hand believes this is a premature consideration.

According to **TIM,** BEREC should assess whether the application of the Net Neutrality rules provide MNOs with enough flexibility to exploit the full potential of the network slicing for the benefit of verticals and of end users (according to the conditions provided under each specific private commercial agreement), or if any adjustment of the guidelines is needed to this specific purpose. The coherence with Open Internet principles should not hinder innovative services and new business models for the benefit of citizens and businesses.

BEREC response

The responses received largely support BERECs position that network slicing has the potential to play a larger role in the future, as specific QoS requirements might be implemented using 5G network slices. BEREC points out that the relation of slicing and net neutrality has been clarified in the context of BEREC's revision of its Open Internet Guidelines (see BEREC's consultation report, BoR (20) 111 p.28). Responses further showed that stakeholders see functioning wholesale markets as key enablers for competition and therefore should continue to be in the focus of regulatory monitoring with the necessity of access to 5G network slices on fair, reasonable and non-discriminatory conditions explicitly mentioned.

2.8. QoS requirements of pan-European Services (section 9)

How might 5G impact the operation of potential transnational / pan-EU operators.	Pan-European services (e.g. connected mobility) will require continuous QoS and seamless handover, both within a country and between different countries. This could imply a need for increased QoS provisioning for interconnection and roaming.

5G MAG and **EBU** refer to the fact that media service providers have the ability to control the user experience which will require a predictable QoS. This may be facilitated through a service level agreement with network operators or via the use of dedicated 5G broadcast network infrastructures and private 5G networks for the distribution of media services. Also, production teams (ENG, special events, touring events) would very much benefit from pan-European services with homogeneous QoS as well as from network interoperability down to the user device level.

According to **ETNO-GSMA** and **TIM** the competition on the retail and wholesale levels is sufficient for the domestic and roaming services. **ETNO-GSMA** concludes that regulators should not disrupt the current functioning of the wholesale market, imposing QoS obligations, nor should regulators impose new obligations on the retail market, specifically in terms of service quality, given the risks to the efficient functioning of the wholesale market and the lack of complaints from end users.

TIM adds that for direct short range communications (normally used for safety applications), based on C-V2X in the 5.9 GHz frequency band, the transition from one provider to another is already ensured. The industry is already working on technical specifications to ensure a smooth and seamless handover based on QoS for services that need communications through the network. Regulation must be flexible enough (no exceedingly restrictive wholesale caps) to provide room for operators to differentiate QoS at wholesale level.

To **ECTA** it seems premature for BEREC to consider harmonized information requirements on 5G coverage and QoS.

BEREC response

Based on the input from stakeholders it seems that the relevance of the topic is undisputed. QoS is an important topic, and users could benefit from harmonization of QoS. From the stakeholder input it cannot be concluded whether or not there would be a role for BEREC, and what this role could be. BEREC will keep this topic on the radar, as an important topic, and will use the coming time to assess its possible role.

2.9. Transparency of information (section 10)

Stronger need for information on coverage and QoS of 5G networks to enable informed choices.	The introduction of 5G enables operators to differentiate products and services in much more complex ways. Information on coverage and QoS potentially becomes more important, not only for M(V)NOs, CAPs, for IoT SPs, for verticals, but also for end users. Especially with services tailor-made for specific user groups (network slicing) it becomes crucial where and when a service is available (e.g. geographically or in a roaming situation).

ETNO-GSMA agrees with the relevance of transparency, but points out that the EECC already contains requirements to provide end users with a greater degree of transparency on QoS and information generally. The EECC should be allowed to take effect before introducing further requirements. BEREC should refrain from considering new provisions until relevant services are in the market. BEREC's work in this area could instead focus on best practices or similar soft tools.

TIM also refers to already existing initiatives. For building on that, TIM suggests BEREC to evaluate the adequateness, with respect to the fast evolving technological scenario, of the currently set QoS parameters (i.e. throughput and latency) for the purposes of reaching the Digital Single Market and the satisfaction of the end-users. The second suggestion is to develop a common, consistent broadband measurement tools in Europe.

DIGITAL EUROPE points at the relevance of transparency on coverage. Digital Europe advises BEREC to build on existing initiatives, like e.g. voluntary publications and the EU-funded project for mapping of broadband services.

Huawei suggests that regulators require operators to provide detailed coverage and QoS information earlier and refresh it regularly which will facilitate subscribers' selection. Special emphasis should be given to the shortcomings of crowd-sourced measurement tools like speed tests. Information is especially required where no tests or a very low number are performed.

BEREC response

The stakeholders agree on the relevance of this topic, and are not proposing to place this item closer or further in the future. Just like with the previous topic the stakeholders have different ideas about BEREC's possible role. With respect to the topic of transparency, BEREC will keep it on the same place on the radar.

2.10. M2M numbers and mobile numbers (section 11)

Increased demand for M2M and mobile numbers.	Massive Machine Type Communications increase. As a result demand for numbers for M2M/IoT/MTC communication increases (given the expected increase of number of connected devices). The rising demand for devices could also lead to an increasing and potentially massive demand in other E.164 numbers (e.g. mobile numbers) and other types of numbering resources/identifiers (e.g. IPv6).

ETNO-GSMA considers the availability of numbering resources to be important given their scarce nature. To that end, directly assigning numbers to non-ECN/ECS entities should be avoided. For M2M/IoT/MTC that do not require E.164 numbering since interworking with the public telephony service and/or SMS is not necessary, IP addresses and internet domain names could be used instead as an identifier. E.164 numbers should be reserved where necessary. In this sense, number portability should not be imposed as the numbers are not used by end users in those cases. Instead, it makes sense to consider the availability of e-SIM.

