Body of European Regulators for Electronic Communications
BEREC

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BEREC Report on the outcome of the public consultation on draft BEREC Guidelines on Common Approaches to the Identification of the Network Termination Point in different Network Topologies

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1 Executive summary

BEREC published the draft Guidelines on common approaches to the identification of the network termination point (NTP) in different network topologies ('the draft Guidelines') on 7 October 2019. At the same time, a public consultation was opened, running until 21 November 17:00 (CET).

The draft Guidelines and public consultation are in accordance with Article 61(7) of the European Electronic Communications Code (EECC).[1] In particular, Article 61(7) stipulated that '*By 21 June 2020 in order to contribute to a consistent definition of the location of network termination points by national regulatory authorities, BEREC shall, after consulting stakeholders and in close cooperation with the Commission, adopt guidelines on common approaches to the identification of the network termination point in different network topologies*.'

BEREC received 68 responses to the public consultation from various types of stakeholders (see Table 1). Apart from network operators and their associations, Telecommunications Terminal Equipment (TTE) manufacturers and consumers (most of the individuals are likely consumer) and their organisations, BEREC received responses also from other associations, non-profit organisations and other organisations. Please refer to the list of stakeholders in the annex for a thorough overview. Stakeholders who have requested confidentiality are referred to as "Confidential contribution". In addition, the stakeholders had the possibility to provide clarifications to their written contributions in a meeting held on 4 February 2020 in Brussels.

Table 1: Overview on the type of stakeholders who responded to the public consultation

Type of stakeholder	Number of stakeholders
Individual	31
Consumer organisation	2
Association of TTE manufacturers	1
Network operator	9
Association of network operators	13
Other associations	6
Non-profit organization	4
Other organizations	2
Total	68

Source: BEREC

This report provides an overview of the responses BEREC received and the BEREC response to each topic addressed by stakeholders in particular with regard to the need to adapt the draft Guidelines.[2]

[1] Directive (EU) 2018/72 of the European Parliament and the Council establishing the European Electronic Communications Code, OJ L 321/36 of 17 Dec. 2018

[2] The paragraphs the stakeholders refer to are the paragraphs in the consultation document (see https://berec.europa.eu/eng/document_register/subject_matter/berec/regulatory_best_practices/guidel

The overview of the responses BEREC received is structured according to the structure of the draft Guidelines as follows:

- General aspects
- Location of the fixed NTP
    - Conformity of the definition of the fixed NTP location with the legal provisions
    - Impact on TTE market
    - Assessment whether there is an objective technological necessity for equipment to be part of the public network
        - Interoperability between public network and TTE
        - Simplicity of the operation of the public network
        - Network security
        - Data protection
        - Local traffic
        - Fixed-line services based on wireless technology
- Location of the mobile NTP
- Annex

In addition, BEREC published all non-confidential stakeholder responses received.

2 General aspects

Stakeholder responses

In para. 6 replace "equipment" with "public network equipment"

The Alliance of Telecommunications Terminal Equipment Manufacturers (VTKE) suggests in para. 6 to replace "*equipment*" with "*public network termination*"

Note to Figure 2 "Different locations of the fixed NTP in case of an internet access service" in para. 7

The European Cable Communications Association (Cable Europe) and the joint opinion of Association of Private Cable Network Operators (ANGA), Federal Association of Fiber Optic Connection (BUGLAS), Association of the Providers of Telecommunication- and Value-Added-Services (VATM) point out that the fact that modem and router may be physically integrated must not prevent defining the NTP at point B, because modem and router are still logically separate and the router functionality can be switched off, enabling the user to use a router of his/her own choice.

VTKE suggests the following addition in Fig. 2 the asterisk (*): "In the case that the NTP is at point B, router and modem shall not be integrated in one device. The modem provided by the network has to be standalone modem.

ines/8821-berec-guidelines-on-common-approaches-to-the-identification-of-the-network-termination-point-in-different-network-topologies)

It should be legally possible to disconnect connection when TTE harms the network

The Dutch telecoms operators CAIW, KPN, T-Mobile/Tele2, VodafoneZiggo and the providers united in NLconnect (hereinafter: 'The Dutch telecoms operators') are of the view that it should be legally possible to disconnect connection when TTE harms the network. If the NTP is defined as point A, an end-user's TTE could harm the network or cause security incidents. The network continuity and security are of the utmost importance for telecoms operators, as it is a vital sector and providers of public electronic communications networks and services are to take appropriate and proportionate measures to appropriately manage the risks posed to the security of networks and services, according to e.g. Article 40 of the EECC. The Dutch telecoms providers find it important that BEREC takes a step further and recommends that point A may only be defined as location of the NTP, if legal provisions are in place for network operators to disconnect the TTE in order to protect the continuity and security of the network.

Definition of NTP, section 2.1

In the view of Dansk Energi, the new definition of the NTP shall apply for access of the end-user only and not for network-operators and service providers. This makes it unclear where the point of access between fibre networks and service providers should be. BEREC should clarify that point.

Ambivalent NTP in 2.2 and 2.3

In FTTH Council Europe's view, an ambivalent kind of NTP may occur in networks where the modem host both private and public networks where operators have stipulated that their end-user lets a public Wifi run on his modem which supplies services to any bypassing user, alongside a private network which only supplies services to the specific end-user.

Services not provided "through", but "at" the NTP

Cable Europe and the joint opinion of ANGA, Buglas and VATM suggest that in para. 11 BEREC should consider replacing the word "*through*" by "*at*" since e.g. OTT services are provided through the NTP but are by no means to be described nor controlled by the operator. The same applies for wholesale products offered by the network operator to competitors on the service level.

TTEs do not need to comply with the characteristics of the NTP

In VTKE's view, there is no legal obligation for end-users' TTEs having to comply with the characteristics of the NTP to which they are connected. The following sentence should either be deleted or replaced by: "*End-users' TTEs have to comply with the applicable essential requirements and are accompanied by the EU declaration of conformity*."

EU law prohibits "Any Requirement may therefore be taken into account" (in para. 12, para. 68)

VTKE states that network operators shall not have the possibility to take any requirement their networks have into account when defining the characteristics of the NTP.

Requiring the publication of all NTP characteristics is beyond the scope of BEREC's mandate

Liberty Global observes that in section 2.4 of the draft Guidelines, BEREC holds that 'characteristics of the NTP need to be defined and made publicly available (in the form of detailed interface specifications)'. Additionally, BEREC holds that network operators 'have to define the characteristics of the NTP in sufficient detail to permit the design of TTEs to be capable of utilising all services provided through the NTP'. As is clear from para. 13, BEREC infers these obligations from Commission Directive 2008/63 EC on competition in the markets in telecommunications terminal equipment.

However, Liberty Global notes that article 4 of the Commission Directive only obliges 'users of the telecommunications network' to publish the 'physical characteristics of [new public network interfaces]'. A broader obligation, addressing Member States, is laid down in article 5 of the Commission Directive, but in Liberty Global's view this cannot be interpreted as conferring upon network operators the obligation to publish more than a description of the physical characteristics of network interfaces. Such an interpretation would clearly depart from the text and spirit of the Commission Directive's provision, since that provision is not addressing network operators directly.

Add "*and harm the network*"

VTKE suggests to add "*and harm the network* in para. 59 "*In the case of TTEs not complying with the characteristics of a particular public network's NTP are connected to that public network and harm the network, the necessary measures are in place to handle such situations properly.*"

In para. 61 "*National legal provisions or end-user contracts might stipulate that end-users who harm the public network are liable for any damages […] to the public network*."

In para. 68 "*b. Appropriate measures need to be in place which allow the network operators to adequately protect their networks in case TTEs are connected to the public network which do not comply with the NTP characteristics and harm the network, and to resolve disputes between network operators and end-users*."

Guidance to be provided for NRA for national process to define NTP including stakeholder involvement

The European Telecommunications Network Operators (ETNO) suggests that the guidelines should include guidance on processes that NRA's have to follow in order to define the NTP. The national process would also need to involve discussion with stakeholders.

NTPs already defined, costs of changing established NTP definitions

ETNO believes that in various countries NRAs have already defined NTPs at national level. Thus, there is no reason to renew national conclusions in relations to NTPs if these have already been made after appropriate national consultation with all relevant stakeholders and implemented in the market. Operational consequences of amending existing national definitions may lead to high cost and great uncertainty, which would not be proportionate.

No forced harmonization

ETNO considers the Guidelines to be mainly relevant for future technologies and the equipment used therefore and they should consequently not copy PSTN as role model for other technologies, network topologies or services. Thus, ETNO is not in favour of forced harmonisation in context of the Guidelines. For new technologies, it would be wise to wait with the definition of any NTP until an acceptable level of maturity with regard to network solutions, technology and related standardisation.

Bouygues Telecom suggests that the NTP approach should mainly concentrate on the networks of the future in order to avoid disruption on existing practices or networks at the end of their lifecycle.

Guidelines too open

The Dutch telecoms operators are of the view that the guidelines do not give enough guidance on how the different criteria are to be evaluated. The NTP should be set for networks and not for services, leading to only one NTP, and only for broadband networks because all other technologies are old technologies for which no new obligations should be created.

Specific services and NTP

ETNO believes that there is no reason whatsoever to revisit longstanding practices and to include traditional networks and services as referred to in para. 143 under 1, 2, 3 and 8. If such services would nevertheless be included in the Guidelines, they should be separately analysed, potentially leading to similar outcomes as the historic ones. ETNO would therefore favour to exclude such services from the Guidelines and leave existing national practices untouched.

ETNO acknowledges that modern IP based networks are capable of carrying the other services of the annex, but the implied conclusion that defining an NTP at either point A, or point B, or point C has consequences for all equipment used to offer the different services is unjustified. Even where point A or B are chosen as the point where the network ends, there will be reasons that specific equipment for such specific services has to be supplied by the service provider. The requirement on the (IAS-) modem would for such services simply be that on the network termination point a transparent (ethernet) port is available to which the service specific equipment (e.g. a settop box) can be connected. ETNO prefers that the Guidelines only cover the physical NTP location and are not extended to equipment used for services carried over the network. As a consequence, such services would be out of scope of the Guidelines and references thereto should be deleted, as well in the annex as in the text of the Guidelines (such as references to ‘media-boxes’).

If BEREC however would include all (networks and) services mentioned in the annex, the Guidelines should apply the framework to each and every service separately, with potential different outcomes for different services.

BEREC response

BEREC agrees with the suggestions from VTKE to make it more clear in para. 6 of the Guidelines that the word “equipment” refers to the equipment of the public network and in

paras. 61 and 68b that the measures considered refer to the situation where the TTE harms the public network and to take this into account also in para. 59 and adapted the Guidelines accordingly.

BEREC agrees also to the point made by VTKE that there is no legal obligation to use only equipment that conforms to the requirements of the NTP specification. Nevertheless, end-users have to use equipment conformant to the technical characteristics of the NTP if they want to fully claim the services, especially regarding service quality, that are defined in their contract. BEREC adapted the wording of para. 10 of the Guidelines.

With regard the view of Cable Europe, ANGA, BUGLAS and VATM that in case the NTP is located at point B the modem must not necessarily be a standalone modem and an integrated device that only provides modem functionality and has switched off the other functionalities is also allowed and the opposite view of VTKE that in this case the modem must be a standalone modem, BEREC would like to clarify. According to the draft Guidelines (para. 53b), in case of point B "*The NTP is the interface at the end-users' side of the modem (e.g. traditional DSL modem, fibre modem, cable modem) which provides network termination but no further functionality (e.g. without switching, routing, NAT, WLAN)*." This does not say anything about how the modem functionality needs to be technically implemented (traditional DSL modem and fibre modem are solely mentioned as an example). BEREC considers it out of scope of the Guidelines to prescribe network operators how they shall implement network functionalities which would also violate the principle of technology neutrality and adapted the Guidelines in order to make this more clear.

BEREC shares the view of the Dutch telecoms operators that measures are important that enable network operators to protect their networks in case a TTE harms the network. The draft Guidelines take this into account and, for example, require that the NRA assessment needs to consider in particular that "*appropriate measures need to be in place which allow the network operators to adequately protect their networks in case TTEs are connected to the public network which do not comply with the NTP characteristics [and harm the public network][3] […]*" (para. 68b of the draft Guidelines). BEREC, however, regards as sufficient that the NRA assessment shall take this into account and does not see a need to limit the appropriate measures to legal provisions only and to deploy a more restrictive approach.

In respect to the proposal from Dansk Energi that the Guidelines shall clarify the point of access between fibre networks and service providers, BEREC would like to point out that, according to the definition of the term 'NTP' in the EECC (Art 2(9)), this point is not an NTP (see explanations in paras. 2 to 5 of the draft Guidelines) and, therefore, out of scope of the Guidelines. The wholesale level (including open access) may also have an impact on the NTP location and the Guidelines take this into account (see BEREC response in section 3.3.1).

With regard to FTTH Council's point that a modem may host both a private and a public network, BEREC's view is that typically a network operator needs the end-user's consent when providing public WiFi services based on an access point located at the customer premises. Therefore, in case the NTP is located at point A, the end-user has in any case the

[3] See BEREC's comment to VTKE's proposal above.

possibility to use its own modem and router. If the end-user allows the network operator to provide also a public WiFi service based on his equipment, then the end-user at the customer premises has access to the fixed public network at point A and the other end-users in the street to the wireless public network.

BEREC's response to ETNO's proposal to include in the Guidelines also guidance on processes that NRAs have to follow is that the Guidelines with the foreseen NRA assessment already provide comprehensive guidance to the NRA and the processes NRAs have to follow at national level based on national law differ. Therefore, BEREC suggests not to adapt the Guidelines.

