

**BEREC Report on the outcome of the
consultation on the Draft Preliminary report in
view of a common position on monitoring
mobile coverage**

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Executive Summary

This report summarises the responses received to the consultation on BEREC's Draft Preliminary report in view of a common position on monitoring mobile coverage. The Draft Preliminary report set out to provide guidance to National Regulatory Authorities (NRAs) on monitoring mobile coverage and sharing best practices.

The response to the public consultation served as an input for the definition of a BEREC common position on monitoring mobile coverage. Further internal work was then performed to prepare a Common position to be submitted for a second public consultation in the first quarter of 2018.

In response to the consultation on the Draft Preliminary report, BEREC received 5 contributions. Stakeholders also contributed their views on practical matters related to the common position on monitoring mobile coverage, in particular, the definition, monitoring and publication of mobile coverage information. They indicated that monitoring principles should be coherent with national requirements and mechanisms agreed between NRA and domestic mobile operators to ensure higher comparability of results and transparency on mobile coverage.

In general, stakeholders welcomed the opportunity to comment on BEREC's Draft Preliminary report on monitoring mobile coverage. They provided their brief comments, addressing matters of principle and also specific recommendations. Stakeholders also highlighted a variety of other issues for BEREC to consider and actions to take.

The Introduction section provides further background to the process behind BEREC's Draft Preliminary report in view of a common position on monitoring mobile coverage.

The following sections of this document sets out the observations, comments and recommendations raised by stakeholders.

1. Introduction

Each national regulatory authority (NRA) uses different means to provide information on national mobile coverage. It constitutes an important obstacle to a consistent approach in terms both of public policy and users' information.

A common understanding on how mobile coverage is measured and published and the definition of a common vocabulary for mobile coverage is a first step to alleviate this obstacle.

To this end, the draft Preliminary report in view of a Common position gives a description of the high-level characteristics that seems essential to the provision of mobile coverage information to consumers, policy makers and industry. It also describes some of the key features of maps used by NRAs to report on mobile coverage.

The purpose of the public consultation was to increase transparency on the on-going work of BEREC regarding the monitoring of mobile coverage and to provide BEREC with valuable feedback from stakeholders. In particular, stakeholders were invited to comment on the list of characteristics for mobile coverage and on the key features of maps identified in the draft Preliminary report.

To this end, BEREC launched a consultation on its draft Preliminary report on 11 October 2017, running until 8 November 2017, in which it sought input from stakeholders, particularly, on the list of characteristics for mobile coverage and on the key features of maps identified in the draft Preliminary report. In response to the consultation, BEREC received 5 contributions from the following entities:

1. V3D;
2. TIM;
3. GSMA (GSM Association) and European Telecommunications Network Operators' Association (ETNO);
4. ECTA, the European Competitive Telecommunications Association;
5. MVNO Europe.

These contributions are summarised in the following sections of this report and have been taken into account in the draft BEREC common position submitted for a public consultation alongside this report. The non-confidential responses are also published on BEREC's website.

For ease of cross reference, stakeholders' observations, comments and recommendations are set out under the headings of the structure of the draft Common Position on monitoring mobile coverage now published alongside this report, and under an additional heading titled "Other comments received".

2. Comments relating to “Introduction and objective”

ECTA, GSMA/ETNO pointed out that further work may create a realistic prospect for:

- a) agreeing common definitions (of mobile coverage in its own right, and of a few simple categories associated to quality, e.g. ‘outdoor’, ‘indoor’, ‘in-vehicle’, and ‘limited’, ‘good’, ‘very good’),
- b) better alignment of what is measured,
- c) better alignment of how measurement is carried out, and
- d) better alignment on whether and how monitoring results are published, including on a comparative basis.

GSMA/ETNO supports cost-effective and appropriate steps to increase transparency to enable consumer choice and, also highlights that the possible definition of a single Europe-wide system designed to monitor and measure the quality of broadband on all national levels must be sufficiently flexible to allow an adjustment to the individual national characteristics and should always be available on an opt-in basis, allowing regulators who have already implemented their measurement systems to maintain them.