TIM does not consider direct assigning of E.164 numbers to non-ECN/ECS entities to be reasonable in light of the scarcity of numbering resources. TIM shares the same view with ETNO-GSMA regarding to the use of E.164 for M2M, IoT and MTC services and number portability.

BEREC response

Regulators need to carefully monitor uses of different numbering resources or other identifiers to prevent scarcity while also supporting current technological developments. A joint approach among NRAs can help avoid costly migration efforts. In March 2020, BEREC published guidelines on common criteria for the assessment of the ability to manage numbering resources by undertakings that are not providers of electronic communication services and of the risk of exhaustion of numbering resources if numbers are assigned to such undertakings (BoR (20) 50). Given the different market dynamics in Member States the effort to monitor

current and future use of numbering resources cannot be postponed to a later point in time. The relevance of the issue also varies for different markets, but as an issue cannot be neglected. The timing and relevance should remain as previously determined by BEREC.

2.11. Mobile network codes (section 12)

Increased demand for MNCs, especially due to local/private networks (campus networks).	The importance of having a sufficient supply of numbering resources available to meet the demand, especially of campus networks. Verticals and intermediary operators may want to provide own SIMs, potentially leading to increased demand for MNCs. When E.212 MNCs are used for cross-border IoT/M2M applications, global MNCs under MCC 90x could be used. MCC 999 could be applied for standalone private networks where interconnectivity and roaming are not supported.

ETNO-GSMA and **TIM** believe that the development of 5G does not require Mobile Network Codes (MNC) to be allocated to verticals and intermediary operators due to the risk of scarcity. The E.212 identification plan should therefore not be modified. The assignment of MNC to non-ECN/ECS entities would require compliance with the international interoperability standards of the ITU-T, ETSI and GSMA. Local/private networks (e.g. campus networks) may use shared resources or not unique resources (such as behind MCC 999, which is dedicated to internal use within private networks).

BEREC response

The responses BEREC has received support BEREC's previous assessment, that having a sufficient supply of numbering resources available to meet current and future demand for MNCs is important. As outlined in the response under 2.10 (M2M numbers and mobile numbers), the current and potential needs arising from technological developments must be carefully balanced with the availability and supply of numbering resources. This is why regulators must pay continuous attention to market and technical developments to determine whether there is a need and the means to meet future demand for MNCs.

2.12. eSIM (section 13)

Using eSIM to support application implementation and switching.	Using eSIM may help in initial device provisioning and in switching between providers due to lower implementation costs when over-the-air switching is applied. The availability of eSIM is also relevant in IoT use cases with device miniaturization and deployment in high-risk and/or restricted accessibility environments.

ETNO-GSMA believes that remotely providing eSIMs is more efficient and is likely to cost less than other means such as assigning MNC to non-ECN/ECS entities. The use of eSIM allows

switching connectivity providers for IoT connected devices or to select them at a later stage. At this stage of market development, remote provisioning should be offered depending on the IoT use case (e.g. open internet or open voice) and where there is a request from the enterprise customer/hardware manufacturer.

TIM shares the same view as ETNO-GSMA. In addition, provisions regarding customer identification and enrolment should be harmonized to avoid potential discrimination and market abuse due to remote provisioning.

BEREC response

BEREC welcomes the ability to provision eSIMs remotely as this will help foster competition among connectivity providers. This does not automatically preclude other technical solutions, which might differ between the wide arrays of 5G use cases. BEREC believes that in time solutions that are more efficient and less costly will prevail on the market.

2.13. Interoperability (section 14)

Possibilities of interoperability of networks, including cross-border.	There will be an increased number of service providers and localised networks. It will be vital that different networks are interoperable, wherever this is demanded, especially in a context where 5G involves important virtualization of the network and increased reliance on software, notably through SDN and NFV technologies. It might require a deeper standardization process or the implementation of APIs. Lack of interoperability could raise many issues. Notably, it could hinder end-to-end connectivity. Furthermore, if verticals want to switch to a new service provider whether WISPs, MNOs, MVNOs, micro-operators or fixed providers, vendor lock in could become a more prevalent issue due to the opportunity to highly customise networks in 5G.

BREKO comments that a higher number of service providers and localized networks will increase the importance of interoperability of networks, especially concerning fixed networks and end user connectivity. A lack of technological compatibility could lead to negative effects on competition at the retail and the wholesale levels alike. Interoperability will allow verticals to easily switch between new service providers, therefore, it is essential that new standardization processes consider the important role of fixed networks, which can reliably provide high bandwidth, especially in comparison to all other technologies. As a result, BREKO evaluates interoperability as moderately/highly relevant with timing until 2023.

According to **EBU** and **5GMAG**, NRAs should indeed monitor and promote interoperability. It is essential that non-public 5G networks are able to connect to public networks, where

appropriate. Besides, interconnection and interoperability between 5G and other types of networks, including satellite and terrestrial broadcast networks, should be possible.

ETNO-GSMA emphasizes that at present, this will be catered for by the market. ETNO-GSMA supports the ongoing work within standardization organizations.

DIGITAL EUROPE agrees with BEREC that it is key to encourage interoperability, particularly interoperable standards. Even though this might go beyond BEREC's strict mandate, DIGITAL EUROPE believes that BEREC can play a key role in encouraging interoperable standards as an important vehicle for harmonization on technology, business and policy considerations and thus also for the achievement of the EU Digital Single Market.