BEREC's view on ETNO's further suggestions not to renew national conclusions in relations to NTPs and avoid a forced harmonisation is that the question when NRA shall define the NTP location is out of scope of the Guidelines. This follows from the EECC (Art. 61(7)) which requires that "*NRAs shall take utmost account of those guidelines [the Guidelines] when defining the location of NTPs*" but does not stipulate when NRAs have to define the NTP location.

With regard to ETNO's view that the Guidelines shall focus on networks of the future and not include traditional networks as well as the Dutch telecoms operators' view that the Guidelines should consider broadband networks only, BEREC would like to point out that, according to the EECC (Art. 61(7)), the scope of the Guidelines is not limited to a certain type of network.

BEREC does not share the view of the Dutch telecoms operators that the Guidelines do not give enough guidance since, for example, they do not recommend or define specific NTP locations. The Guidelines (section 3.3) define in detail the assessment a NRA has to carry out when defining the NTP location. The Guidelines shall provide "*common approaches to the identification of the NTP*", according to the EECC (Art. 61(7)) and not identify the location of the NTP itself.

Regarding the Dutch telecoms operators' comment the NTP location should be defined for networks and not for services, BEREC would like to clarify that the annex of the Guidelines solely "*illustrates for several (retail) services that the location of the NTP has an impact on whether an equipment is part of the public network or part of the TTE*" but do not suggest to define the NTP location separately for different services.

BEREC does not agree with ETNO's view that the Guidelines shall apply the framework to each and every service separately since the NRA assessment needs to consider all services offered by the network operator at the NTP together. Otherwise contradictions may result as the following example shows. The NRA assessment of the internet access service only (case (5) in the annex of the Guidelines) may result in a NTP location at point A and the NRA assessment of the VoIP service only (case (4) in the annex of the Guidelines) may result in a NTP location at point B. Then the modem is both not part of the public network (internet access service) and part of the public network (VoIP service) which is not possible.

Contrary to the opinion of ANGA, BUGLAS, VATM and Cable Europe, in para. 11 of the draft Guidelines the wording "through the NTP" is in BEREC's view correct because the interface description at the NTP must also contain information necessary to realize services at

interfaces after the NTP if they have to be provided by the network. Otherwise TTE manufacturers would be unable to design and manufacture TTE that is capable of realizing all services that the operator offers from the network. Network operators however do not have to describe OTT services because they do not provide these services themselves, but these services are based on IAS, and only the latter is provided by network operators.

BEREC does not agree to the point made by Liberty Global that Art. 4 of Directive 2008/63/EC is no basis for the obligation to publish comprehensive interface descriptions by network operators. The wording of Art. 4 of Directive 2008/63 has to be interpreted in the light and the context of the replacement of the R&TTE-directive 1999/5/EC by the RED-Directive 2014/53/EU. Art. 4 para 2 of the R&TTE Directive 1999/5/EC stipulated the following:

> *Each Member State shall notify to the Commission the types of interface offered in that State by operators of public telecommunications networks. Member States shall ensure that such operators publish accurate and adequate technical specifications of such interfaces before services provided through those interfaces are made publicly available, and regularly publish any updated specifications. The specifications shall be in sufficient detail to permit the design of telecommunications terminal equipment capable of utilising all services provided through the corresponding interface. The specifications shall include, inter alia, all the information necessary to allow manufacturers to carry out, at their choice, the relevant tests for the essential requirements applicable to the telecommunications terminal equipment. Member States shall ensure that those specifications are made readily available by the operators.*

Recital 5 of RED-Directive 2014/53/EU saw no need for a replacement of this obligation in that directive because '*competition issues in the market for terminal equipment are appropriately covered by Commission Directive 2008/63/EC, in particular through the obligation for national regulatory authorities to ensure the publication of details of technical interface specifications for network access. It is therefore not necessary to include in this Directive requirements facilitating competition in the market for terminal equipment covered by Directive 2008/63/EC.'* From this follows that the provisions of Directive 2008/63/EC are a sufficient basis for the respective paras. (9, 11, 13) in the draft Guidelines.

This also pertains to the view of VTKE that interface descriptions may not feature *"any requirement of the network."* From Art. 4 2008/63/EU follows (see above) that interface descriptions must feature any requirements that TTE must fulfil to interwork with the network they are intended to be connected to and to support the services provided through this interface.

3 Location of the fixed NTP

Stakeholder responses

The NTP can only be passive since the EECC (recital 273 and Art. 105 (1)) refers to modems and routers as terminal equipment

In VTKE's view the EECC (recital 273 and Art. 105 (1)) refers to modems and routers as terminal equipment. This means that the first active device (the modem) at the end of the local loop is already a terminal device. Consequently, the NTP can only be passive. According to the designation of the BEREC Report BoR (18) 159, only an NTP at point A is consistent with the EECC.

The Guidelines must address the currently fragmented regulatory landscape of NTP definitions

Liberty Global is of the view that in defining the common approaches that national regulators shall apply, the forthcoming guidance must eliminate (potential) uncertainties and address existing regulatory fragmentation.

The Guidelines must accommodate different network topologies by supporting the adoption of multiple NTP definitions

As Liberty Global holds in its position paper, to support a mixed technology approach, which will not only maximize scope for innovation, and infrastructure competition, but will also serve as the most cost-effective means to achieve Gigabit Society objectives, it may be necessary for national regulators to adopt multiple NTP definitions. This is also recognized by the text and spirit of the Code, which support the adoption of multiple NTP definitions explicitly and emphasize that the Guidelines must provide '*common approaches to the identification of the* [NTP] […] *in various concrete circumstances*'. Liberty Global commends BEREC to adopt this approach in its draft Guidelines.

The guidelines should only provide guidance to NRAs on common approaches to the identification of the network termination point (NTP) in different network topologies, and in that sense help identify what "the physical point" which "is identified by means of a specific network address" is in different network topologies, without judging on a by default network termination point. Only some key technical parameters must be defined, and NRA have some tools to assess the risk of having the network termination point located at point A, B or C, for different network topologies.

Criteria to be taken into account by NRA

The European Competitive Telecommunications Association (ecta) argues that in para. 14, it should be clarified that the NTP is not "*defined*" but "*identified*" by the NRA. It should be furthermore elaborated how the three criteria mentioned in para. 14 were derived, which at present is unclear.

Ecta notes that BEREC disregards the first criterion, conformity with legal definitions, and relies instead on other non-essential criteria.

BEREC response

BEREC does not share the view of VTKE that modems and routers must in all cases be TTE and cannot be part of the public network because in this case, the identification of the NTP and the development of guidelines for this process would not have been necessary and not stipulated by Art. 61 (7) EECC.

Concerning the request by Liberty Global that the Guidelines should unify a fragmented regulatory landscape concerning NTP definitions, BEREC replies that the Guidelines shall serve this purpose, but cannot achieve a homogenization of national NTP identifications that in themselves result from technical and market conditions in the respective member states.

With regard to Liberty Global's request that the guidelines shall not prevent the identification of multiple NTP definitions, BEREC points out that such multiple NTP definitions are possible if the objective technological necessities for them exist.

In the same way, and with reference to the comments made by Liberty Global and Bouygues Telecom, objective technological necessities that result from a specific network topology can and must be taken into account in the NRA assessment and can lead to differentiated definitions of the NTP location. The Guidelines also refer explicitly to specific topologies as for example to point-to-multipoint topology (see para. 19, 111-114, 116b of the draft Guidelines).

Concerning the view of ecta that the NTP shall only be "identified" and not "defined" by the NTP, BEREC refers to the wording of Art. 61 (7) EECC that refers to the 'definition of' and 'defining' the NTP location and one time to the 'identification' of the NTP. The usage of 'defining the NTP location' thus follows from the EECC itself. The criteria for doing so are derived from the interpretation of the definitions of the NTP and the local loop in their context of access regulation, and from the Regulation 2015/2120 and the affiliated BEREC Guidelines, see 3.1 below.

3.1 Conformity of the definition of the fixed NTP location with the legal provisions

Stakeholder responses

Article 3(1) of Regulation 2015/2120 as well as Recital 3 of Directive 2008/63/EC unambiguously demand to give end-users the right to use their own TTE

Free Software Foundation Europe (FSFE) points out that according to Regulation 2015/2120 and Directive 2008/63/EC, end-users must have the right to choose the electronic devices in order to connect to the internet, which includes both the modem and the router. This freedom of choice enables them to choose devices that suit their individual needs best.

Homo Digitalis states that the values of digital sovereignty and independence from internet access service (IAS) providers are enshrined in the Regulation 2015/2120 as well as the Directive 2008/63/EC.

Further Homo Digitalis agrees with BEREC that setting the network termination point (NTP) at point A contributes the most to the competition on the telecommunications terminal

equipment (TTE) market and aligns with the FSFE's position that only point A as the NTP location allows for a competition of equipment manufacturers for better security precautions, update service reliability, and complementary features.

GSM Association (GSMA) is of the opposite view that although the Open Internet Regulation (Regulation (EU) 2015/2120) does enable end-users to make use of TTE of their choice, it provides no mandate to broaden the domain of the end-user to make more equipment fall under the 'free choice' requirements for TTE, by choosing to set the NTP at a specific location based on parameters that suit the purpose of the right to free choice.

Point A is best aligned with the spirit of the Open Internet regulation

Center for Democracy & Technology and Public Knowledge (CDT and PK) support Point A as the best option because it gives users the greatest number of choices and greatest control over the TTE in their own homes. Although other NTP placements could potentially satisfy the regulatory language in Article 3(1) in conjunction with the definition of "terminal equipment" in Directive 2008/63/EC (Art. 1(1)), Point A is best aligned with the spirit of the Open Internet regulation because it maximises users' control and choice while also reducing opportunities for ISPs to exert unnecessary control over users' internet access and local networks.

Any definition of NTP location which prevents the end-users right to use TTE of their choice should be construed narrowly

The Italian Internet Service Provider Association (AIIP) argues that any exception to the general rules under Article 3(1) of Regulation (EU) 2015/2120 should be assessed on a "case by case" basis with the participation of all market players and only be accepted if there is an objective and absolute technological necessity of equipment to be part of the public network.

When defining the NTP location BEREC and NRAs should always bear in mind three aims

AIIP points out that in defining NTP location among the different options (A, B or C), BEREC - and, by consequence, NRAs - should always bear in mind the following aims:

- to ensure full competition in the market for TTE as provided by Dir. 2008/63/EC;
- to ensure full competition among network operators and service providers and to prevent the use of TTE for anti-competitive purposes;
- to protect consumers and to cope with the interfering obligations set forth by Regulation 2015/2120/EU to ensure network neutrality;

NTP definition does not mean choice of NTP by NRAs

In Cable Europe's view (and similar for ANGA, BUGLAS, VATM and Bouygues Telecom) identifying the NTP should not be a judgement call by the NRA based on which point best promote a particular set of parameters as proposed by the draft Guidelines. Therefore they consider that the inclusion of the parameters "The impact on the TTE market" (section 3.2),

"Interoperability between public network and TTE" (section 3.3.1), "Simplicity of the operation of the public network" (section 3.3.2), "Network security" (section 3.3.3), "Data protection" (section 3.3.4) and "Local traffic" (section 3.3.5) not to be suitable to identify the location of the NTP. They are instead tools that can be used to promote different regulatory objectives. The draft Guidelines go beyond the mandate given by the EECC and BEREC should therefore remove those parameters from the final version of the document.

The stakeholders KIKE, PIKE and similar GSMA consider that BEREC's mandate should be limited to identifying the NTP's technical location in accordance with the EECC definition (Art. 2(9)):

"'*network termination point' means the physical point at which an end-user is provided with access to a public electronic communications network, and which, in the case of networks involving switching or routing, is identified by means of a specific network address, which may be linked to an end-user's number or name*"

Eir notes that defining the NTP should be a purely technical exercise based on the definition of Art. 2 (9) EECC, network topology and associated technical characteristics. Additional criteria will instead reflect different policy objectives and fragment the NTP definition at the Member State level.

NOS interprets the provisions in article 2(9) EECC in a sense that the common approaches *to the identification of the network termination point in different network topologies* should have a technical approach and entail an analysis of the technical specifications underlying regulatory intervention.

Criterion "objective technological necessity" cannot be drawn from Open Internet Regulation (Regulation (EU) 2015/2120)

Several stakeholders (ANGA, BULGAS, VATM and Cable Europe) consider that the criterion of "objective technological necessity" drawn from BEREC's Open Internet Guidelines, were not meant to broaden the end-user's domain, but to determine whether an ISP justifiably provides "obligatory equipment."

Ecta notes that conformity requirements for NTP identification are derived from the Open Internet Regulation. Whether an objective technological necessity exists for equipment to be considered part of the public network when identifying the NTP location cannot be derived from the Regulation itself. While the Regulation does grant a right to choose terminal equipment, the test of whether an objective technological necessity exists for equipment that end-users receive from an IAS provider to form part of the latter's network is specified only in BEREC's Open Internet Guidelines. Overall, ecta therefore neither sees the basis for the criterion of 'objective technological necessity' in the Open Internet Regulation, nor how this criterion materially supports the identification of the NTP.

For the aforementioned reasons, ecta proposes to delete section 3.1.3 and 3.3.

Local loop

In Deutsche Glasfaser's and FTTH Council Europe's view, the definition of the NTP should not restrict operators in their use of the local loop as an access product. The user of an

unbundled local loop should not have to choose his ONT according to the service operator or consumer.

Furthermore the FTTH Council Europe points out that the point of access to local loop can change with the technology deployed.

Ecta notes that no systematic approach has been adopted to the analysis of the role of the identification of the NTP on aspects of access regulation like very high capacity networks, public communication networks, geographic number and caller location information. Further, there is no definition of the local loop as such and the potentially implications deriving from this determination.