Regarding recommendation on comparability, **GSMA/ETNO** welcomes the attempt to harmonize measurement tools across the EU, provided that these tools deliver reliable results. If such tools are supposed to cover different technologies, the distinct characteristics of network technologies have to be taken into account (i.e. copper, cable, fibre and mobile) and also the state of play of the broadband market in each EU jurisdiction. In this regard, **GSMA/ETNO** believes that more detailed work should be carried out at national level by the different NRAs.

MVNO Europe considers that BEREC and NRAs need to be budget conscious, and avoid imposing material new costs on industry, including data collection and data presentation (coverage mapping) costs.

ECTA is concerned about costs of regulation, which in most cases are ultimately borne by industry. BEREC and NRAs should ensure that any modified or enhanced monitoring of mobile coverage (and extensive proactive technical supervision of net neutrality – section 2.3.2.2), does not impose significant new costs on operators, and that any costs of regulation are apportioned in accordance with the revenues generated by operators.

BEREC Response:

BEREC has carefully considered the views of respondents in progressing this work. BEREC considers that the draft Common Position on monitoring mobile coverage is a positive step towards achieving the benefits identified by respondents, and also addresses **GSMA/ETNO’s** view that more detailed work should be carried out a national level.

In relation to the views by **MVNO Europe** and **ECTA** on costs, BEREC is of the view that the costs of achieving a Common Position on monitoring mobile coverage should be reasonable

to achieve the benefits which have been identified and agreed by all stakeholders. BEREC does not consider that cost would be a significant barrier given that several NRAs successfully manage and maintain websites which display mobile coverage information. Further, a coordinated approach with an appropriate level of harmonisation may help reduce costs.

3. Comments relating to “Context for monitoring mobile coverage”

GSMA/ETNO noted that mobile coverage highly depends on various local factors, such as the location of the antenna, whether the location is in-house or outside. It should be sufficient to perform metrics outside buildings and not set higher requirements for outdoor conditions to make sure that mobile signal is available indoor as well. As BEREC recognizes, indoor coverage depends on the type of construction and it would be misleading to assume they are all the same. **GSMA/ETNO** highly welcomes the BEREC findings about the level of mobile indoor coverage, thus it is not sensible to impose any indoor coverage requirements since the heterogeneity of the buildings would operators not allow to calculate the needed effort to fulfil such a requirement.

GSMA/ETNO also considers the large number of different devices used for accessing mobile services make metrics and comparisons difficult between devices Therefore suggests BEREC to aim at simplifying and harmonising the number of devices to be considered for the quality of service analysis, and take into account the different factors that may affect handset sensitivity.

In **GSMA/ETNO’s** opinion as regards mobile connectivity, the following features are already important today and will be even more important in 2025: download speed, latency, network congestion, resilience, reliability, fall back or seamless integration with other wireless technologies (i.e WiFi, HetNets, 2G/3G/4G/5G), security and uninterrupted access. There is no “one size fits all” commercial connectivity offer to satisfy each and every customer’s needs.

VD3 states that working with commercial devices (i.e. non-rooted or jailbroken) is the only sure way to be as close to the perceived user experience as possible. Also OS and OS versions should also be considered.

VD3 considers that new services such as VoIP/VoLTE, or audio/video streaming use IP networks (IAS) with more strict requirements in terms of latency, packet ordering, therefore they should be considered individually, and not be grouped under a single topic.

BEREC Response:

BEREC recognises that indoor coverage depends on the type of building material used and that other connectivity solutions may be available to consumers indoors (e.g. native Wi-Fi calling or mobile repeaters, or both). Along with the large number of consumer devices used for accessing mobile services, different factors may affect consumer’s quality of experience such as handset sensitivity and performance by radio frequency band. As a result, the draft Common Position sets out the view that NRAs provide a data set which is easy to understand

by consumers, coverage information presented to consumers should be based on a limited number of combinations of these elements that are deemed relevant to consumers.