TIM agrees with BEREC that interoperability is important for the provision of different services end-to-end and for the development and uptake of verticals avoiding customers lock-in. The use of standardized solutions should be promoted. Special focus should be put on open standardized interfaces in order to avoid the risk of vendor lock-in.

BEREC response

Responses in general agree with BERECs position that interoperability will remain an important aspect of regulatory attention (and possible intervention). Respondents addressed a wide variety of relevant types of interoperability ranging from interoperability between public and private 5G networks; and interoperability between fixed networks and 5G networks; to end-to-end connectivity. Furthermore, interoperability for specific services like media or specific customers like verticals was mentioned. Respondents indicated that interoperability is not only a regulatory issue but also needs to be addressed in close cooperation with standardization bodies.

2.14. New requirements for national roaming (section 15)

National roaming agreements will include new requirements, such as coverage and infrastructure sharing.	New services will become available requiring a high level of coverage and/or QoS which in many cases will not be possible to be provided by a single network or operator alone. Operators may therefore require national roaming or infrastructure sharing agreements for the new services to meet QoS requirements or coverage obligations set out in the spectrum authorization regime. This would allow an efficient use of spectrum. Operators may also wish to share the costs of deploying network elements and engage in co-investment projects.

1&1 considers national roaming to be crucial for new entrants to be able to expand their network. To provide better coverage, especially in rural areas, national roaming is essential for the customers of new entrants to have seamless coverage. Network operators should therefore be mandated to provide national roaming (including the existing 3G and 4G networks) to ensure an efficient use of limited resources, to avoid supply gaps and to promote competition by interconnecting networks. Such infrastructure sharing arrangements based on agreed terms provides for certainty in planning in contrast to rolling out network components.

In this regard, 1&1 would welcome any guidance similar to BEREC's guidance in international roaming and urges to define rules about cooperation. Regarding the timing, 1&1 considers the intended timeframe of 2023 to be too late as national roaming is required in regions that are difficult to access.

EBU believes that national roaming could help overcoming coverage and capacity issues. Interconnection between public and non-public 5G networks should also be possible.

According to ECTA it needs to be ensured that the companies holding less complete radio spectrum portfolios and holders of new entrant 5G spectrum are able to participate effectively in any sharing and national roaming agreements, to ensure effective competition. Promotion of national roaming is essential to ensure effective competition and enable new entrants to enter the market. National spectrum managers, supported by NRAs, need to ensure that roaming obligations to this end facilitate the emergence of sustainable competition in mobile services. In particular, deals between the two (or three) largest spectrum holders (5G-relevant – which means essentially all spectrum bands going forward) in EU Member States need to be subject to particular scrutiny, to ensure that such deals do not foreclose competition. Unequivocal obligations of openness of deals between the two (or three) largest spectrum holders to any others' participation are necessary, to ensure that there is no exclusion of smaller or new spectrum holders. ECTA also considers international roaming to be important to enable pan-EU IoT markets.

ETNO-GSMA believes that infrastructure sharing or national roaming agreements work best if based on commercial agreements so as to maintain the incentives to expand the networks. It is important for the market to explore options instead of facing regulations that could slow down 5G roll-out. Only in cases of identified market failure should there be regulatory intervention. Currently, national roaming and infrastructure sharing agreements comply with competition law requirements and assessed by competition authorities, where required.

TIM shares the same view like ETNO-GSMA. In addition, TIM points out that it is bound by the specific spectrum award roaming conditions, so national roaming obligations should be avoided and eventually only included in the spectrum licensing conditions in case of market failure.

According to **MVNO Europe**, wholesale roaming for 5G clearly also needs to be ensured as a matter of priority, and needs to be moved forward from 2022 to 2020/21.

BEREC response

National roaming and infrastructure sharing agreements are ways to support the roll-out of 5G. Given the different dynamics in different national markets, BEREC considers a case by case approach may need to be taken by NRAs to address potential issues under this topic. BEREC considers that it would be useful to observe relevant market developments closely to enhance relevant information exchanges between NRAs.

The one-line description in the box above as it is presented on the radar is slightly modified for more accuracy:

"Requirements for coverage will increase the need (or demand) for national roaming and infrastructure sharing".

2.15. New requirements for international roaming (section 16)

5G will contribute to the addition of new services to the current international roaming services portfolio, such as M2M.	In the next few years, other international roaming services than voice, SMS and data, such as IoT/ M2M are likely to play an increased role. It makes sense for the current revision of the Roaming Regulation to consider those services and investigate whether there is a need to adapt the provisions to meeting both the market and technological developments.

1&1 considers the international roaming provisions and BEREC's contribution to be of importance and to be continued. In particular, the level of wholesale roaming charges is a key determinant for the intensity of competition. 1&1 points out that it is necessary for MVNOs to manage their wholesale costs in light of their restricted abilities to negotiate wholesale roaming charges compared to MNOs. Therefore, 1&1 urges BEREC to push towards much lower wholesale prices and more competition to ensure a level playing field in the roaming wholesale markets.

ETNO-GSMA and **TIM** advise M2M/IoT to be excluded from the roaming regulation, as the nature of IoT/M2M business model is fundamentally different from traditional voice and data services (e.g. typically not used for interpersonal communication, lower data volumes and revenues and relatively high use of signaling resources, cross-border deployment with a need for permanent roaming, variable QoS requirements enabled by 5G network slicing). Unlike the mature voice/SMS/data business from standard customers, many M2M/IoT applications and services are still being defined and require commercial sophistication and innovative models to drive their full potential to end users.