Ecta concludes that solely relevant criteria derived from Art. 2 (9) EECC should be taken into account in identifying the NTP.

Guidelines must recognise that the EECC is the sole legal basis for adoption of NTP definitions

Given the current fragmented state of the regulatory landscape, particularly with regard to the legal basis for adoption of NTP definitions, Liberty Global recommends BEREC to amend the section on 'General aspects', with a view to laying down explicitly that the Code can be the sole legal basis for adoption of NTP definitions.

Chief concern not Terminal Equipment Market, but Art. 3 EECC

Even though ETNO acknowledges the fact that the terminal equipment market is fully liberalised and the use of equipment that is in conformity with the published specifications cannot be restricted, ETNO is of the opinion that in these Guidelines the focal points for the analysis should be derived from Article 3 EECC. This article does not include the promotion of competition on the TTE market as an objective for BEREC and NRAs. ETNO believes that based on the objectives of the EECC BEREC should prioritise the promotion of competition in the provision of electronic communications networks and associated facilities, including efficient infrastructure-based competition, and in the provision of electronic communications services and associated services. For this, the NTP can define the legal border of liability of network operator and the consumer, but for this it's not necessary to make a physical hardware cut between two devices.

Ecta considers that the conformity requirements associated with the Equipment Directive do not provide a tangible criterion with which the location of the NTP would have to comply. Further ecta believes, that section 3.1.4 and 3.2 should be removed from the guidelines.

GSMA is of the view that Directive 2008/63/EC solely exists to address and remove the existence of exclusive rights granted by the Member States for the supply of user terminal equipment for connection to the network and considers it to be a misinterpretation to define the NTP location in order to promote free choice of TTE.

NTP definition has to depend on network topologies

Cable Europe, ANGA, BUGLAS and VATM in their joint opinion and Bouygues Telecom believe that NRAs should apply the NTP definition of Article 2(9) EECC and identify the physical point based on where it is specified and apply it to a given network topology. In P2P

networks the end-user can be individually addressed by an immovable physical point – the socket at the end of the local loop – and its dedicated connection to the next element in the operator's network. In P2MP networks, on the contrary, there is no such individual connection, but the individual connection must be achieved logically, i.e. the provision of a unique address by an active device. The draft Guidelines should be amended to include such analysis for all relevant network topologies, including for switching and routing made through HFC networks.

In Bundesverband Breitbandkommmunikation e.V.'s (BREKO) view pursuant to Article 61 (7) of the EECC, BEREC has to provide guidance to NRAs to determine the network termination point in different network topologies. It should therefore be concluded that there may also be different network termination points, or the network termination point has to be determined in such a way that due account is taken of the specific requirements of different network topologies. In this respect, it is too short and does not meet the requirements of the EECC if the consultation document does not take different network topologies into consideration.

Open Fiber points out that a network address must be an IP address, which can only be attributed to an active component. In PON, a network address cannot be given to an ONT, but only an active component after that, situated at a point between B and C.

Specific network address does not need to be implemented in the NTP itself

VTKE agrees that it is not necessary for the specific network address to be implemented in the NTP itself.

The requirement in the NTP definition does not contradict the requirement of a passive NTP (point A).

VTKE agrees that the requirement in the definition (para. 19) does not contradict the requirement of a passive NTP (point A). It is assumed that the NTP must be located behind the last routing definition of the network operator with which the terminal equipment linked to the number of the subscriber can be reached.

Only point A is consistent to the definition of the NTP

VTKE is of the view, that it should be stated clearly in the guideline that only point A is consistent to the definitions of NTP, local loop and public electronic communications network.

Epicenter.works states that BEREC should express a preference for the NTP to be located at point A as the default option as it allows end-users to operate their networks with the maximum autonomy and facilitates a large TTE market.

Homo Digitalis suggests NTP at point A as the default recommendation for NRAs and endorses FSFE's input in this regard.

Bouygues Telecom argues that the Guidelines should not adopt a de facto position where point A is the default NTP as far as no technological necessity for another point may be found.

Identification of NTP "by means of" specific network address

In Cable Europe's view (and similar in the joint opinion of ANGA, BUGLAS and VATM) the definition in Article 2 (9) EECC requires that the NTP is identified by means of, and not just "*with the help of*" a specific network address so that the NTP cannot be changed by actions of the end user, e. g. moving an identifying device to another socket in P2MP networks.

Further, the above suggests that the NTP is to be defined as the point at which access to network is granted and the end-user can be addressed. In P2P networks, this point is the local loop. In P2MP networks with shared media, the end-user must be addressed logically by means of an active device.

Liberty Global states that the position in the Guidelines that in point-to-multipoint technology (e.g. cable, fibre access) the NTP has not to be defined by a specific network address for lack of switching and routing in such networks is factually incorrect, fails to adhere to the principle of technology neutrality and misinterprets the EECC by focusing on the access network exclusively.

In case of internet access point A is the default NTP

VTKE believes that end-user telecommunication terminal equipment for accessing the Internet falls in general under Directive 2008/63/EC and Regulation (EU) 2015/2120 when regarding Internet access. This implies point A to be the default NTP in the case of Internet access.

Include further legal provisions of Directive 2008/63/EC and that point A is compliant to this directive

VTKE suggests that reference to the legal definition of TTE as given in Art. 1 No. 1 (a) of Directive 2008/63/EC should be added as follows:

"*The legal definition is consistent with the common sense of TTE to directly contact the local loop and use the signals transported over the local loop. The legal definition indicates strongly that TTE is supposed to be connected to point A in fixed networks. It should be explicitly noted that point A is compliant to Directive 2008/63/EC*."

Include further guidance (paragraphs)

VTKE suggests to add the following guidance after para. 28 "*Operators of public telecommunications networks shall not refuse to connect telecommunications terminal equipment to appropriate interfaces on technical grounds where that equipment complies with the essential requirements*". This is justified due to Directive 2008/63/EC that states in Art. 3 (b) that Member States may "in the case of other terminal equipment, refuse to allow such equipment to be connected to the public telecommunications network where it does not satisfy the relevant common technical regulations adopted in pursuance of Directive 1999/5/EC or, in the absence thereof, the essential requirements".

Furthermore, the following new guidelines should be added:

"*If a network operator intends to refuse TTE to connect at point A by defining point B or C as NTP then the network operator shall prove objective technological necessity why the interface specification for point A can only be made available to selected vendors of*

equipment to be considered as part of the public network and cannot be made publicly available for the TTE market".

"*When defining the NTP at point A, B or C, it shall be assessed what typical end-user products then would be connected to the respective NTP and if they really comply to be (and intend to be) telecommunication terminal equipment and fall under Directive 2008/63/EC*."

"*For point A undoubtedly only TTE would connect, whereas at point C a local area network printer would mutate to TTE. At point B it is unclear what kind of products are connected to the interface*"

Guidelines must take other relevant legal instruments into account

Liberty Global observes that despite the fact that the draft Guidelines make (ample) reference to the Open Internet Regulation's provisions on the freedom of end-users to use the TTE of their choice, they omit to describe the relationship between the definition of the NTP and the conformity assessment of internet access services with regard to speed or other quality of service parameters, to which Liberty Global has called upon BEREC and all national regulators. Therefore, Liberty Global recommends to take these matters into account, – particularly in view of the relevant Commission Study, – as well as their impact on the application of the forthcoming ePrivacy Regulation.

BEREC response

Answering to the opinion of Cable Europe, Liberty Global, ANGA, BUGLAS, VATM, Bouygues Telecom, ecta, KIKE, PIKE and eir that the criteria and considerations of the EECC were taken account of insufficiently, BEREC wants to point out that the primary context of the legal basis of the draft guidelines, Art. 61 EECC, is concerned with access regulation. The NTP is part of the definition of the local loop` in Art. 2 (30) EECC, which is an access product. The NTP must thus be the border on the end-user side of the network where the bottleneck conditions are still valid that lead to its regulation in the first place. Equipment that can be replicated – technically and economically – by an access seeker should therefore not be part of the NTP. This follows both from the principle of unbundling and the principle that only investment in infrastructure that is necessary for providing an access product can be considered when setting rates for access products if price control and accounting obligations (Art 74 EECC) are imposed. Including equipment that is not technically necessary in an access product would impede access seekers by higher costs, by limiting their ability to design their own networks and by restricting their ability to offer modems, routers or integrated access devices (IADs) to their customers, be it on an obligatory or optional basis. The criterion of objective technological necessity that in the draft Guidelines was derived solely from the BEREC Net Neutrality Guidelines[4] therefore follows even more strongly from considerations of access regulation competition and thus complies with the demand made by ecta, ETNO and AIIP that the focus should be on the effects of the NTP on access regulation and competition. An NTP location where the access network would include equipment that is not objectively technologically necessary would thus be

[4] BEREC Guidelines on the Implementation by National Regulators of European Net Neutrality Rules (BoR (16) 127)

contrary to the regulatory aims of fostering competition, efficient infrastructure investment, innovation and customer choice, Art. 3 (2) lit. b), c) and d) EECC. BEREC considers it appropriate to refer in the Guidelines also to the access regulation in the EECC and adapted the draft Guidelines accordingly.

The analysis of other legal provisions and aspects of access regulation like very high capacity networks, public communication networks, geographic number and caller location information as demanded by ecta does not undermine, but rather support that view. The definition of 'very high capacity networks' and 'public communication network' simply mention the NTP without giving a hint about how the equipment used at the end-points of the relevant networks affect their operation or performance. The "transfer of information between network termination points" would even take place between passive end-points on the premises of different customers if the addition of active equipment were necessary to deploy a working service to the customer, and that would make sense from the perspective of access regulation if that last device would be added to the access product by the access seeker. The definition of 'geographic number' in Art. 2(33) EECC simply states that it contains 'geographic significance used for routing calls to the physical location of the network termination point.' The receiving function of active equipment at the borders of the network is however not routing but the transposition and/or customer selective decoding of information that has been, in the case of networks with shared media, transmitted to the end-user via what is effectively a line-based broadcast service.

It is for this reason that in networks based on shared media like cable networks and PON, a network address cannot have the pivotal role attributed by ANGA, BUGLAS, VATM, Cable Europe and Liberty Global. A network address implemented in a device at the end of the line/on the customer premises is unable to identify the physical point at which an end-user is given access to the network because an end-user can access the network and its services at any physical point of the shared medium to which his device can be connected, and he can be addressed at any point in the shared medium. The network by itself cannot identify this physical point beyond the shared medium to which the end-user's connection is assigned. This is as valid from the end-user as from the access-seeker perspective, for a bitstream product could connect the end-user at any point of the shared medium. The bitstream-based access seeker has no interest in the specific infrastructures leading to its customer because its access consists of a share in the use of the infrastructure anyway.

As soon as no switching or routing takes place, the identification of the NTP by the network address becomes purely administrative information in the database of the network. Finally, this is in line with the definition of the 'caller location information' in Art. 2 (40) EECC, which simply refers to the 'data of the physical address of the network termination point.' This physical address can only be supplied by databases, but cannot be verified by any active equipment on the customer premises in shared-media networks. The contributors who insisted on linking the implementation of the network address in an active device were unable to overcome the absence of a link between the network address and a definite physical point and the purely administrative nature of this address in such networks. This does not preclude the inclusion of active equipment into the NTP for other reasons, however. This point also shows that it is not possible to define the NTP location solely on the basis of the definition of the term 'NTP' in the EECC (Art. 2(9)) as suggested by Cable Europe,

ANGA, BUGLAS, VATM, eir and ecta. This follows also from point-to-point topologies where e.g. point A and point B are conform with the definition of Art. 2(9) EECC and this definition does not provide any further information where exactly the NTP is located as pointed out in the draft Guidelines (para. 17).

The considerations above apply as well to the criterion of network topology that ANGA, BUGLAS, VATM, Bouygues Telecom and Cable Europe propose as an argument for the necessary inclusion of active customer premises equipment in public networks based on shared media. It is true that in such networks, a logical point is necessary to supply the end-user with the information designated for him. Under the aspect of access regulation, this alone however does not mean that this logical point must be provided by the supplier of the access product, but can be as well supplied by the operator who furnishes the final end-user product. And if there is no necessity that the operator of the network which provides the access has to supply that logical point, the further question arises why this logical point cannot be implemented in a customer supplied device that complies with certain technical requirements, as is the case in wireless broadcast networks like mobile networks or in case of conditional access (CA) systems for TV services with their smart cards. The Guidelines nevertheless do not preclude that the specifics of a certain network topology can be taken account of if objective technological necessities can be demonstrated to result from them on their own or in conjunction with other criteria.

Contrary to the view of Liberty Global, transparency obligations following from Art. 104 EECC and Art. 4 of Regulation 2015/2120 cannot lead to the inclusion of equipment into the network of the undertaking for which otherwise no objective technological necessity exists. Art. 104 (1) EECC states clearly that the obligation to publish information on the quality of service has to take into account how far the undertaking concerned controls the elements of the network over which its services are provided. Insofar as terminal equipment affects the measurement of performance, the reference to specified equipment that conforms to the interface description of the network would allow meeting transparency obligations without forcing the end-user to use obligatory equipment.