In response to the point by **VD3** that, for example, voice over data services be considered individually (and not grouped under a single topic) given they use IP networks with more strict requirements, BEREC points out the service examples identified by it in the report and in the subsequent draft Common Position are indicative of the type of usage scenarios relevant from the perspective of the consumer. The relevant issue is the combination of location, device and service. To consider individual combinations may generate unnecessary levels of complexity. In particular, the context needs to be reasonably understandable from the consumer perspective and that coverage information presented to consumers should be based on a limited number of combinations of these elements, that are deemed relevant to consumers.

4. Comments relating to “CP1 Technical specifications for monitoring mobile coverage in Europe”

VD3 notes that a standardisation of ranges of thresholds for each indicator (e.g. good 4G coverage is RSRP between -40 and -80 dBm...) can also help comparing operator services, since these values often differ between countries and operators. **VD3** suggests to consider also SNR. **VD3** notes that the speed calculations should follow ETSI recommendations and recommends to consider the test parameters by adding service access time.

VD3 suggests to use a scoring approach, e.g. a single grade per service (Voice: 4/5, Internet: 3/5, Streaming: 4/5...), to easier understanding for the general public that is not necessarily familiar to RF or QoS indicators. The standardisation of the threshold ranges defines a good/average/bad coverage in **VD3's** view would allow an easier comparability of operators across Europe. **VD3** indicates that the percentage of time spent in good/average/bad quality should also be considered as a further analysis allowing to consider if an area is covered or not.

GSMA and ETNO explains that a proper standardisation process within ETSI and already established standards should be used. With regards to QoS, **GSMA/ETNO** comments that only a robust monitoring system can deliver measurements that provide transparency of an ISP's actual performance. To be robust, the system needs to exclude external factors that interfere with the IAS's performance, such as infrastructure beyond the ISP's backbone and the end-user's infrastructure. NRAs should also take into account that different types of data traffic may need to be assessed differently.

VD3 explains that the methods used to determine the end status of a voice call should be explained, as these statuses are not readily available using API's on Android for instance. **VD3** suggests consider CSFB time (Call Switch FallBack time), i.e. the time to return to 4G after a voice call.

GSMA/ETNO considers that due to the technological characteristics of mobile networks, monitoring systems and processes applied to mobile IAS may need to differ from systems

applied to fixed IAS. They should, at least, take into account the different kinds of specific interfering factors.

TIM considers that mobile services Quality of Service (QoS)/Quality of Experience (QoE) issue is to be considered a separate and distinct matter with respect to mobile coverage.

GSMA/ETNO believes that monitoring QoS can be a positive and fruitful exercise both for European citizens and for European market players operating along the broadband value chain.

GSMA/ETNO considers that comparisons sanctioned by Public Institutions should avoid as much as possible measurement techniques for QoE that introduce a large subjective component, such as consumer surveys, especially when the aim is comparing MNOs at national level.

BEREC Response:

In relation to **VD3's** view on the ranges of thresholds, BEREC sets out further evidence on NRA practices in its consultation on the Common Position on monitoring mobile coverage (e.g. for LTE based services, BEREC notes that 18 NRAs report using thresholds between -100 dBm and -125 dBm). Further, BEREC observes that different practices may be explained by the fact that Member States have imposed different coverage obligations to resolve the specific coverage issues they deal with, or due to the requirements they have specified to do measurements in the field. BEREC intends to continue to develop a common understanding on thresholds and is seeking further views on this matter.

In relation to **GSMA/ETNO's** view that established standards should be used, BEREC would note that because mobile coverage is one input variable in the probability of successful service reception, a holistic view needs to be taken so as to be relevant to consumers. For example, in order to provide useful information for consumers on mobile coverage, it might be necessary to limit the number of scenarios for presenting mobile coverage on a map. BEREC considers that whatever approach is taken, that it would need to be objectively justified for the circumstances at hand. As a result, BEREC would also note the potential difficulty identified by **GSMA/ETNO** as regards the performance of the various infrastructures in the internet access value chain. In this aspect, the draft CPs specifically address the need to provide accurate and transparent information to consumers.

In relation to **VD3's** views on the methods used to determine the successful service reception, BEREC observes that different use cases may require different methods, however, it would be unreasonable to expect NRAs to cover every possible use case and scenario when mapping coverage, as the cost of doing so might outweigh the benefits. However, BEREC will continue to consider the most appropriate methods and with a view to promoting harmonised best approaches.