BEREC response

The responses support the importance and immediacy with which BEREC is treating this issue. BEREC will use its long-standing expertise to promote solutions that are market-oriented, open to new technological advances and aligned with regulation.

2.16. Backhaul, fronthaul and anyhaul (section 17)

Further fibre roll-out in networks.	Because of the increasing demand for bandwidth, connections to the RAN (x-haul) will mainly be realised using fibre, as well as fast wireless technologies. Stakeholders emphasize that NRAs should ensure the existing backhaul is available on reasonable terms while fibre is rolled out quickly.

BREKO welcomes BEREC's key focus on fiber roll-out, and believes that NRA's should be encouraged to primarily strengthen the promotion of fixed-VHCN. Given the performance of fiber 5G, technologies can only be considered supplementary to fiber networks. Moreover, there will be an increasing demand for bandwidth in the future that includes connections to the Radio Access Network (RAN) and the x-haul respectively. Only fiber connections are capable of meeting these high-performance standards, which will be demanded from customers and IoT. A timely roll-out of fiber is thus a prerequisite for the success of a functioning 5G ecosystem. To accelerate the deployment of fiber infrastructure it is necessary to incentivize further infrastructure sharing and open access to fair market conditions. For this reason, regulators should prevent the potential market foreclosure from dominant network operators. With that in mind, it is important to safeguard existing and emerging market dynamics and to encourage access offers and the negotiated deployment of fiber.

According to **BREKO**, the FTTB/H connection of 5G base stations is a functioning market. Imposing regulatory measures on FTTB/H networks under construction, would be to the detriment of fiber rollout and thus, would not promote but considerably hinder the connectivity of VHC-networks. Consequently, BREKO agrees with BEREC on this issue's high relevance, as it is necessary to encourage and strengthen the deployment of fibre networks by 2021/22.

EBU also believes that the demand for fiber will further increase with densification of 5G networks. As well as 5G will only be successful if it comes with massive fiber roll-out to cope with the increased traffic. Fiber deployments should remain a key target as a basis for 5G roll-out. In addition, a large-scale fiber deployment can also provide connectivity to non-public 5G networks and ultra-fast fixed broadband to the home and socio-economic drivers (schools and hospitals). In-door reception of media content via IP-based networks is greatly facilitated by fiber-based networks, as they provide high-enough capacity. Therefore EBU comments that Fiber backhaul should be encouraged in parallel with FTTH deployments.

TIM agrees with BEREC that the fast wireless technologies can be a valid complement to fiber. BEREC should not presume a need for regulatory intervention in the mobile backhaul market since the market has shown at EU level to be competitive. In particular, in Italy all mobile operators are vertically integrated and are able to exert a countervailing market power. MNOs can use self-produce radio links and indeed not solely rely on fiber based solutions.

BEREC response

Backhaul, fronthaul and anyhaul seem to be a relatively high-priority topic for stakeholders. Several stakeholders provided feedback aimed to assist BEREC to understand the importance of fiber-connections in the context of backhaul and x-haul. BEREC agrees with the stakeholders that fiber-connection will play an important role in 5G and ultra-fast fixed network. In addition, BEREC encourages the industry to continue seeking creative backhaul solutions by combining different technologies.

BEREC has considered stakeholders' views about the importance of co-investment and/or network sharing possibilities. BEREC understands these options can offer significant benefits in terms of pooling of costs and sharing of risks and accelerate the network rollout in certain areas. BEREC considers that the EECC provides sufficient certainty about the possibilities for network sharing and/or co-investing. For its part, BEREC will continue to support regulatory

certainty in relation to infrastructure sharing and co-investment in line with the requirements and obligations of the EECC. BEREC considers it too early to address the question as to whether x-haul needs to be regulated. However, BEREC notes that potential regulation of x-haul is a multi-facet issue involving not only the balance of negotiation power between operators but also the availability of the infrastructure and information on a fair reasonable and non-discriminatory basis.

The one-line description in the box above as it is presented on the radar is slightly modified for more accuracy:

“Because of the increasing demand for bandwidth, connections between the RAN and the CN are mainly expected to be realised using fibre, and other fast (wire)less technologies. Stakeholders emphasize that NRAs should ensure the existing backhaul is available on reasonable terms while fibre is rolled out.”

2.17. Small cells (section 18)

Gigabit coverage requires small cell deployment.	Small cell deployment will be necessary in order to achieve gigabit coverage. A harmonised approach for network planning and permits will facilitate roll-out. Deployment is costly and initiatives seeking to allow deployment in a cost effective manner such as infrastructure sharing or other co-investments initiatives will likely occur.

BREKO acknowledges that the connection of small-area wireless access points or small antennas is a crucial part of the timely deployment of 5G networks. However, an existing fiber network infrastructure is a precondition for small cells to deliver their high-capacity, increased coverage and advanced connection speeds. BREKO agrees with BEREC’s stipulated assessment that the roll-out of small cells is very costly and that this will require initiatives to seek means for a cost-effective infrastructure deployment, such as infrastructure sharing and co-investment initiatives. In that sense, BEREC will have to prevent overregulation and protect existing deployment incentives. Furthermore, small cells should only be considered as a suitable alternative to connect individual households, when fixed networks are not financially and economically feasible. BREKO concurs with BEREC’s rating, which is highly relevant and a timing until 2023.