Contrary to the opinions of ecta, ETNO, GSMA and Liberty Global, the definition of the NTP cannot be based on the EECC without concern for the neighbouring regulatory frameworks of TTE regulation and Net Neutrality Regulation. A definition of the NTP solely from the perspective of access regulation would risk opening a gap between the regulatory framework for electronic communication networks and services and the regulatory framework for TTE because the NTP of the network made available to the access seeker and the NTP at which the operator supplies the services to the end-user could fall apart despite being both physically situated on the end-user premises. This would disregard recital 19 EECC that sees the NTP, and therefore one NTP only, as the boundary between two regulatory frameworks. It is therefore appropriate to step beyond a narrow focus on access regulation to fill the scope of the definition of the NTP in Art. 2(9) EECC that the NTP is the point where the end-user is provided with access to a public electronic communications network. This however entails by necessity taking into account concerns of the regulatory frameworks with which this border is shared. One of them is TTE regulation, the other is Net Neutrality Regulation (Regulation (EU) 2015/2120) which addresses in part the fact that the EECC

does contain a definition of the NTP, but no specific obligation where network operator or service provider have to provide access to the end-user.

Contrary to the view of ANGA, BUGLAS, VATM, Cable Europe and ecta, the criterion of objective technological necessity follows from the Net Neutrality Regulation, namely the fact that, without such a criterion, the right of end-users to access the internet with TTE of their choice (Art. 3(1)) would be pointless if the respective network operator could draw the perimeter of the network at will, with the effect of including (especially integrated) devices into the operator's domain that include functionalities far beyond those necessary for transmitting signals and data.

Contrary to the view of GSMA, the aim of the Directive 2008/63/EC is not limited to withdrawing exclusive rights, but fostering competition and free choice for users as well. This is shown by recital 5 of Directive 2014/53/EU, see BEREC's response to section 2 (General Aspects) above.

Concerning ETNO's demand that the draft Guidelines should focus on fostering competition in the provision of electronic communications networks and associated facilities, including efficient infrastructure-based competition, and in the provision of electronic communications services, the criterion of objective technological necessity, stemming from the principle of unbundling, does just that, because it is not evident how the inclusion of unnecessary equipment in the NTP should foster the aims quoted by ETNO, while the inclusion of necessary equipment is still possible.

For the same reason, concerns of net neutrality or the TTE market on their own cannot lead to a definition of the NTP always at point A as proposed by VTKE, FSFE, Homo Digitalis, CDT and PK and several individuals because they are not the sole concerns, and the understanding of what a TTE is depends on the definition of the NTP. Developing guidelines for the definition of the NTP location would be unnecessary if one definition of the NTP at a specific point could be derived for all circumstances. The issues raised can be taken into account using the criteria already present in the draft Guidelines. The additions to the Guidelines requested by VTKE which concerned an obligation of the operator when connecting or refusing to connect a TTE to its network are beyond the scope of these Guidelines.

BEREC's response to Liberty Global's view that the Guidelines omit to describe the relationship between the definition of the NTP location and the conformity assessment of internet access services with regard to speed or other quality of service parameters according to Open Internet Regulation (Regulation (EU) 2015/2120) is that currently there is not a full homogeneity of the NTP location and, therefore, this Regulation needs to be applicable for different NTP locations.

Regarding the comments from Deutsche Glasfaser and FTTH Council Europe on the topic 'local loop', BEREC wants to point out that equipment at the customer premises is only part of the local loop if there is an objective technological necessity for that.

3.2 Impact on TTE market

Stakeholder responses

NTP at point A contributes the most to innovation and competition on the TTE market

FSFE agrees with the conclusion that the NTP at point A contributes the most to innovation and competition on the TTE market.

Freifunk Hamburg states that if the end-user can choose his own modem, he or she can choose the modem best suited to his home network, and the operator cannot disable or limit certain features like adding a SIP account.

It is of vital importance that CPE (modem, router, media box) is left to end-user choice.

AIIP is of the view that due to market economics, in order to prevent possible foreclosure behaviours by largest operators, as well as in order to comply with the EC legislation on TTE as well as on network neutrality, it is of vital importance that CPE (modem, router, media box) is left to end-user choice. This might reveal a very fair balance between the need to ensure, fair interoperability between the different CPEs, free access to the Internet as well as to CPEs, full competition in the markets in TTE, competition between service providers.

CDT and PK agree with BEREC's assessment of the market impacts

CDT and PK agree with BEREC's assessment of the market impacts of choosing Point A as the NTP and support Point A as the best way to enable more choices for internet users while also fostering innovation and competition in the TTE market.

Competition on the TTE market no relevant concern

Cable Europe argues that fostering competition on the TTE market is no appropriate criterion because Directive 2008/63/EC was only concerned with issues connected to TTE being subject to state monopolies and wanted to remove such exclusive rights. It was not concerned with the choice of end-users as such, but only with the rights of economic operators to import, market, connect, bring into service and maintain TTE. The term "user" in directive 2008/63/EC comprises, in accordance with the terminology of the Framework Directive (2002/21/EC) relevant at that time also included operators. The border between the sphere of the operator and the end-user cannot be shifted to foster competition in the TTE market because failures of competition in this market are subject to ex-post regulation by National Competition Authorities on the basis of Articles 101 and 102 of the Treaty on the Functioning of the EU.

Ecta shares the above-mentioned and adds that fostering competition on the TTE market is beyond the mandate of art. 61(7).

The Dutch telecoms operators considers the promotion of competition on the TTE market not an objective for BEREC and NRAs. The role of BEREC and NRAs is considered to be first and foremost to "*promote competition in the provision of electronic communications networks and associated facilities, including efficient infrastructure-based competition, and in the provision of electronic communications services and associated services*". The analytical framework in the draft guidelines mentions that particular definitions of the NTP may

negatively affect the competition on the TTE market. That may be the case but if an NRA defines the location of the NTP as point A to promote competition on the TTE market, it could be regarded as imposing an access obligation for which a solid market analysis procedure should form the basis.

Eir considers that the Guidelines should focus on providing guidance with regard to the individual elements of the NTP. This should involve a technical assessment that identifies the physical location of the NTP in various network topologies and eir would urges BEREC to refrain from adopting an approach that focuses on non-technical characteristics such as such as the impact on the telecommunications terminal equipment (TTE) market and net neutrality.

PIKE and KIKE points out that impact on the TTE market should not be considered at all because it is not connected with the technical issue of NTP. What is more, the TTE market is not an area of NRA's competence, but rather competition authorities. In addition there is no proof of a lack of competition on that TTE market

Criterion impact on TTE market has no legal basis in EU law

Liberty Global calls upon BEREC to remove the criterion of '*impact on TTE market*' from the Guidelines because there is no basis in relevant instruments of EU law. Additional criteria will unnecessarily complicate the identification process and undermine the Guidelines' objective of harmonization. The significant discrepancies between national regulators' assessments of the TTE market which can be foreseen, will likely lead to a divergence in the adoption of NTP definitions between Member States.

Bouygues Telecom states that the importance of effects on TTE market are overstated. End user choice is no aim in itself but has to be balanced with cost and effects on network security, customer experience and innovation.

Ecta believes that the sphere of the network operator and the sphere of the end-user are not of equal rank in the EECC, and there is no indication that the EECC wants to reduce the sphere of the operator to the benefit of the user. The guidelines should respect the autonomy of the network operator and the wholesale customer in specifying the network.

TTE market observations are incorrect

In Cable Europe's view (and similar to ANGA, BUGLAS and VATM) the supposed positive effects of a larger private network domain and the supposed negative effects of a larger public network domain are theoretical and not supported by facts.

Furthermore, with regards to para. 35, it was stated that:

In sub a, the draft Guidelines consider that a potentially higher number of individual buyers have a positive impact on competition and innovation in the CPE market. There is no reason to even assume that there are currently inefficiencies in this market in terms of innovation and competition.

With regard to para. 35 sub b, the draft Guidelines assume that individual CPE buyers will have sufficient effect on OEMs to develop devices towards their demand. This assumes that both individual buyers can effectively articulate their specific needs, and that OEMs are able to receive those needs.

It is doubtful whether para. 35 sub c and sub d would materialise at all.

Para. 35 sub e. seems to exist on the assumption that OEMs are currently bound by few large customers and implies that this leads to negative effects on the market. Due to the functioning of the TTE Directive, this market is liberalised and any OEM can serve any of the hundreds of operators in the EU.

In ecta's view, even if the NTP was located at point A, this would not automatically imply that providers would no longer offer equipment to end-users or indeed that end-users would decide to use their own equipment. Contrary to BEREC's suggestions, no immediate conclusions about the beneficial impact on innovation from the location of the NTP appear appropriate

Ecta also finds that customers are more interested in differentiation of services than equipment.

Ecta is convinced that the criterion "impact on TTE market", which of itself offers no guidance for identifying the NTP location, should be removed from the guidelines. This applies in equal measure to section 3.3 to the extent that the argument therein draws on this criterion.

Limited adoption of free modem and in our view negative impact on the connectivity experience of end-users

Since the 2018 resolution of AGCOM only 0.01% of a stakeholder's customer base have chosen a TTE of their choice. In the stakeholder's opinion, the free modem legislation introduced in Italy had a negative impact on the connectivity experience of end-users by decreasing their quality of service and on operator's business plans by increasing their operating costs (i.e. separation of the modem from the router, which is integrated into the CPE by means of a pluggable module).

In BREKO's view the directive 2008/63/EC does not define the NTP, but depends on its definition to define the TTE market. It follows from its definition of the TTE however that the router cannot be part of the network because it cannot be directly connected to the NTP. The regulation 2015/2120/EU wants to safeguard the user's freedom to access internet services with a device of his choice, which is not impaired if the ONT is the NTP and the router part of the TTE sphere. At the ONT, no discrimination of services is possible.

An unclear view of TTE market

VTKE welcomes the fact that the guidelines also consider in particular the "Impact on the TTE market". This necessarily follows on from Recital (19) EECC and 2008/63/EC. However, the Guidelines concerning the TTE market should only consider the TTE market, analogous to the heading "Impact on the TTE market" (and not the CPE market).

Impact of point A, B and C on TTE market

In VTKE's view section 3.2 shall discuss the "Impact on TTE market", not on the CPE market. In case of point A, the TTE market and CPE market are identical. This is not the case for point B or C. This is because the conclusion in guideline 42. applies to the TTE

market, not the CPE market. It should be added that in case of point A, TTE market and CPE market are identical.

VTKE proposes to replace the term "*CPE market*" with "*TTE market*" in paras. 35. and 36.

Furthermore, VTKE suggests an amendment to para. 35 (a) and some new points related to competition in the TTE market in para. 35 i.a. since market access is not restricted to sale to a few network operators, there will be an increase in vendors and manufacturers and all actors would be competing in the TTE market.

VTKE notes that by setting point B as NTP, the network operator (or its supplier of network infrastructure equipment) might tend to proprietary solutions.

Furthermore VTKE believes that providing modems as NTP would shift functionality and thus market value away from the TTE market, distort the market that cannot respond to the end-user demand for integrated products (such as IADs), remove competition for the best modem, remove potential for innovation from the TTE market and lead to ecological problems.

VTKE states that providing modems as NTP would increase complexity and costs for the remaining TTE market. Due to the lack of standards, the interface at point B (between modem and TTE) is not well defined. It is particularly unknown for service bundles, such as Internet access combined with voice telephony. Important subscriber line technologies lack a relevant modem market because end-users prefer modem-integrated combined products (like IADs).

VTKE argues that the analysis of point C (para. 40 and para. 41) does not examine the TTE market but the CPE market. The results of para. 40 and para. 41 can therefore not be used here in para. 38 to describe the impact on the TTE market.

VTKE concludes that the NRA definition of point B may in practice have the same impact on the TTE market as if point C were defined. Therefore, it is of great importance to clarify the BEREC definition of a modem (point B) that it shall be a standalone and obligatory modem with no functionality other than modulation/demodulation of bitstreams to electrical, electro-magnetic and/or optical signals for the DSL, Cable and fiber optics subscriber line.

In VTKE's view the conclusion in para. 40 "*and not the end-user decides which equipment will be used*" violates Directive 2008/63/EC and Regulation (EU) 2015/2120. Thus, an NTP at point C must be excluded from further assessment.

VTKE agrees that the impact denoted in para. 41 a. to e. is correct, however it applies to a B2B market between the network operator and its equipment supplier. It does not apply to the TTE market. VTKE believes it is essential that the impact on the TTE market is considered.

VTKE proposes the following new guideline to be added in para. 41:

"*The impact for alarm transmission devices/Supervised Premises Transceiver (SPT) in alarm transmission systems over IP according to EN50136 to permanently check the availability of the physical transmission path should be assessed. This includes the event of a power failure and DDos attacks*."

VTKE agrees that the conclusions drawn in para. 42 refer to the TTE market. However, many assessment points in section 3.2 do not relate to the TTE market, but to the CPE market.

Therefore, VTKE suggests the following modifications:

"*The degree that the NTP location fosters innovation and competition on the TTE market*

- *Is highest for point A.*
- *Is drastically lowered for point B.*

The largest and most important (in terms of volume) of today's TTE category of modem-integrated products, e.g. IAD, loses its market and is eliminated from the TTE market. Accordingly, there is no longer any innovation and competition for this largest and most important group of IADs.

- *Is zero for point C*.

The TTE market, as we have had for decades, is then completely eliminated. Without a market there is of course no competition or innovation. In turn, devices such as printers, PCs or IoT, which are not yet part of the TTE market, would make up the "new" TTE market."

The stakeholders ALLNET.ITALIA, Altroconsumo, Assoprovider, BHE Bundesverband Sicherheitstechnik e.V, Confartigianato Antennisti Elettronici, Federation OPTIME, Free Modem Alliance, AIIP, Movimento Difesa del Cittadino (MDC) and VdS Schadenverhütung GmbH (VdS) are of the view that in the case of Option B, the market for TTE with an integrated modem (such as IADs) could de facto cease to exist because the draft guidelines do not allow the integration of modems and other functionalities in this scenario. In the terminal equipment market, this would mean a massive restriction of competition and innovation standstill. Option B would also entail a considerably higher economic cost for network operators since they would have to provide all their customers with a "standalone modem" as a network component and, in line with customer expectations, market a second, higher-quality integrated device (e.g. with WLAN or DECT) for connection to the forced modem.