BEREC notes **GSMA/ETNO's** view that monitoring processes for mobile may be different than those used for fixed. BEREC's present work stream is on monitoring mobile coverage for the purpose of providing information for consumers.

In relation to **TIM's** view that the QoS/QoE issue be considered separate and distinct with respect to mobile coverage, BEREC considers that there is a relationship between service / experience and mobile coverage. BEREC recognises, however, that service / experience is a multi-facet issue. BEREC sets out its current thinking on the key elements of mobile coverage information from consumer perspective in the consultation on draft Common Position, which addresses this point.

The above points are also relevant in considering **GSMA/ETNOs** views on monitoring QoS. BEREC considers GSMA/ETNOs view on QoE to be reasonable, and notes that the user experience is likely to be more difficult to consider consistently given the evidence from research about sensitivity of devices by radio band and use case scenarios. BEREC welcomes further views on this during its consultation on the Draft Common Position.

5. Comments relating to “CP2 The use of signal predictions for mobile coverage”

GSMA/ETNO comments that data should be robust, up to date and mirroring reality to improve end-users' informed choice. It should be considered to compare which are the metrics collected in each Member State that are aligned with EU objectives (e.g Coverage for 30 Mbit/s mobile broadband EU Digital Agenda and more recently Connectivity for a European Gigabit Society).

For theoretical modelling, **VD3** explains that the biggest flaw is by definition “theoretical”, and more often than not far from the actual coverage observed by end users on the ground. It does not account for instance for misconfigurations in the antennas or interference with other networks or devices.

GSMA/ETNO considers that interactive maps that are based on crowd-sourcing can only provide an overview, possibly incomplete, of measurements reflecting subscribed tariffs and not of deployed networks. If publication is considered, this should only encompass clusters of location and measurements, reflecting a reasonably high number of measurements.

Drive tests as a type of data gathering is probably the most accurate in the view of **VD3**, but remains costly to put in place, with a limited range of areas that can be tested. It captures data on a given day and time, hence does not allow to follow the evolution over longer periods of the quality of the coverage for the area.

VD3 remarks regarding the cost of implementing walk tests, especially when mitigated against the area covered by testers on foot. This is however quite relevant for large indoor buildings (e.g. shopping malls, offices etc.).

VD3 considers that app-based solutions represent the easiest method to implement with a big ROI. Measurements or tests also should provide the ability for users to report issues they observe on their network in real time, or answer satisfaction surveys.

VD3 points when using a crowdsourcing application, it is imperative to be transparent with the end-user and to let them know exactly what type of monitoring is operated, what kind of measurements are done, and to allow them to opt out of the monitoring at any time. For instance, some of these testing apps can consume more than 100 MB of data over 4G in the few seconds of a test.

BEREC Response:

In relation to **GSMA/ENTO**'s view that data should be robust, and in relation to **VD3**'s view that theoretical modelling is more often than not far from the coverage observed by the end users on the ground, BEREC would refer interested parties, in particular, to its draft CP2 on the use of signal predictions for mobile coverage. BEREC observes that the results of signal predictions are a statistical representation of potential levels of coverage that offers a reasonably well understood and industry standard means of presenting geographic mobile coverage information for consumers. BEREC notes that for practical implementation reasons, it would not be appropriate to try and model the details of a fully functioning network when presenting mobile coverage to consumers, as it may not be possible accurately account for network capacity which may fluctuate over time.

BEREC has considered the views of **GSMA/ENTO** on crowd-sourcing and would note some NRAs have successfully facilitated sharing of data obtained on crowd-sourcing platforms but, that where they have done so, they have clearly indicated the source of information obtained. BEREC considers that it would be of benefit to consumers to identify the sources of information in order to assist them make objectively justified decisions about the levels of mobile coverage.