ETNO-GSMA believes that small cell deployment is an important option for mobile networks as they evolve to address the growing demand for mobile connectivity, improved capacity and coverage. In order to support efficient small cell deployments authorities should adopt concrete policies. BEREC could support that work by timely facilitating good practice sharing. Therefore, ETNO-GSMA considers the timing of this action should be sooner given that 26 GHz awards have already taken place, and more are expected.

Huawei notes and appreciates the newly released Implementation Regulation on Small cells by the EC. One aspect is to simplify procedures and to shorten the approval period for building

and public municipal facilities permits for mobile sites. Another aspect is that in scenarios of indoor coverage by small cells, it is recommended to have a holistic view of both polices on FTTC/FTTB/FTTH and on mobile technologies.

Many issues arising out of small cell deployment are a part of the more general problem of network densification that is already a burning one. Therefore, the timing of 2023 should be re-considered in particular with a view to the long legislative process on European level and the necessary implementation on national level, because the solutions require localized approaches. Huawei suggests addressing this issue earlier.

TIM shares BEREC's view regarding the importance of facilitating the deployment of small cells and that infrastructure sharing and co-investment are important models to reduce the costs of fixed and mobile network roll-out. The measure should not only focus on small cells, but should facilitate the deployment of any element of a network capable of contributing to the achievement of Gigabit society targets. The large number of new sites may also make it necessary for operators to share infrastructure. TIM suggests that infrastructure sharing agreements on a commercial and voluntary basis should be promoted.

According to **ECTA** a review of BEREC's Common Position on Infrastructure Sharing is necessary in the light of 5G, including as regards electrical power to base stations. The review should address sharing towers/masts/any supporting structures, electrical power, spectrum pooling, RAN sharing, national roaming, specifics on small cells, backhaul, network slicing (including cross-border QoS on network slicing), etc.). Improving local (and other) authorities' permitting procedures for rights-of way, and antenna siting requirements, is key for 5G, to support macro antenna sites, and increasingly micro antenna sites, and indeed fiber networks providing the essential backhaul/midhaul/fronthaul supporting wireless networks. This should be done as soon as possible. Subsequently, it can be linked with the EC's review of the Broadband Cost-Reduction Directive 2014/61/EC which has recently been initiated.

BEREC response

Responses generally acknowledge BEREC's position that small cell deployment will be necessary in order to achieve gigabit coverage in high demand areas. Firstly, respondents mention the close connection of the small cell deployment with the rollout of fibre infrastructure as necessary precondition. Secondly, respondents emphasize the importance of models for cost-effective infrastructure deployment, such as infrastructure sharing and co-investment initiatives, and propose to collect and evaluate best practice examples of small cell deployment. Accordingly, taking into account the timely legislative process and the growing availability of 26 GHz spectrum, some respondents suggest to reconsider the time schedule (2023) and start earlier with BEREC activities. Another aspect mentioned as potential topic for BEREC is the rising opposition against 5G that could hinder the densification of 5G networks by means of small cells.

In relation to these two suggestions/topics, BEREC is actively progressing work streams on both mobile infrastructure sharing and spectrum related EMF issues, as follows;

- Mobile infrastructure sharing workshop (Virtual) held on 16 November 2020; and
- BEREC and RSPG adopted a joint position paper on EMF and spectrum-related EMF matters (with more associated work streams likely to be incorporated into the 2021 Work Programme).

As set out in the Guide to the 5G Radar, the timeframe attached to all topics was not intended to imply that the work would only commence at that time. The proposed timeframes were indicative of the timeframe after which the topics could become a barrier to 5G; i.e. the barrier to 5G could have been lessened by relevant work being commenced in advance.

2.18. Coverage (section 19)

State-aid to meet coverage targets.	Extension of broadband coverage to rural areas is one of the main objectives of national state aid rules and spectrum licensing conditions. The requirements associated to 5G use cases could potentially affect existing state aid plans for broadband extension. In order to increase coverage in rural areas and to reduce a digital divide, state-aid for FWA or fibre based backhaul solutions, state-owned infrastructure or spectrum coverage obligations could for example be relevant to apply.

BREKO supports the extension of broadband high-connectivity coverage to rural areas. State aid programs are very important for this. The introduction of new requirements associated with 5G should not be to the detriment of existing fiber funding schemes. Additionally, new state aid programs in other technologies rather than fiber should be required to consider existing coverage in order to prevent double coverage in specific areas. BREKO gives state aid to meet coverage targets a high relevance and timing until 2022.

Also **Huawei** points at the relevance of broadband coverage in rural area and warns of a digital divide. The NRAs will usually apply coverage obligation on spectrum auction. Since it might not be profitable to deploy 5G networks in very rural area, a set of stimulation measures and incentives should be released by government and NRAs. It can be state-aid policy, infrastructure access and sharing, new site resources deployment by government, national subsidy funding and so on. BEREC should work on the mechanisms for incentivizing the industry to roll-out. Other ways of incentivizing roll-out to rural areas reduce the risk of crowding-out private investment that **TIM** and **BREKO** warn for.

Most **EBU Members** - Public Service Media organizations - have an obligation (in law or in any other instrument that sets out their remit) to make their content universally available with a satisfactory technical quality. This requires an infrastructure with sufficient capacity and the ability to reach 100% of the population. This may not be possible to achieve using market-based approaches alone, especially when it comes to remote areas. This is why we support the use of state aid to enable network roll-out where it is not commercially viable. Other solutions should be explored such as coverage obligations linked to spectrum fees that network operators are obliged to pay.