In the view of the 10 aforementioned stakeholders, if the NTP is set at point C, the public telecommunications network ends behind the router. This means that all devices connected to the router (such as printers, smart televisions or refrigerators, etc.) are terminal devices. With regard to competition in the terminal equipment market, this would mean that only providers would be able to market integrated equipment to their customers. This would de facto put an end to competition in the terminal equipment market, with disastrous consequences for terminal equipment manufacturers.

Only in Option A, the stakeholders ALLNET.ITALIA, Altroconsumo, Assoprovider, BHE Bundesverband Sicherheitstechnik e.V, Confartigianato Antennisti Elettronici, Federation OPTIME, Free Modem Alliance, (AIIP, MDC and VdS Schadenverhütung GmbH see a free, competitive market for IAD possible, in which the NTP is defined at point A, the public telecommunications network ends at the end of the "local loop", i.e. at the "socket on the wall". In this case, both routers and modems, which in the vast majority of cases are

integrated into one device (IADs), are terminal devices. Option A also has economic advantages, also in terms of the free internal market of the European Union.

Effects of NTP at point B

VTKE points out that, given the popularity of IADs, setting the NTP at point B would limit the TTE market significantly because customers would still opt for integrated devices, which the network operator could still supply, Therefore, the effect on the TTE market could only be limited if the supply of an isolated modem by the manufacturer became mandatory.

For this reason Open Fiber demands that in case of IADs, the equipment must be in the operator‘s responsibility as a whole.

From the draft BEREC guidelines there is no doubt that the modem must be a so-called "standalone modem". In view of ALLNET.ITALIA, Altroconsumo, Assoprovider, BHE Bundesverband Sicherheitstechnik e.V, Confartigianato Antennisti Elettronici, Federation OPTIME, Free Modem Alliance, AIIP, MDC and VdS Schadenverhütung GmbH, BEREC's comments so far do not make this sufficiently clear.

Limited choice for customers of PON

Deutsche Glasfaser is of the view that setting the NTP for PON at Point A would actually limit the choice of end users for TTE because PON rarely follow standards in an unmodified manner and therefore differ technically widely. Setting the NTP at point B would increase choice because it establishes a standardized interface regardless of transport infrastructure. Standardization in PON is much less developed than in other networks, and standardized solutions are regularly modified to reap performance gains. Fibre networks will have a variety of OLTs in their networks and therefore huge compatibility problems. Point B is therefore the only appropriate NTP for PON.

FTTH Council Europe states that it is currently unforeseen to have an integrated modem/router having complete interoperability with all existing different optical transport systems and its relevant tweaks by different manufacturers, Point A and therefore combined Modem/routers for fibre networks will severely limit competition in TTEs for consumers

Innovation Dynamics in PON

BREKO states that in PON, the dynamics of innovation are less driven by the TTE side but by the network side where new solutions are constantly implemented.

FTTH Council Europe argues that if the NTP is set in a way that the CPE is considered part of the network, this does not imply that there may be a lower level of innovation as suggested at para. 41 (d).

In ecta’s view the element of technical maturity, needs to be taken into consideration in the guidelines as it may have a direct impact on the identification of the NTP to the extent that it shapes deployment decision-making and objectively limits the options available for independent selection at end-user level.

Effects of NTP at point C

The FTTH Council Europe expresses the view that a NTP at point C would lead to fewer customers, but these would be network operators with more sophisticated and demanding requirements that would drive innovation stronger than a broader, non-specialized customer base.

BEREC response

BEREC welcomes the supportive comments on this section by AIIP, CDT and PK, Freifunk Hamburg, FSFE and VTKE.

BEREC agrees with VTKE that section 3.2 “Impact on TTE market” shall consider the TTE market, but the definition of the NTP will affect which kind of equipment is part of the TTE market and how large the effects of the competition on the TTE market will be for equipment that will be used for accessing the network in question and the end-user choice and end-user experience. BEREC clarified that point in the Guidelines, which also affects comments by VTKE on the effects of defining the NTP at point C. BEREC is of the opinion that for reasons given under paras. 32 and 33 of the draft Guidelines, an overarching term for active equipment on the customer premises is needed, comprising both the operator’s network and the home network.

BEREC agrees with VTKE to include in para. 35 the example residential or business requirements (35a) since this makes the point more clear.

BEREC agrees with VTKE that in case the NTP is located at point B and, therefore, the modem is not part of the TTE, the TTE market is smaller compared to NTP location A and does not include IAD and adapted the Guidelines accordingly. In the view of VTKE, the modem needs to be a standalone modem and not an IAD which has all other functionalities than the modem functionality switched off. BEREC’s response to this topic is presented in section 2 of this document.

BEREC agrees also with VTKE that in case the NTP is located at point C, the TTE market does not include modem, router, media box but instead devices such as printers, PCs or IoT and, therefore, there is no competition on the TTE market with regard to modem, router, media box and IADs and adapted the Guidelines accordingly.

With regard to VTKE’s further suggestion to add that the impact for certain alarm transmission systems over IP shall be assessed, BEREC would like to clarify that this is part of the NRA assessment (section 3.3 of the draft Guidelines), however, section 3.2 solely describes the impact on competition in the TTE market.

BEREC’s response to the view of ALLNET.ITALIA, Altroconsumo, Assoprovider, BHE Bundesverband Sicherheitstechnik e.V, Confartigianato Antennisti Elettronici, Federation OPTIME, Free Modem Alliance, AIIP, MDC and VdS Schadenverhütung GmbH that in the case the NTP is located at point B, the market for TTE with an integrated modem (such as IADs) could de facto cease to exist is as follows. BEREC agrees that in case the NTP is located at point B, the TTE market does not include IADs and adapted the Guidelines accordingly.

With regard to the other comment of these stakeholders that in case the NTP is located at point B, the network operators have to provide a standalone modem to their customers which result in higher economic costs, BEREC would like to clarify that it is up to the NRA what further regulatory measures follow from the definition of the NTP location at point B, which is beyond the scope of the Guidelines (see BEREC response in section 2 of this document).

BEREC agrees with the following two further comments of these stakeholders. (1) In case the NTP is located at point C only network operators and not TTE manufacturers have the possibility to market IADs to end-users and, therefore, there is only little competition[5] between network operators and no longer with TTE manufacturers with regard to this. (2) Only in case the NTP is located at point A, competition in the TTE market is possible with regard to IADs.

BEREC's response to the view of these stakeholders that, according to the draft Guidelines in case the NTP is located at point B, the modem needs to be a standalone modem (and not an IAD with switched off further functionalities) and the Guidelines should make this more clear is presented above and in section 2 of this document.

BEREC does not agree with Deutsche Glasfaser's view that in case of PON point A would limit and point B would increase the choice of end-users and FTTH Council's view that in case of fibre networks point A and, therefore, combined modem/routers would severely limit competition in TTEs for consumers for the following reasons. In case the NTP is located at point A, network operators have the possibility to offer modem and router and IADs to the end-user as in case the NTP is located at point B or C. The difference between these points is that in case of point A and not in case of point B or C also TTE manufacturer can offer router, media box as well as modem and IADs (only in case of point C) to the end-user which increases (and never decreases) the choice of end-users.

Concerning the objections of Cable Europe, ecta, the Dutch telecoms operators, eir, PIKE and KIKE to considering the effects of the NTP definition on the TTE market, it has already been stated in section 3.1 that these effect have to be taken into account when defining the NTP for legal reasons. A further reason is that restrictions on the equipment that an end-user can deploy would mean that the market power that the network operator has within its own networks will spill over into the market for equipment on the customer premises. The situation here is comparable to that on call termination markets. Here, significant market power follows from the fact that other operators can put through calls to the customers of the terminating network only through this network. In a similar way, a network operator limits both the choice of its end-users and the access of equipment manufacturers to them if it can decide which active equipment can be connected to the network. This effect will be especially strong in markets that are dominated by a few large network operators, and can only be tolerated when an objective technological necessity exist for the equipment being part of the network, and in this way being subject to the more stringent telecommunication regulation. The 'autonomy of the network operator' within its network mentioned by ecta

[5] The competition could only result from end-users switching their operators solely because of the equipment provided.

cannot be used to push this sphere beyond the limits of the objective technological necessities.

Ecta, Cable Europe, ANGA, VATM, BUGLAS and another stakeholder have remarked that the draft guidelines overstate the positive effects for the TTE market either because the observable uptake by end-users is minimal, or because innovation will be driven by the network operators who as large-scale and technically sophisticated buyers of equipment will drive innovation and competition much better than a diffuse number of single customers who will be less effective in communicating their needs to the equipment manufacturers. Actual uptake however varies between countries and has shown to be growing in strength when end-users change operators and thus cannot be judged by the share of customer-provided equipment at a network as a whole. Moreover, even when the NTP is defined at point A, network operators will still be able to offer TTE to their customers on a voluntary basis. This makes their markets contestable markets where the prospect of end-users providing their TTE themselves will spur network operators on to offer their customers a broad choice of cheaper and better equipment on a voluntary basis.

Regarding the point made by Bouygues Telecom that competition on the TTE market is no aim in itself, but has to be balanced with the effects of a NTP definition on other matters like network security, customer experience and innovation, BEREC points out that such concerns are to be considered under 3.3.1, 3.3.2 and 3.3.3. of the draft Guidelines which will also be able to deal with matters of service innovation.

Insofar as BREKO, Deutsche Glasfaser and FTTH Council Europe have pointed out that positioning the NTP at point A in fibre networks would actually reduce innovation and the choice of customers on the TTE market, BEREC points out that such effects can be taken into account should they materialize. Furthermore, operators would retain the ability to offer equipment on a voluntary basis like an ONT with standardized ports for connecting further equipment.

Concerning the negative effects of defining the NTP at point B stated by VTKE, ALLNET.ITALIA, Altroconsumo, Assoprovider, BHE Bundesverband Sicherheitstechnik e.V, Confartigianato Antennisti Elettronici, Federation OPTIME, Free Modem Alliance, AIIP, MDC and VdS Schadenverhütung GmbH, BEREC points out that such a definition would be based on objective technological necessities. It is beyond the scope of these Guidelines to specify which accompanying measures should be taken with such a definition, e. g. whether the network operator should supply a standalone modem in all cases or upon request, or whether the ability to bypass the additional functions of an IAD to connect customer-provided equipment would be sufficient (see also BEREC response to that subject in section 2). BEREC has however included a reference to the effects of a customer predilection for IADs in para 39. Contrary to the opinion of Open Fibre, there is no technical reason why IADs should be in the responsibility of the operator as a whole, because this would mean that the operator would control router functionalities even if there is no objective technological necessity for defining the NTP at point C.

With regard to VTKE's view that a CPE market should not be mentioned, BEREC is of the opinion that for reasons given under paras. 32 and 33, an overarching term for active

equipment on the customer premises is needed, comprising both the operator's network and the home network.

3.3 Assessment whether there is an objective technological necessity for equipment to be part of the public network

Stakeholder responses

Guidelines shall define that the NTP is located at point A

The following individuals express the view that the Guidelines shall define the NTP at point A - Benjamin Henrion, Roland Wells, Joaquin Gutierrez, Denis Carikli, Christoph Franzen, Ilario Gelmetti, Uwe Kleine-König, Dirk Brenken, Sebastian Ober, Michael Jerger, Stephane Gudon, *[confidential]*, Björn Oberst, Kirlis Solovjovs, Hartmut Goebel and Lutz Lutterbeck (16 individuals)

NTP at point A is the rule

VTKE states that the guidelines indicate in various sections that point A should be the preferred NTP. A statement such as "*NTP at Point A is the rule*" should therefore be in the front part of the Guidelines contributing to the clarity of the document and the simplicity of its implementation.

Furthermore the stakeholders ALLNET.ITALIA, Altroconsumo, Assoprovider, BHE Bundesverband Sicherheitstechnik e.V, Confartigianato Antennisti Elettronici, Federation OPTIME, Free Modem Alliance, AIIP, MDC and VdS Schadenverhütung GmbH, FSFE and several individuals (Thomas Rother, Tiglio, Sergiu Marton, Andreas Grupp, Alexandre Leroux, Sebastien Delafond, David Mändlen, Michael Saunders, Leonardo Barcaroli, Pierre-Yves Bonnetain-Nesterenko, Thomas Hipperson, *[confidential],* Stuart J Mackintosh) are of the view that BEREC should clearly state in the guidelines that it is in favour of point A as the NTP or make it clearer that point A should be the rule when determining the NTP.

Overall CDT and PK supports point A as the best choice for the NTP and further suggested BEREC to consider proposing Point A as the default NTP, with the option for NRAs to make a different determination, for example where certain network topologies require a different assessment

No case justified a violation of the end-user rights to use their own TTE

FSFE points out that they cannot find a real case where any incident with customer premises equipment (CPE) would have justified a violation of the basic user rights determined in Regulation 2015/2120 and Directive 2008/63/EC. The experiences made in Germany after the legal clarification to set point A as NTP as of 1 August 2016 serve as a positive example that devices chosen by end-users do not cause technological damages for ISPs and other customers although some ISPs and network providers warned against this. A significant number of end-users decided to make use of this freedom, a vital market for CPE is evolving, and there were no such breakdowns in neither the cable nor the DSL network. 12 individuals (Thomas Rother, Tiglio, Sergiu Marton, Andreas Grupp, Alexandre Leroux, Sebastien Delafond, David Mändlen, Michael Saunders, Leonardo Barcaroli, Pierre-Yves

Bonnetain-Nesterenko, Thomas Hipperson, Stuart J Mackintosh) second this FSFE's contribution.