BEREC agrees with **VD3**'s views that drive testing is an accurate method of collecting data on mobile coverage, and so considers there to be benefit using this method to verify coverage, where appropriate. As more methods become available in the future (e.g. crowd sourcing apps or walk testing, or both), there may be alternative best approaches to help NRAs to verify coverage, and these could be considered on a case by case basis having regard to the goal of achieving accurate and transparent information for the benefit for consumers.

6. Comments relating to “CP3 Ensuring the reliability of coverage information”

Regarding recommendation on comparability **GSMA/ETNO** welcomes the attempt to harmonize measurement tools across the EU, provided that these tools deliver reliable results.

GSMA/ETNO pointed that regulators should concentrate their harmonization efforts on ensuring that the information gathered and presented is valuable for the intended users and uses, and is not counterproductive. They suggest to follow certain principles:

- The information should be accurate. Realistically, no measurement technique is 100% accurate. Minimum high threshold should be required for any measurement technique sanctioned by a Public institution.
- The information should be unbiased;

- The scope of the characteristics of mobile coverage that induce a customer to choose one provider over another, or a vertical to invest in services that are complementary to mobile coverage should be narrowed;
- The frequency of publication and the detail of the information presented should enhance competition, not degrade it.

GSMA/ETNO, ECTA considers that NRA's have to set clear objectives for the initiatives on monitoring mobile coverage, ensuring these initiatives a real added value and do not result in undue burdens for the operators (e.g. resources, IT developments). This also refers to maps and indication of quality with regard to voice services. Providers of voice services should have an incentive to provide quality and should not be burdened in case they decide to offer quality.

GSMA/ETNO notes that BEREC should provide guidance to NRAs on how to define certification criteria for robust monitoring systems and the certification procedure for third party measurement systems should be lean, non-bureaucratic and non-discriminatory.

GSMA/ETNO explains that drive tests performed by independent third parties or by an NRA, provide a more robust indication of a network performance at different times and different locations. The use of this complementary transparency measure should be supported by Member States. On the other hand, crowdsourced information should not be over-relied upon as they cannot guarantee the same level of accuracy and reliability.

VD3 proposes short surveys displayed to the user on particular events, e.g. after a phone call or the usage of a particular app. This allows to capture the overall impression of users after a specific activity they initiated.

GSMA/ETNO points that BEREC and NRAs must take into account the existing trade-off between the granularity of information provided to the end user and the confidentiality of information about operators' network elements localization, when defining criteria for the presentation of mobile coverage (i.e. through maps). Accordingly, in addition to BEREC's meaningful components of accuracy, the overall importance of reliability of measurement tools in **GSMA/ETNO's** view should explicitly be highlighted and any limitation of the quality of measurement results, particularly regarding accuracy, should be made transparent.

GSMA/ETNO comments that any limitation of reliability of data should be transparency displayed; e.g. mapping of individual mobile measurements which are not representative for general network performance.

BEREC Response:

BEREC agrees of the harmonization efforts need on ensuring that the information gathered and presented is valuable for the intended users and uses noted by **GSMA/ETNO**. Therefore BEREC considers that NRAs should verify the reliability of mobile coverage information using, where appropriate, field measurements, noting that for technical and resourcing reasons it may not be possible to make widespread measurements. Measurements by drive-testing offer an effective method of testing the accuracy of mobile signal predictions. NRAs should ensure

statistical robustness of the measurement methodology and of the measurement processing and analysis.

7. Comments relating to “CP4 Availability and presentation of mobile coverage information”

ECTA believes that the finality of mobile coverage monitoring must be given more explicit consideration in developing this draft report towards a Common Position. While the draft report does distinguish between the provision of independent and reliable information on the one hand, and assurance of coverage obligations being met by licensed MNOs on the other, and proposes to focus exclusively on the former, it remains entirely unclear how the relations between the two, and other functions for which coverage measurement may be pertinent (e.g. emissions and EMF monitoring, network integrity testing), are to be conceived.

In regards of coverage presentation **VD3** considers that it is also very important to be able to provide updated maps at regular intervals. During NRA measurement campaigns, operators tend to boost their performance to get better results. Maps that are regularly updated with fresh measurements (e.g. every week) display a more accurate indication of the mobile coverage the end users can expect.