According to **ECTA** state aid for broadband networks needs a more coherent EU-wide regulatory approach. BEREC could use its role as an advisor to EU institutions to favour genuinely transformational networks, moving away from subsidizing network upgrades from legacy technologies. Attention in the context of state aid also needs to ensure that backhaul/fronthaul/midhaul is fibre-based.

ETNO-GSMA believes that the topic of state aid should get a relative lower priority, because NRAs only have very limited competences in the area of state aid. This item is only relevant in relation to how coverage obligations are specified and financed. If at all, BEREC should recommend that state-aid related open access obligations should not go beyond the scope of SMP access obligations. With respect to mobile network rollout especially in less dense populated areas, coverage obligations must remain moderate and set the right investment incentives for network rollout. One should think about additional stimuli in case of areas in which an economical roll out of infrastructure is not possible. This can happen in complement to assignment procedures or, instead, in the form of new assignment procedures that give priority to roll out commitments instead of state profit maximizing. Better coordination between European funds (under state aid rules or not) as well as a higher usage of these funds are necessary for a better coverage, notably mobile in rural area.

BEREC response

BEREC welcomes the confirmation of the stakeholders that coverage in rural areas is very important. Because not all rural areas are economically attractive or profitable enough, coverage based on state aid could be an effective alternative.

BEREC observes some relevant considerations about the application of state aid rules in this context, such as understanding the potential impacts on private investments and preventing distortions to competition, amongst others.

Similar to points raised about the priority of other topics, and that this topic should be a priority in 2021, BEREC considers that the proposed timeframe set out in the draft 5G Radar of 2022 was not intended to imply that the work would only commence in 2022. In this regard, BEREC expects to participate in Peer Review Forums organized by RSPG, where market shaping aspects of spectrum assignments will be considered and which may provide useful updates on how Member States are considering relevant coverage obligations in awards.

BEREC therefore, intends to keep the indicative timeframe for this topic as 2022, noting that the extension of broadband coverage is a complex topic involving many aspects, some of which may directly involve BEREC and NRAs.

2.19. Convergence (section 20)

Issue of convergence of broadcast and broadband requirements in 5G.	In the context of 5G, convergence could become an issue with advances in 3GPP Release 14 principally allowing improved support for national TV services to both mobile devices and stationary TV sets over eMBMS (enhanced

	multimedia broadcast and multicast system over LTE) and unicast.

5G MAG considers that media service providers are currently subject to a wide range of regulatory and technical requirements regarding the distribution and scope of their services. These provide important safeguards for their viewers and it is important that these are maintained in any discussion about convergence between broadcast and broadband services.

EBU mentions the same, and adds that the issue of convergence of broadcast and broadband requirements in 5G is very important for Public Service Media (PSM) organizations, especially in enabling unconstrained access to PSM content / General Interest content for the European citizens on all relevant platforms. The frequency band 470-694 MHz should continue to be used to support this objective taking into account that specific needs may be different in different EU Member States. Furthermore, the safeguards for distribution of PSM content and services must be maintained for broadcasting and extended to broadband-based distribution. This would ensure the long-term viability of PSM distribution in the context of 5G.

EBU also mentions that it will be important to enable integration of different types of networks in the '5G context', including not only cellular mobile, WiFi, and Internet of Things but also terrestrial broadcast and satellite. Standardization efforts in this respect are being made.

EBU comments that some of the identified services are already possible with other technologies and may also be possible with 5G. Hence it is incorrect to say that these are 'future service categories made possible by 5G'. **ETNO-GSMA** confirms that telecom operators are already working with other stakeholders without the intervention of authorities. For example, the industry is collaborating with EBU and EBU's members on the potential of 5G for broadcasting and on facilitating the distribution of the whole range of PSM services to portable and mobile devices. Furthermore, any potential regulatory implications of convergence between broadcast and mobile networks are mostly within the scope of dedicated authorities, and should be analyzed in the broader context of the future of the Digital Terrestrial Television (DTT) platforms.

BEREC response

BEREC agrees with EBU that certain services are indeed already possible with existing techniques. BEREC also acknowledges the work already being undertaken by EBU and operators. The input received from the stakeholders confirms BEREC's views on the priority and timing given to this topic on the radar.

The title of this topic is changed to "Media distribution convergence" to make a better distinction with the next topic, FWA. Both topics are presented on the radar under the theme heading "convergence".

2.20. Fixed Wireless access (section 21)

FWA potentially emerging as pioneer 5G use case.	5G Fixed Wireless Access (FWA) has emerged as one of the early 5G use cases offering gigabit connectivity. With increased capacity in the networks, operators are likely to have more opportunities to offer competitive FWA services. The technological developments will enable mobile networks to match the expectations that consumers already have with regard to fixed broadband services.

BREKO, ECTA, TIM and **Huawei** recognize the importance of Fixed Wire Access (FWA) as one of the early 5G use cases. Where **TIM** argues that 5G FWA will be able to offer gigabit connectivity and that mobile broadband will be more and more a substitute service to fixed broadband, **BREKO** emphasizes that FWA should be considered as complementary to fiber networks and it cannot be assumed that the technological developments of FWA will enable mobile networks to match the expectations that customers already have with regard to fixed broadband services.