In the view of AIIP, it appears that there is no objective technological necessity for any equipment at the customer premises to be part of the public network. Exceptions are fixed wireless access (see Italian Internet Service Provider Association in section 3.3.6) and tailored business services (e. g. videoconferencing) which might imply a larger recourse to control over CPEs by network operators.

Advantages and disadvantages of different NTP locations

VTKE states advantages of determining the correct NTP (point A) and disadvantages of determining the incorrect (active) NTP. The correct (passive) NTP, in conjunction with disclosed specifications including layer 1 i.a. allows for an open market for terminal devices and easy change of terminal equipment by end-users. The diversity of terminal equipment used on the networks of different operators will lead to interoperability overall. An incorrect (active) NTP without disclosed specifications including layer 1 bears the risk of serious negative consequences i.a. limitation of end-users' digital sovereignty, the creation of monoculture, proprietary, obligatory, not exchangeable and not controllable CPEs operated on the end-users premises.

In view of ALLNET.ITALIA, Altroconsumo, Assoprovider, BHE Bundesverband Sicherheitstechnik e.V, Confartigianato Antennisti Elettronici, Federation OPTIME, Free Modem Alliance, AIIP, MDC and VdS Schadenverhütung GmbH a NTP located at point A would have a dozen advantages i.a. it gives the end-user complete freedom to choose and connect the terminal equipment in their home. When switching providers, end-users can keep their terminal devices and thus avoid renting an obligatory terminal device. Competition for the best TTE encourages innovation at all technical levels. On the contrary, a NTP located at point B would have far more disadvantages i.a. restricted choice of TTE, no usage of IAD and high security risks due to a monoculture of TTE. Not only the NTP located at point B, but also a NTP located at point C would have disadvantages for end-users, competition in the TTE market, security etc.

Technological realities in cable networks with regard to NTP located at point A, B or C

In CableLabs' view, in distinguishing three distinct NTP options ('A', 'B', and 'C'), BEREC depicts an overly simplified, fixed view of network equipment. Nevertheless, among the options, Option C is the most conducive to broadband network innovation and security.

CableLabs states that 'Option A' is inconsistent with technological reality.

Furthermore, CableLabs argues that for the provision of a secure cable broadband service the standardized incorporation of DOCSIS signalling into a cable modem is essential. Cable networks clearly do not terminate on the network side of the modem; modems are part of the network and thus *"Option A" is inconsistent with technological reality*. DOCSIS standards require modem software updates to occur through the secure code verification certificates (CVCs). Undermining this practice might lead to serious security threats and undercut the operation of the network, network maintenance, and its upgrade over time, both in terms of performance and security.

In CableLabs' view 'Option B' runs counter to technology trends.

CableLabs elaborates that in some limited cases, where end-users do not utilize an integrated modem / router gateway, and instead utilize a router that is not managed by a network operator, "Option B" may be a plausible NTP definition. Gateways and managed routers enable consistent network performance through the incorporation of modern DOCSIS and Wi-Fi technologies, and also enable proactive maintenance of both media. Security-focused innovation is facilitated by network-administered modems, routers, and gateways. Therefore, utilizing Option B as a static NTP definition risks these performance and security benefits, and may halt or slow developments that are highly beneficial for Internet users.

CableLabs considers 'Option C' as consistent with innovative development.

In CableLabs' view, the realities of cable technology development and service provision are best reflected in "Option C", which enables performance and security features to be integrated in both modem and router and leads to more consistent and rapid advancement of network performance and security.

Standalone modem has no further functionality

VTKE suggests that in para. 53.b of the Guidelines it should be made clear that "*This modem shall be a standalone modem without hardware or software for voice telephony, analogue voice ports, switching, routing, NAT, wireless LAN, PBX, DECT, and so on). This standalone modem is obligatory and may not be replaced by the network operator by different products, such as integrated terminal equipment*." Furthermore, the following two sentences should be added to the footnotes in the Annex graphics (3), (5) and (6):

"*In the case that the NTP is at point B, router and modem shall not be integrated in one device. The modem provided by the network operator has to be a standalone modem.*"

Liberty Global argues that the Guidelines should adopt a technologically neutral approach and allow modems with router functionality as long as they are able to operate in 'bridge mode'.

The consideration of the IAD as the largest market segment is missing

VTKE states that, when it comes to the effects of the location of the NTP (A, B or C), reference is made to the device classes modem, router, VoIP adapter and set-top box. Depending on the location of the NTP, the device is assigned to the TTE or the public network. However, the IAD device classes were missing from these considerations. They are by far the most important device class and the most popular product among end-users in terms of quantities and sales. Both network operators and manufacturers offer IADs to end-users.

End-user expectations

In ecta's view the chief concern for network operators must be the seamless functioning of the network with a high degree of integrity and security because that is the end-users highest priority. To ensure this, the autonomy of the network operators on the parameters of network provisioning must be acknowledged.

Contractual obligations

Epicenter.works suggests that the guidelines should clarify that contractual obligations of virtually unbundled operators to deploy specific equipment in their network are not considered as technological necessities.

Slightly different description of Point A

CDT and PK suggests that BEREC consider a slightly different description of Point A. Rather than describing Point A as depicted in Figure 2, essentially "before the modem," we propose that Point A should be considered the first point at which the customer can attach standardised network interface equipment, such as devices that support DOCSIS or Ethernet. This aligns the NTP more closely with both the physical space within end users' control and with end users' understanding of network topologies. CDT and PK understand that this may, in some cases, merge Points A and B and in others merge Points B and C, but it would also reduce confusing abstractions like defining the NTP as a point residing inside a single piece of terminal equipment on the customer premises.

Further CDT and PK argues that for some fiber optic network connections, it may be the case that third-party equipment like optical modems (or optical network terminals) are not available in consumer retail markets. In other cases, such as fiber-to-the-node or fiber-to-the-building, these optical-to-digital modems are not accessible to end users at all. In these cases, CDT and PK proposes that Point A should be considered the point at which the customer can attach standardised equipment, such as devices that support DOCSIS or Ethernet.

BEREC response

The interpretation of many contributors that the draft guidelines favour point A as NTP stems from the combined effect of the principle that the definition of the NTP must follow from objective technological necessities, and certain views on the present technological conditions in deployed networks. BEREC has slightly modified the draft Guidelines insofar as to clarify the point that an objective technological necessity has to exist to include equipment into the NTP. Nevertheless, should such conditions exist, an NTP at point B or C can be identified.

The issues for defining the NTP at point A and against defining it at point B given by VTKE and ALLNET.ITALIA, Altroconsumo, Assoprovider, BHE Bundesverband Sicherheitstechnik e.V, Confartigianato Antennisti Elettronici, Federation OPTIME, Free Modem Alliance, AIIP, MDC and VdS Schadenverhütung GmbH raised can be addressed within the framework provided by the criteria in 3.3.1 ff of the draft guidelines, which do not need to be refined further.

The reasons CableLabs gives for defining the NTP at point C are too short on detail and cannot fulfil the requirements of an objective technological necessity. Practical experience (e.g. Germany) shows that, given a sufficient interface description, customer access to cable networks can be given at point A. The fact that, from a network operator's view, managing the whole transmission of signals and data up to and including point C may be desirable is no reason to project the perimeter of its network to this point when there is no objective technological necessity. Customers may judge their benefits differently, and a network

operator is still able to provide network management services at point C on a voluntary basis to its customers. This is valid as well in situations where objective technological necessities would put the NTP at point B. In the same way, ecta's idea of end-user expectations of a seamlessly functioning network could be fulfilled by voluntary offers by the operator should there remain a small difference between the service quality achievable by TTE compliant with interface descriptions and TTE provided and maintained by the network operator.

The contractual obligations of virtually unbundled operators as such mentioned by Epicenter.works cannot be objective technological necessities as such, but objective technological necessities may be caused by virtual unbundling that are reflected in such contractual obligations.

Descriptions of what kind of modem might be provided in case of a NTP at point B, as demanded by VTKE, are beyond the scope of these guidelines which only deal with the definition of the NTP (see section 2).

The modification of access at point A proposed by CDT and PK is in BEREC's view not necessary, because the fact that the NTP has to be on the customer premises makes sufficiently clear where the point A should be.

Concerning the comments by CDT and PK on fibre networks, the networks and their relation to the NTP definition have to be analysed carefully. The NTP is the physical point at which the end-user is given access to a network. In FTTC and FTTB networks, the premises of the end-user are not reached by fibre connections directly, but by XDSL-services originating from an MSAN which are part of the network and therefore not accessible to end-users. For defining the NTP for fibre networks, it is not necessary that suitable equipment is already available on the market for end-users, for the NTP definition may open up such a market. On the other hand, network operators are not requested to provide alternative equipment if it is not offered by the manufacturers on their own.

3.3.1 Interoperability between public network and TTE

Stakeholder responses

BEREC's considerations are valid and support for point A as optimal default location

CDT and PK states that the considerations BEREC proposes to ensure interoperability of TTE and NTP characteristics are valid. CDT and PK understands from the obligation in Directive 2008/63/EC, Art. 5 that that all TTE producers should have sufficient technical information to design and build compatible products for any given access provider's network. From this perspective, CDT and PK believe that market forces and standardized protocols are sufficient to ensure that TTE makers will produce safe and interoperable products, regardless of which NTP location is selected. ISPs should be discouraged from configuring their networks so that their NTPs require specific, proprietary equipment for purposes of market control.

Liberalisation of the TTE market did not cause significant harm to the public network

FSFE points out that, although the argument of endangered network security and stability has been brought up on many occasions before by some ISPs and network providers, FSFE

is not aware of any occurrence where liberalisation of the TTE market caused significant harm to the public network. FSFE requested network providers and manufacturers to work together instead of trying to create a false sense of security by isolating the public network from TTE not provided by the ISPs.

It is dangerous for NRAs to make the location of an NTP dependent on interoperability

VTKE states that it is dangerous for NRAs to make the location of an NTP dependent on interoperability. This would only be in the interest of individuals and not of the general public. To ensure interoperability, NRAs should encourage network operators to publish standard-compliant interfaces instead of proprietary solutions.

VTKE proposes for para. 57 the following modification: "*Interoperability between the public network and the TTE depends on the quality of the interface specification and the conformance to it either by the network or by the TTE. All parties should contribute to best possible interoperability between the network and the TTE at all times. EU regulation prohibits bringing TTE to the internal market that harm a network. In case of TTE harming the network or in the case of a network harming TTE, measures to remediation need to be installed at both sides*."

VTKE further suggests to replace the term "*needs to be ensured*" by "*is a primary goal*." and the following new Guideline: "*Obviously, the network interfaces at point A can be specified by the network operator as specification for its supplier of the equipment to be considered as part of the network. So it should be assessed why this existing specification cannot be published so that the open market can also provide equipment for the interface at the point A.*"

Competition and freedom of choice of TTE may not be sacrificed by claiming risks to Interoperability

AIIP states that interoperability of communications services and of TTE is the key for maintaining a competitive environment in the future and shall be ensured in a promptly and effective manner by NRAs. NTP located at point A should be the rule and in this case, appropriate measures need to be in place which allow the network operators to adequately protect their networks in case CPEs are connected to the public network which do not comply with the NTP characteristics, and to resolve disputes between network operators and end-users as it is foreseen in the draft Guidelines (para. 68b).

Effect on Access Models

ANGA BUGLAS and VATM express the view that in networks with share media (Cable, GPON), open access models and obligations to provide bitstream access require that operators have control over the active equipment terminating the network (ONT, cable modem) to prevent interferences between active components and the networks and to be able to guarantee service quality for their access products.

Dansk Energi describes that there is a technological necessity (and advantages) of locating the NTP interface at the end-users' side on the media converter (point B), i.e. the fiber-utilities must ensure that they can provide the right wholesale products for the end-user

installation and the control via the media converter, meaning that, the media converter is part of the public network (obligatory equipment).

Effects on signal transport

Ecta suggests that it has to be taken into account whether equipment affects just distribution on the local level or has an effect on the signal transport in the network as a whole.

Innovation and multiple service providers in PON

Deutsche Glasfaser and BREKO state that standardization in PON is much less developed than in other networks, and standardized solutions are regularly modified to reap performance gains; there is an ongoing dynamic technological development. Fibre networks will have a variety of OLTs in their networks and therefore huge compatibility problems. Incompatibility of an ONT with an OLT will not only affect the user of the ONT, but all users of the OLT, up to several dozen users. The ONT is the only point where PON operators can distinguish between parallel service offers by different service providers that are provided over different VLANs and have to be managed by the network operator accordingly, who has to comply with service level obligations towards the service providers. PON are therefore still terminated by ONTs only and not IADs that comprise modem and router functions. Consequently Point B is the only appropriate NTP for PON.

Similar to the aforementioned the Dutch telecoms operators believe that telecoms providers will be much more capable to protect the reliability and security of shared networks, such as PON or HFC networks, if the NTP will be defined as point B.

In FTTH Council Europe's view, combining modem and router in one box does make sense in mature networks like copper and HFC. In fibre optic transport systems, existing standards are still tweaked by manufacturers to gain operational and performance advantages over competing manufacturer's equipment. This is to the detriment of interoperability across all functions between ONTs and OLTs of different manufacturers, even though all adhere to the same standards. For fiber optic networks (especially PON-based), the results described by BEREC are not accepted. In FTTH Council Europe's view, Point B is the only NTP for fibre networks, where the results described for Point A will actually happen.

Standards are complex in practice

The Dutch telecoms operators are of the view that even when standards are applied, variations in their deployment may lead to compatibility issues and thus the possibilities to guarantee interoperability are limited in practice.