GSMA/ETNO highlights that aggregated data should be published with sufficient context information, e.g. linked to information on technical details of network coverage. Publication of results should not lead to promotion of certain technologies or operators based on differences measured on arbitrary chosen parameters, certainly if those differences do not translate into objective differences in quality perceived by the customer.

TIM refers to the application created by AGCOM (reachable at the following address: www.agcom.it/broadbandmap), which provides aggregated maps allowing customers to check the number of operators covering a specific area, and the technologies, be it 2G, 3G or 4G, available in a definite place. These maps are created combining the information supplied directly by single operators at national level with a resolution of 250m x 250m, indicating for each technology the presence of sufficient outdoor signal to deliver the service. Data aggregation is carried out by AGCOM as to safeguard the principle of confidentiality and security. **TIM** concludes, when defining criteria for the presentation of mobile coverage (i.e. through maps), BEREC and NRAs should take into account the existing trade-off between the granularity of information provided to the end user and the confidentiality of information about operators' network elements localization.

VD3 suggests to discard provisions of any locations with a precision of over 100 meters and considers that vendors should be able to provide clear descriptions of how they detect this parameter, as well as an index of confidence for each measurement so that NRA's can then decide whether to include or not these measurements in their coverage maps.

ECTA suggests dedicating additional efforts to conceptual clarification of coverage characteristics and their communicability, before investing further resources into presentational aspects.

VD3 supports the publication of maps is and all the more powerful if the data building the map layers are constantly recalculated based on fresh measurements coming from end user devices.

VD3 recommends in urban areas with high population densities the using a granularity of 50 m x 50 m, as it is common that operators deploy arrays of micro base stations with small coverage radiuses. This granularity ensures a more precise coverage map in cities that concentrate the most users.

VD3 suggests NRA's to be careful when designing maps that overlay several layers of different colours as they tend to become saturated and unreadable. **VD3** recommends providing the dates and number of measurements that contributed to the map should also be included.

BEREC Response:

In response to **ECTA**'s claims that other functions for which coverage measurement may be pertinent (e.g. emissions and EMF monitoring, network integrity testing) and are not dealt with, BEREC confirms that this paper does not set out to consider emissions and EMF monitoring. These items are outside of the scope of monitoring mobile coverage for the purpose of displaying coverage on a map or to address the consumer perspective about availability of services. Further the availability of radio equipment in the market must be in accordance with the Radio Equipment Directive, which requires equipment to be constructed for efficient use of the radio spectrum, as well as electromagnetic compatibility, to avoid interference with terrestrial and orbital communications.

In addition, BEREC does not consider there to be benefit for consumers in accessing information on network integrity testing for the purpose of displaying coverage on a map.

8. Other comments received

ECTA observes that the document contains many references to 'consumers' / 'consumer audience' / 'consumers and citizens', but a more systematic inclusion of businesses, non-profit and public sector organisations (e.g. in education, healthcare, transport, safety) is required. **ECTA** stated that accordingly, non-individual measurement of network performance, the most accurate way to provide general and objective transparency is based on drive test. Complimentary to drive tests, many operators offer coverage maps in the internet, which provide calculated information about deployed networks in different regions and such sources are usually not reliable and provide no robust indication of an IAS provider's network performance.

BEREC response:

In relation to **ECTA's** view that the report should include broader reference to businesses, non-profit and public sector organisations, BEREC responds that the aim of the report is about publishing easy-to-access, accurate, reliable and comparable information to increase transparency and help consumers to know if they receive the service they bought, or to empower them to make informed decisions before subscribing to a mobile service. BEREC does not intend to identify different individual consumers (at the end-user level) at this point, as a similar context would seem to apply in all cases.

ECTA explains where operators have different spectrum portfolios (e.g. several challenger mobile operators have a spectrum deficit compared to incumbents/earliest entrants, and several have a lack of < 1 GHz spectrum which is crucial for indoor and in-vehicle coverage), this needs to be appropriately reflected and measures need to be taken in other areas of regulation to correct spectrum deficits that are harmful to competition. In particular, the monitoring of coverage through national roaming should not only establish whether or not national roaming arrangements are in place, but clearly seek to identify the conditions to which they are subject and assess the limitations that these impose for delivering on coverage targets.