ECTA adds that 5G is a key use case for its members not only in a first stage, or solely for existing mobile network operators, but especially for existing FWA operators that have invested to deploy optical fiber up to the base station. They will be able to easily upgrade their networks to new bandwidths and deliver Gigabit performance as soon as spectrum and technology become available. It is therefore essential to ensure that these operators, who are already making important contributions to connecting underserved regions, will be given due and equitable consideration when allocating 5G bands to give them a clear development perspective for their business.

ETNO-GSMA comments that in its view, FWA solutions based on cellular technologies (5G) can satisfy in the most efficient way the main service requirements of home broadband. And according to **EBU** radio spectrum remains a scarce resource, and FWA network rollout should be limited to those areas where sufficient spectrum is available. In general, fiber deployment should be favored wherever possible.

TIM suggests a study to assess the impact of 5G on the fixed-mobile substitution and the competitive constraints exerted by mobile on fixed markets, and according to **BREKO** NRAs should have the authority to decide on a case by case basis whether an FWA-network fulfils the requisite criteria to be considered equivalent to a fixed VHCN. For these reasons, BREKO gives the topic of FWA a high relevance and a timing of 2022-23.

ECTA concludes that BEREC should not in any way prejudge substitutability of mobile networks with fixed networks, also not under a heading of ‘convergence’ in BEREC’s draft 5G Radar. The speed and QoS of networks continuously evolves over time. The objective capabilities of wired networks can legitimately be expected to structurally outperform mobile networks by far. This is expected to be applicable in the short, medium and long term.

Huawei considers that EC and NRAs can introduce FWA into the state-aid guideline and national broadband technologies clearly and release incentive policy and state aid (public funding) to encourage MNOs fasten FWA development especially in less dense areas. Since

5G FWA can play a big role in European broadband market and 5G FWA is one of the early developed use cases which can help Europe achieve the target of gigabit society, Huawei strongly recommends that this work could be shifted to an earlier year rather than 2022~2023. Huawei also suggests that BEREC can put higher priority on this topic and encourage NRAs to release incentives policy and public funding to support FWA development. BEREC is familiar with the industry mechanisms and competitive dynamics, and should start to develop proposals for incentive policies to overcome the digital divide, in which FWA can play a major role.

BEREC response

BEREC observes that stakeholders' views on the FWA topic are varied. For example, one view was that there should be a need to limit rollout of FWA to areas where there is sufficient spectrum availability (presumably the respondent is of the view that other services may also have spectrum requirements and that all the spectrum should not be used for FWA in an area), another view was that detailed market analyses may be needed so that certain operators can be *"[]… given due and equitable consideration when allocating 5G bands to give them a clear development perspective for their business",* another view was that BEREC should consider this topic in the context of convergence, and another view was that BEREC should start to develop proposals for incentive policies to overcome the digital divide, in which FWA can play a major role.

Essentially, the views received do not modify BEREC's high-level view that one of the early 5G use cases offering gigabit connectivity would be from FWA. How the topic develops in practice, and what regulatory issues might arise, if any, would most likely be the subject of other targeted work streams developed in the normal manner through BEREC Work Programme as appropriate. Therefore, BEREC maintains the relative timeframe and relevance of this topic in its 5G Radar.

2.21. Electromagnetic fields (section 22)

Increased attention for EMF.	At the EU level, the limitation of exposure to EMF is based on the Guidelines from ICNIRP (endorsed by WHO and ITU). This is updated in March 2020[6] to include 5G technologies and may impact the EU-level framework in 2021-2022. Consistency at EU and national/local level with ICNIRP EMF exposure limits is a matter of concern for stakeholders, to avoid adverse effects on rollout and reassure public opinion using evidence-based scientific recommendations.

ETNO-GSMA agrees that the timing identified is appropriate, in view of sites being identified for upgrade and rollout of 5G. ETNO-GSMA supports BEREC's approach to combatting

[6] https://www.icnirp.org/cms/upload/publications/ICNIRPrfgdl2020.pdf and https://www.icnirp.org/en/applications/5g/index.html

misinformation on health effect of EMF in the context of 5G. Unjustified EMF concerns significantly hinder network roll-out activities and, thus, they are a potential risk for 5G deployment in the EU. BEREC should support an active, evidence and science based communication on 5G and EMF at national and EU-level and countering related misinformation. Furthermore, BEREC should encourage Member States to ensure that national and local EMF exposure limits are based on scientifically grounded recommendations, reflecting the recommendation of WHO/ICNIRP including in the recently updated guidelines, to not burden roll-out. ETNO-GSMA would welcome a BEREC study and best practices sharing on enhanced RF-EMF compliance techniques, not only based on the maximum theoretical output.

Huawei supports BEREC's approach combatting misinformation and fake news of EMF for 5G technologies. EMF issues have become a significant obstacle to deploy 5G networks in some countries. Huawei expects that BEREC could align with NRAs and RSPG for the EMF information, to remove the negative effect on misinformation and fake news. Huawei also expects that BEREC could have a common position on EMF limits and regulation, in accordance with the latest ICNIRP/IEC/IEEE/ITU norms and studies.

TIM suggests BEREC to ensure that national and local EMF exposure limits are based on scientifically grounded recommendations. Accordingly, TIM supports BEREC's proposal for action and to encourage to remove unreasonable barriers that are to the detriment of 5G roll-out and potential benefits of EU citizens. On the other hand, TIM sustains any possible initiative in order to promote both a well spread knowledge based on scientific facts on 5G and its effects on health as well as a general education to the respect for technology and what it brings and will bring to people's lives, especially during these days of uncertainty.