Business services

In ETNO's view, business services are developed upon customer request and may require specific terminal equipment in order to secure the required level of QoS, network and service security and business continuity. Business market services should therefore be excluded from the scope of the guidelines.

Ecta points out that providers of business connectivity often use novel and unstandardized and/or uncertified equipment. Competent authorities should be attentive to any involvement

of undertakings with significant market power which might frustrate a timely competitive provisioning of business connectivity.

Degradation of OLT as a whole

Open Fiber states that in PON, different from XDSL networks, incorrect communication between Optical Line Termination (OLT) and Optical Network Termination (ONT) causes a total degradation of the line.

Ecta notes that freedom of choice at the ONT (modem) level will lead to errors in that equipment (and thus in the TTE) being passed on to the OLT and thus impact all other parties connected there. Scenarios of several hundred affected parties have been reported.

No TV service without point B

Dansk Energi argues that fibre-operators cannot deliver CATV without NTP at point B.

Specific additional criteria

In terms of ”Quality/innovation capacity” Bouygues Telecom proposes to focus on key technical parameters, with the associated risks.

Regarding quality, Bouygues Telecom believes that the NRA should mainly focus on the quality of service that the clients will be able to have, and eventually the impact of the availability of some services.

Interoperability best served at point C because network operator can control whole sequence of equipment

According to KIKE and PIKE, when modem, router and media box are part of public network, operator can ensure the interoperability of that equipment.

Degree of maturity of proven modem (to network) interoperability

Vodafone Group states that the degree of maturity of proven modem (to network) interoperability should be taken into consideration when establishing the NTP. For example, for cable (and DOCSIS 3.1 in particular), interoperability of the technology is at an early stage, which will mean that it is not technically ready for the network termination point to land at Point A without incurring risks to performance, end user issues and security risks. However, as the technology itself becomes more mature, the network termination point may move to point B or C.

BEREC response

BEREC welcomes that CDT and PK and AIIP agree with the draft Guidelines.

BEREC acknowledges the comments from FSFE that liberalisation of the TTE market did not cause significant harm to the public network. No need to adapt the Guidelines results from this comment.

Concerning VTKE’s comment that interoperability should be no criterion when defining the NTP location, BEREC likes to point out that requirements of interoperability can make a very strong case for objective technological necessity. Standards may reveal how far

interoperability requires that equipment be provided and managed by the network operator. The operator however is not obliged to stick to established standards, but only to publish the interface descriptions of the network. Lack of interoperability is not just a case of “harming the network,” as VTKE seems to suggest, but a question whether services can be deployed at all or with the expected quality.

With regard to the point that the provision of wholesale services (incl. open access) based on a shared medium (PON, cable) requires that the operator has control over the modem expressed by ANGA, BUGLAS, VATM, Deutsche Glasfaser, BREKO and Dansk Energi, BEREC would like to respond as follows. BEREC agrees that also the wholesale level (including open access) is relevant and adapted the Guidelines in order to make clear that an objective technological necessity for equipment at the customer premises to be part of the public network may also result from the wholesale level (including open access).

In respect to the view of several stakeholders that in case of access networks based on a shared medium (e.g. PON, coax cable) in general the NTP needs to be located at point B and point A is not possible, BEREC would like to point out that the NRA when carrying out the assessment foreseen in the draft guidelines (section 3.3) may come to this result. However, since BEREC shall issue Guidelines on common approaches to the identification of the NTP, the draft Guidelines foresee the NRA assessment (section 3.3) but do not identify the location of the NTP itself. This applies also to the argument of Dansk Energi that fibre-operators cannot deliver CATV without NTP at point B.

Regarding the view of Deutsche Glasfaser, BREKO and FTTH Council Europe that the standardization of PON is not yet fully developed which requires the NTP to be located at point B, BEREC would like to point out that, according to the draft Guidelines (paras. 58 and 68a), network operators have the possibility to take into account any requirement their network may have when defining the characteristics of the NTP and, therefore, they are not limited to standards and may provide additional information. Nevertheless, in such situations the NRA assessment may conclude that there is an objective technological necessity for the fibre modem to be part of the public network and, therefore, the NTP is located at point B. This BEREC’s response holds also true for the argument of the Dutch telecoms operators that even when standards are applied interoperability may be limited in practice.

Deutsche Glasfaser and BREKO are also of the opinion that in case of PON there is an ongoing dynamic technological development and that this is a further reason why the NTP needs to be located at point B and not at point A. BEREC would like to clarify that communications networks continuously are developed further and, therefore, the characteristics of the NTP need to be updated accordingly. In case of dynamic developments this may have the consequence that the NRA assessment comes to the conclusion that the fibre modem needs to be part of the public network and that the NTP is located at point B.

Deutsche Glasfaser, BREKO, Open Fibre and ecta point out that in case of PON incompatibility of an ONT with an OLT may not only affect the end-user of the ONT, but all end-users of the OLT. BEREC points out that the draft Guidelines (para. 57) provide the possibility to take this into account by stating that interoperability also needs to ensure that an end-user’s TTE does not harm the network, i.e. other end-users.

Concerning Bouygues Telecom's proposed examples of risks that might occur, BEREC would like to point out that in case interoperability is ensured these risks do not occur and the NRA assessment foreseen in the draft Guidelines (section 3.3) already include the criterion interoperability.

BEREC's response to the point made by Vodafone Group that the degree of maturity of proven modem (to network) interoperability is that this can be dealt with under the criteria interoperability, simplicity of the operation of the public network and network security and need no special handling.

Regarding the view of ETNO that business market services shall be excluded from the scope of the Guidelines, BEREC would like to point out that Art. 61(7) of the EECC does not allow to exclude certain services from the scope of the Guidelines. The development of individual products upon customer requests is beyond the scope of these Guidelines.

3.3.2 Simplicity of the operation of the public network

Stakeholder responses

Worries as to simplicity of the operation of the public network are almost irrelevant

AIIP is of the opinion that worries as to simplicity of the operation of the public network are almost irrelevant if compared with the aim of such regulations, and may be rebutted as circumstances to be considered when assessing whether there is an objective technological necessity of equipment to be part of the public network. The advantages of having the NTP located at point A (see Italian Internet Service Provider Association in section 3.2) would exceed by far the possible disadvantage outlined in para. 72 of the draft Guidelines that "*the use of a variety of different types of TTE not owned by the network operator could make network operations more complex compared to a case where only a few different types of own TTE are used*".

Point A is default NTP location despite some increase in the complexity of network operation

CDT and PK argues that with the NTP defined at Point A, timely maintenance of terminal equipment admittedly requires higher levels of coordination among equipment makers, ISPs, and subscribers than if the ISP controls the firmware of users' modems, but preserving user choice of home TTE aligns more closely with open internet principles and Article 3(1) of Regulation (EU) 2015/2120. Therefore, despite some increase in the complexity of network operation and equipment maintenance, CDT and PK continue to suggest that BEREC's guidelines recommend Point A as the default NTP option.

Para. 85 a and b (conclusions) seem to go beyond BEREC's remit

Vodafone Group states that the conclusions in para. 85a and para. 85b seems to go beyond BEREC's remit, which is to provide guidance to help identify what "the physical point" which "is identified by means of a specific network address" in different network topologies according to Art. 2(9) EECC.

OAM interface is standardised therefore no additional effort arises to handle different modems

VTKE would like to point out that the interworking between the modem at the customer premises and the modem at the central site is fully standardized by ITU or ETSI, including network management (OAM). No additional effort arises therefore to handle different modems. In addition, in practice there are only two to three chip vendors supplying the CPE market. Those chips have proven interoperability before being used in the market.

Further VTKE states that the public network does not need to manage the CPE differently. The public network does only comply with its own network interface specification.

No obligation to secure interworking with third-party TTE

A stakeholder requests to highlight in para. 73 that it shall not be an obligation that network management system of the public network have to interwork with the modem freely chosen by the end-user. Support of the end-user shall be imposed on the manufacturer or the terminal equipment vendor in para. 74.

Obligations of TTE manufacturers

A stakeholder suggests in several paras. (74, 89, 94) that failing interoperability should have consequences for the TTE manufacturer. Equipment vendor support to the end customers shall be imposed to the terminal equipment vendor or manufacturer, in order to safeguard customer's rights and network operator's interests.

Add a new guidance on electricity supply

VTKE proposes to add the following new guideline after para. 78:

"*However, the operation of the customer-sided part of the public network depends on the electricity supply at customer premises which powers modem, router, media box etc. and, therefore, the network operator may have to coordinate with the end-user in this regard*."

In case NTP is located at point C, the public network becomes more complex

VTKE suggests a very different view in terms of simplicity. The public network becomes much more complex. In a typical situation there are many NTPs at point C (LAN, FXS, DECT, WLAN, USB and so on) and a great variety of devices at home (networking devices, DECT telephones, Wi-Fi devices, Smart Home and IoT devices and so on) are now mutating to terminal equipment. It is much more complicated to achieve interoperability with all these devices. Additionally, those devices have a fast technological turnover. Wi-Fi needs to be replaced every five years.

Simplicity best served at point C because network operator can maintain equipment better than end-user.

PIKE and KIKE state that simplicity of the operation of the public network require location of NTP at point C (or point B at least). When modem, router and media box are part of public network, operator can ensure the security and interoperability of that equipment.

Dynamic technological development

BREKO argues that the interoperability problems in PON due to their dynamic technological development require that the ONT be managed by the operator.

Fault repair

In BREKO's view an efficient fault repair requires NTP at the ONT and thus at point B in PON.

Ecta states that fault repair is an essential concern of operators and impeded when customer equipment can harm the network with repercussion beyond the individual line.

Electricity supply

A stakeholder suggested that para. 75 should mention reverse powering as an exception.

Cost efficiency for operators and end-users

Dansk Energi considers that, Point B allows for cost-optimization for operator, including reasons of scale. It also allows service providers to use simpler equipment without complex fibre modules, and self-installation by end-users.

Specific additional criteria

In terms of "Economic efficiency" Bouygues Telecom proposes to focus on key technical parameters such as specific technical support, scale effect and churn, bills and after sales management.

Bouygues Telecom states that regarding economic efficiency, the NRA should mainly have a specific look at the impact on the costs for the operators.

Increased complexity

The Dutch telecoms operators are of the view that the increased complexity due to end-user provided equipment, the easier access for external parties that comes with it and the dependency on the end user's readiness to update the software of his equipment will make operation of the network more difficult and faults and security breaches more likely.

NTP affects also processes

The Dutch telecoms operators argued that the definition of the NTP may impact operational processes. General agreements and conditions need to be heavily adjusted in case point A is defined as the NTP, to rule out any responsibility for security issues and the quality of service, such as compensation in case of disrupted connection.

Proprietary functionalities

In Epicenter.works' view the introduction of proprietary functions on CPE should not be seen as simpler in terms of objective technological necessity.

BEREC response

BEREC's response to the view of CDT and PK that the Guidelines shall recommend point A as the default location of the NTP despite some increase of the complexity of network operation is that this is not possible. The NTP location depends on the outcome of the NRA

assessment foreseen in the draft Guidelines on whether there is an objective technological necessity for equipment at the customer premises to be part of the public network and, therefore, the NTP may be located at point A or a different point.

With regard to the view of AIIP that the advantage of having the NTP located at point A would exceed by large possible disadvantages outlined in para. 72 of the draft Guidelines, BEREC would like to clarify that, if this is the case, then also the draft Guidelines (para. 85b) foresee that point A is determined to be the NTP.

BEREC does not share the view from VTKE that no additional effort arises to handle different modems since the OAM interface is standardised. As outlined in the draft Guidelines (para. 73), the public network has to manage a higher number of different types of modems, interoperability issues may occur more often and network operation needs to be coordinated with the end-user.

BEREC does not agree with Vodafone Group's view that paras. 85a and 85b seem to go beyond BEREC's mandate for the following reason. As explained in the BEREC response in section 3.1, the Guidelines need to take into account the Open Internet Regulation (Regulation (EU) 2015/2120) and Directive 2008/63/EC on competition in the TTE market and therefore the respective aspects are included in para. 85 of the draft Guidelines.

Concerning the view of a stakeholder that it shall not be an obligation that network management system of the public network have to interwork with the modem freely chosen by the end customer, BEREC would like to clarify that the draft Guidelines (para. 73) do not put this obligations on network operators but the network operators have to define the characteristics of the NTP (paras. 10 to 12) in order to enable interoperability.

BEREC does not agree with the view of a stakeholder that BEREC shall impose on TTE vendors or manufacturers the obligation that they have to support the end-user. This would go beyond the scope of the Guidelines and beyond BEREC's mandate.

BEREC adapted the Guidelines in order to take the new guidance on electricity supply suggested by VTKE into account.

BEREC does not share VTKE's view that in case NTP is located at point C the public network becomes more complex because the network operator has full control only over its network including modem and router and the end-users have to connect their devices to the router as in case the NTP is located at point A or B.

With regard the opinion of PIKE and KIKE that simplicity of the operation of the public network is best served at point C, BEREC would like to clarify that this point can be taken into account when NRAs carry out their assessment. Concerning the opinion of Dansk Energi that point B allows for cost-optimisation for operator, BEREC would like to point out that also the freedom of end-users to use the TTE of their choice and competition in the TTE market need to be considered as described in the draft Guidelines (para. 85).

BEREC's response to BREKO's view that in case of PON interoperability issues and efficient fault repair requires NTP to be located at point B is that the draft Guidelines foresee that criterion "simplicity of the operation of the public network" also consider fault repair. This holds also true for ecta's concern with regard to fault repair.

Concerning the comment from a stakeholder that the draft Guidelines shall mention in para. 75 reverse powering as an exception, BEREC would like to clarify that the draft Guidelines already do this (footnote 18: "*An exception is reverse powering […]*").