BEREC response:

In relation to **ECTA's** view on cases where operators have different spectrum portfolios, BEREC responds that spectrum assignment processes are outside of the scope of this work and that the CPs focus on outdoor coverage only, which is in line with the specific views of respondents on the context for monitoring mobile coverage set out above. In addition, BEREC confirms that the principles of mobile coverage obligations specifications, and the specification process for same, are outside this scope of this document.

ECTA is particularly concerned that competitively relevant information, which includes information about compliance with licence conditions, may be misrepresented or misperceived due to inconsistent reporting standards and contexts, and therefore calls on BEREC to address these concerns carefully and explicitly.

BEREC response:

BEREC does not share **ECTA's** concern that information about licence compliance with licence conditions may be misrepresented or misperceived due to inconsistent reporting standards and contexts. BEREC considers that NRAs may manage appropriate manage information by indicating sources of data used in presenting mobile coverage on maps to consumers and setting out the context upon which those maps are made available.

MVNO Europe asked BEREC to include the wholesale access dimension (roaming access as well as domestic MVNO access) in its work on 5G. In their opinion undue restrictions of a similar nature in the context of 5G would severely damage the innovation potential of 5G, therefore BEREC and NRAs need to be budget conscious, and avoid imposing material new costs on industry, including data collection and data presentation (coverage mapping) costs.

BEREC response:

BEREC does not consider that the wholesale access dimension referred to by **MVNO Europe** is relevant in the context of the scope of the project (discussed above) as the work does not consider the setting of licence conditions. In relation to **MVNO Europe's** view that BEREC and NRAs are budget conscious, BEREC addresses this in the introduction and objective section set out above.

Comments on Internet access services (IAS)

GSMA/ETNO indicates that the performance of the IAS is highly dependent on factors beyond the ISPs' influence (e.g. the kind of downstream in higher network topologies). Therefore, the focus on packet loss metrics could have adverse unintended consequences that ultimately harm end-users and CAPs. New transparency requirements on packet loss could prompt end-users to choose IAS with low packet loss. Consequently, ISPs have an incentive to reduce packet loss through increased router buffers, which could result in slower and less optimized Internet routing systems. **GSMA/ETNO** points out that the measured performance must not be confused with general network performance; e.g. customers may choose a lower bandwidth although tariffs with higher bandwidths are available.

As regards IAS in terms of physical access to the Internet, **GSMA/ETNO** suggests that the exercise of measurement of quality by regulators be carried out by sticking to the legal provisions of the sector-specific regulation, which is by taking into account very well defined parameters defined in the regulation.

GSMA/ETNO considers that in regard to IAS, end-user dependent factors have a crucial importance with regard to accuracy. ISPs only control their networks but there are many things out of their control, such as premises, equipment etc.

Regarding IAS **VD3** notes that video streaming, online gaming or Web browsing do not have the same data rates or latency requirements for a good user experience.

TIM explains that only a reliable monitoring system can deliver measurements that provide transparency of an ISP's actual performance. To be reliable, the system needs to exclude external factors that interfere with the IAS's performance, such as infrastructure beyond the ISP's backbone and the end-user's.

GSMA/ETNO considers that end-user equipment is highly relevant for coverage maps that are sourced with customers' individual measurement, but such measurement tools (e.g. apps) usually do not reflect the actual performance of the IAS since the device distorts the measurement (e.g. restricted technical performance, use of wifi, parallel run apps, measurement server outside of the IAS' backbone).

Regarding Internet Access Services, **GSMA/ETNO** very much support BEREC's finding that up- and download speed are only some parameters crucial for customers' experience. Additional parameters which are in but also outside of the ISP's providers control strongly determine customers' experience. It should be ensured that operators have equal access to test servers outside of the ISP's providers' control.

BEREC Response:

BEREC agrees with end-user factors and ISP's actual performance influence on the coverage map indicators but the present scope of BEREC is not intended to define or find parameters related to IAS performance when measuring coverage maps.