ECTA would welcome explicit BEREC statements on electromagnetic fields, to encourage Member States and regions to promote connectivity, where rules on EMF in place impede 5G development a competitive national market for mobile/wireless communications. BEREC statements to counter disinformation, are also welcome. ECTA recommends that it needs to be prominently on BEREC's radar permanently (2021-2026).

Also **DIGITAL EUROPE** urges BEREC to attach higher importance and more focus to the EMF workstream than what is currently proposed.

BEREC response

BEREC thanks respondents for providing views on this topic. Stakeholders may already note that BEREC has commenced work on this topic in 2020, with the joint BEREC and RSPG position paper. That joint paper represents a precursor to future work for BEREC, recognising that, together with other competent authorities (health, environmental, radiation protection), it is important to remain open to hearing and understanding such concerns of European citizens. BEREC will, within its competence and in line with its strategic pillar of promoting full connectivity, continue to address potential barriers to wireless deployments. For example, in 2021 BEREC intends to continue to work on how best to communicate science-based EMF exposure limits recommended by experts.

2.22. Sustainability (section 23)

5G as an enabler of sustainability in the face of increased network energy consumption	5G systems have been designed to ensure higher level of energy efficiency: the energy required to process a data unit has been decreased compared to previous technologies. Nevertheless, the new services made possible by 5G systems may impact data consumption, which in the end may offset what a better energy efficiency can provide in terms of overall energy consumption: the so called rebound effect.

Overall, **BREKO** agrees with BEREC that digital technologies have a major contribution to the success of sustainability. BREKO contends that 5G will only develop its full potentials concerning sustainability, if it is based on an extensive fiber infrastructure. Fiber networks must be a core component of any sustainable digital solution. BREKO rates sustainability as moderately relevant and with a timing until 2022.

EBU points out that the most efficient and least energy-consuming distribution mode is broadcast (e.g. 'one-to-all' distribution mode). However, today's IP distribution networks are based on unicast ('one-to-one') connectivity, where network resources and energy consumption scale with the number of users. Technically, 5G allows a broadcast mode to be dynamically combined with unicast as well as, a stand-alone broadcast mode. These possibilities must be explored to improve the environmental impact of IP networks, where media represents the largest portion of the traffic. As 5G could enable a lower energy consumption, phasing out old, less energy-efficient systems could be a “green” goal of rolling out of 5G. Therefore 5G deployment is important to avoid the widening of the digital divide or creation of new digital gaps.

ETNO-GSMA welcomes the positive approach of BEREC to addressing the issue of sustainability, in particular the recognition that 5G is an enabler of sustainability and further improves energy efficiency in the face of increased traffic in our networks. BEREC’s activity needs to be embedded in a holistic approach of the sector and the economy.

Huawei agrees that the power consumption is an issue both in economy and in sustainability. The MNOs as well as the whole industry are bound to reduce the 5G energy consumption, and to comply with the social responsibility for a green future.

Digital Europe is of the view that 5G networks and connectivity serve two main purposes. First of all, 5G networks contribute to energy efficiency for the telecoms industry. Second, 5G allows innovative technical solutions that can reduce energy consumption, such as among others, remote diagnostics, advanced teleworking solutions, sensor-based farming or smart cities. Digital Europe strongly believes in the need to deploy sustainable very high capacity networks to contribute to reaching the new EU climate objectives. Making more efficient use of IT and ensuring that data centres are powered with clean energy will be cornerstones in the effort of industries across the board to improve their environmental footprint.

According to **TIM** it is important that all the necessary elements of Europe's telecom policy are streamlined to support the telecom sector and accelerate roll-out of 5G networks. This includes supporting the transition from legacy to new networks, including through a pro-investment approach to radio spectrum policies. On the other hand, it is also fundamental that the Green Deal pushes digitalization across sectors of society. With respect to the "rebound effect" BEREC makes reference to special technical solutions and infrastructure sharing agreements which will bring the better energy efficiency that Europe needs.

BEREC response

Stakeholders generally acknowledge the potential of 5G, along with its higher level of energy efficiency, as an enabler of sustainability. Some specifications related to 5G allowing better efficiency have been pointed out: use of broadcast mode when possible, the sharing of infrastructures - as a relevant way of decreasing cost and increasing efficiency, and the overall 5G efficiency.

Although the approach is supported by stakeholders, comments of various nature have been sent: the parallel with Europe Green Deal, the digitalization of the industry and the benefits for the economy. The second subject pointed out is the phasing-out of legacy networks as a way of increasing overall network efficiency. BEREC thinks that although 5G is more efficient, phasing-out of a legacy network may require further investigation as several services might still be relying on these networks. Finally, there is a comment regarding which technology should be used for backhauling in order to harness the full sustainable potential offered by 5G. The comment presents fiber as the ultimate solution as it provides the highest bandwidth and consumes less energy than its counterparts. This subject is in the 2021 agenda of BEREC and is under investigation in the workstream on regulatory treatment for backhaul.

A comment mentioned the relevance of the subject as moderately relevant. Sustainability is a real matter as traffic is increasing in our networks. In line with the EC goals regarding telecommunications and more largely digital sector sustainability, BEREC considers that sustainability is indeed an important topic. BEREC is actually making sustainability an increasingly integral part of its focus and developing its reflection regarding the environmental impact of the sector with an expert group dedicated to this issue. Thus, sustainability should be considered as relatively relevant within the radar.