With regard to Bouygues Telecom's examples of risks with regard to "economic efficiency" and the Dutch telecoms operators' view that the complexity increases due to end-user provided equipment, BEREC would like to point out that these aspects are already taken into account in the draft Guidelines with the criterion "simplicity of the operation of the public network".

BEREC's response to the Dutch telecoms operators' point that NTP location may impact operational processes is that the draft Guidelines (paras. 67 and 68) do not exclude this aspect.

In respect with Epicenter.works' view that proprietary functions on CPE should not be seen as simpler in terms of objective technological necessity, BEREC would like to clarify that the draft Guidelines do not take this view.

3.3.3 Network security

Stakeholder responses

Point A is default NTP location also with regard to network security

CDT and PK recognizes that giving the ISP control over more of the TTE could make a unified security effort more efficient. However, the consequences for an insecure piece of TTE are greatly magnified in the situation where all NTPs have common TTE. By contrast, greater diversity of TTE diminishes the overall impact of some insecure equipment on a network. CDT and PK suggest that the benefits of users' choice and control over the TTE in their homes, especially from a security perspective, outweigh the risks associated with vulnerable equipment at network endpoints and that Point A remains the best option for a default specification of the NTP.

Network security may not be properly invoked to choose a model different from Option A

AIIP points out that as of nowadays both users and network operators have faced and are everyday (successfully) facing security issues, which has never brought any specific noteworthy and general disruption. Therefore, network security may not be properly invoked to choose a model different from Option A.

ISPs do not care best for their client's security

FSFE points out that the device and network security profits from a more diverse TTE landscape and more competition by manufacturers. The argument that ISPs care best for their clients security has been proven wrong by many incidents where routers did not receive updates for known vulnerabilities and therefore caused massive disruptions for end-users Only point A as the NTP location allows for a competition of equipment manufacturers for better security precautions, update service reliability, and complementary features.

Impact is flawed and incomplete

Liberty Global agrees with BEREC that network security is a key element when assessing whether equipment forms part of the public network. However, Liberty Global finds itself disagreeing with the extremely limited number of factors, identified by the Guidelines, which the national regulators have to take into account in this regard.

By exclusively focusing on whether network operators have sufficient measures in place which allow them to protect their networks, BEREC appears to overlook the fact that network operators also have an obligation under the Code to minimize the impact of security incidents on end-users. Whilst measures '*at the edge of the core network*', as BEREC states, can – in some instances – effectively protect public networks from risks posed by TTE, there is no guarantee that such measures can equally protect end-users who may be affected.

Liberty Global also notes the ambiguous approach BEREC takes with regard to software upgrades. However, what BEREC appears to overlook, is that whilst under the Code there might be an obligation for network operators to ensure their equipment is updated regularly, currently no equivalent obligation towards TTE vendors exists (for equipment which is part of an end-user's private network).

Liberty Global urges BEREC to take account of the recent ENISA reports on telecom security incidents and its analyses of the IoT threat landscape, which provide clear accounts of the persistent threat to network security posed by customer premises equipment such as modems/routers.

Liberty Global holds that BEREC could draw important lessons from security incidents, which should be taken into account in the draft Guidelines.

In conclusion, with regard to network security, Liberty Global holds that BEREC should significantly expand the guidance. Liberty Global recommends BEREC to involve industry stakeholders, as well as ENISA, to ensure that NTP definitions, adopted on the basis of these Guidelines, take all relevant elements of network security into account.

No difference to the obligations an end-user has for all his other connected devices

VTKE cannot find any difference to the obligations an end-user has for all the other connected devices, which he or she owns and which can be as harmful as the router or modem discussed here. Nowadays many connected devices make it rather easy for the end-user to install security updates or these devices, including many modems and routers, have an auto-update function that automatically installs security updates if needed – no user interaction is required at all.

No relation to TTE or modify guidance

VTKE does not see any relation to the TTE. VTKE's suggestion would be to delete the entire guideline or modify it as below:

"*National legal provisions or end-user contracts may stipulate that end-users are liable for any damages they cause in the public network and that the end-users might be required to pay compensation for this*."

In case NTP is located at point B danger of a monoculture

VTKE believes that since the modem has to be installed in each and every customer premises as an NTP, it will most probably be supplied by one vendor. This implies all dangers of a monoculture that might be susceptible on a very large-scale.

ALLNET.ITALIA, Altroconsumo, Assoprovider, Confartigianato Antennisti Elettronici, Federation OPTIME, Free Modem Alliance, AIIP and MDC highlight that, in assessing the "network security" criterion, BEREC and NRAs should consider the existing evidence about the risks of terminal equipment's monocultures (par. 3.3.3).

FSFE argues that the lack of Router Freedom increases the probability that large parts of the router market is dominated by only one or a few product families or manufacturers. As a result, security holes affect an enormous number of users at once. A larger number of available CPE benefits the general security of the complete landscape.

In case of insufficient measures they need to be improved

VTKE is of the view that if the measures are inefficient, then the only solution is to improve these network side measures. These problems cannot be solved by shifting the NTP within the customer's premises. Malicious parties, security researchers or amateurs with an interest will not obey or follow any rules that tell them not to connect a device to point A.

Interoperability in PON

In BREKO's view the interoperability problems in PON due to their dynamic technological development require that the ONT be managed by the operator also for security reasons so that point B is the best suited NTP.

FTTH Council Europe states that in fibre optic transport systems, existing standards are still tweaked by manufacturers to gain operational and performance advantages over competing manufacturers' equipment. This is to the detriment of interoperability across all functions between ONTs and OLTs of different manufacturers, even though all adhere to the same standards.

Dansk Energi and The Dutch telecoms operators consider the main focus of the network owner in stability (reliability) and security of the network, which is best achieved through point B and thus mitigate the risk of unknown equipment connected to the network.

Security best served at point C because network operator can ensure security better than end user.

According to PIKE and KIKE, simplicity of the operation of the public network require location of NTP at point C (or point B at least). When modem, router and media box are part of public network, operator can ensure the security and interoperability of that equipment.

Temporary measures

Epicenter.works argues that certain security measures like traffic management cannot be permanently in place, but can be temporarily deployed in cases of security issues arising from TTE thus para. 105 should be modified accordingly. Homo Digitalis endorses the suggested amendment of para.105 referring to the mitigation of security issues.

In case of VoIP managed services, the NTP should be located at point C in order to avoid network security and integrity issues

A stakeholder argues that, despite of the regulatory aspects, there are technical issues for not taking into account the possibility to use a CPE different from the one provided by the operator. In case the end-user is using its own CPE/modem, the network operator would not be able to prevent illegal practices, as it will not have the possibility to fully control the CPE/modem of the end-user in order to avoid e.g. the access to VoIP service by an unauthorized party. Hence, if the location of the NTP is set at point A, network operators would not be able to protect their end-users from potential fraud or from securities vulnerabilities.

In the stakeholder's view, by providing voice services through managed-VoIP protocol, the network provider is obliged to ensure to the final end-users with additional mandatory functionalities and services, as for instance lawful interception and historical traffic tracking, appropriate voice tariff setting and the integrity of the network for standard network protocols. These services are provided through the entire network operator drive system and some of the functionalities require the control and the interwork of end-user's modem with the operator's network elements. The operator is responsible for the functionalities mentioned above for which it is obliged to comply with the national provisions. This compliance is possible only if the operator has the complete control of the entire drive system of its access network, including obviously the NTP, which dynamically interworks with the other elements of the network.

According to the stakeholder, in addition, the VoIP service could be subject to failures, which operators cannot possibly control without specific functionalities carried out by the NTP. These critical issues are linked to the various implementing choices of the Session Initiating Protocol (SIP).

Specific additional criteria

In terms of "Security", Bouygues Telecom proposes to focus on key technical parameters with the associated risks such as not secured and updated equipment, inability to disconnect and legal obligations. Regarding security, the NRA should mainly consider all the elements to make sure that there would be no breach and risks for the security of the network and by way of contamination to all its clients.

Dansk Energi is concerned that point C would lead to a conflict of interest between network operators and service providers because service providers would have to wait for network operators to optimize their products, e. g. new WiFi standards, and would be forced to follow all technology changes by network operators.

Diversity impairs reaction to incidents

A greater diversity of TTE also makes fault detection and the deployment of fixes more difficult than a more homogenous population of TTE. Therefore a stakeholder suggested amendments in paras. 90 and 101.

Legal ability to disconnect TTE

The Dutch telecoms providers request that point A should only be NTP, if national law allows the network operator to disconnect equipment that harms the network.

Disagreement with para. 89, end-user should not have this obligation

An individual (Linus Lüssing, L.L) argues that there is no and should be no obligation for the end-user for threats caused by third parties. Instead, the network operator should be obliged to provide for security resilience.

BEREC response

BEREC's response to the view of CDT and PK that the Guidelines shall recommend point A as the default location of the NTP also with regard to network security is that this is not possible. The NTP location depends on the outcome of the NRA assessment foreseen in the draft Guidelines on whether there is an objective technological necessity for equipment at the customer premises to be part of the public network and, therefore, the NTP may be located at point A or a different point.

BEREC does not agree with AIIP that security issues have never brought any specific noteworthy and general disruption and, therefore, network security may not be properly invoked to choose a model different from option A. ENISA's Annual Report Telecom Security Incidents report regularly about security incidents and, therefore, this criterion needs to be taken into account in the NRA assessment.

BEREC's response to FSFE's view that ISPs do not care best for their client's security is that, if this is the case, then the outcome of the NRA assessment with regard network security is NTP location A as suggested by FSFE and, therefore, there is no need to adapt the Guidelines.

With regard to Liberty Global's view that the draft Guidelines take into account a limited number of factors and shall expand the guidance, BEREC would like to point out that the draft Guidelines (para. 56) intentionally focus solely on basic aspects of the impact of different NTP locations. Therefore, a further involvement of stakeholders is not necessary. However, BEREC adapted the Guidelines and include a reference to ENISA's Annual Report Telecom Security Incidents which provide an EU-wide overview of telecom security incidents.

Concerning Liberty Global's argument that measurements at the edge of the core network overlook that network operators have also the obligation to "minimise the impact of security incidents on users" (Art. 40(1) EECC), BEREC would like to clarify that the draft Guidelines (para. 92) mention measures at the edge of the core network only as an example and network operators only need take measures in their own domain, not in the TTE, the domain of the end-user.

BEREC's response to Liberty Global's point that with regard to software upgrades no equivalent obligation towards TTE vendors exists is that, according to the draft Guidelines (para. 89), the end-user is responsible for updating the software of the TTE regularly the software updates and he or she may have support from the TTE vendor.

VTKE sees no difference to the obligations an end-user has for all his other connected devices. BEREC would like to clarify with regard to this, that the network security issues differ depending on the NTP locations as described in the draft Guidelines and the NRA assessment shall take this into account.

BEREC does not agree with VTKE that there is no relation to TTE. The TTE is in the domain of the end-user and therefore the end-user is responsible for the TTE and the damages the TTE may cause in the public network.

ALLNET.ITALIA, Altroconsumo, Assoprovider, Confartigianato Antennisti Elettronici, Federation OPTIME, Free Modem Alliance, FSFE, AIIP, MDC and VTKE highlight the topic TTE monocultures. BEREC would like to point out that this topic is already explicitly covered by the draft Guidelines (para. 101).

Concerning VTKE's view that in case of insufficient measures they need to be improved, BEREC considers this issue beyond the scope of the Guidelines.

BEREC's response to the opinion of BREKO, FTTH Council Europe and Dansk Energi that network security can best be achieved with an NTP located at point B and the opinion of PIKE and KIKE that network security is best served at point C is that, if this is the case, then the outcome of the NRA assessment foreseen in the draft Guidelines (section 3.3) will be that the NTP is located at point B or point C respectively.

BEREC adapted the Guidelines (para. 105a) in order to take Epicenter.works point into account that certain security measures like traffic management cannot be permanently in place.

With regard to the stakeholder's view that in case of VoIP managed services, the NTP should be located at point C in order to avoid network security and integrity issues, BEREC would like to point out that the NRA assessment foreseen in the draft Guidelines (section 3.3) also has to take network security and interoperability into account and, therefore, in case of VoIP managed services may result in the determination of point C as the NTP location.

Concerning Bouygues Telecom's examples of risks with regard to "security", BEREC would like to point out that these aspects are already taken into account in the draft Guidelines.

BEREC's response to the view of a stakeholder that a greater diversity of TTE makes fault detection and the deployment of fixes more difficult is that the topic fault detection is covered in the draft Guidelines in the criterion "Simplicity of the operation of the public network" (paras. 74 and 82) and takes into account the differences between locations A, B and C.

BEREC does not share the view of the Dutch telecoms providers that only point A should be determined as NTP if national law allows for disconnecting equipment that harms the network. The draft Guidelines (para. 105a) foresee "measures that are in place" which include but are not limited only to disconnecting equipment that harms the network and BEREC does not see any reason why other measures that allow the network operators to protect their networks against security incidents caused by abuse of modem, router, media box etc. would not be sufficient.

With regard to L. L.'s view that in para. 89 of the draft Guidelines the network operator should be obliged to provide for security resilience and no obligation shall be put on the end-user, BEREC would like to clarify that in case the NTP is located at point A, the TTE is in the domain of the end-user and, therefore, the end-user, who may have support from the TTE vendor, and not the network operator has to ensure that the software used in the TTE is no threat for network security.

3.3.4 Data protection

Stakeholder responses

Data protection is best served by point A as the NTP

FSFE concludes from BEREC's analysis that data protection is best served by point A as the NTP. FSFE agrees to this position and would like to encourage BEREC to communicate this more strongly.

CDT and PK argues that there are strong policy reasons to keep the public internet and users' local networks both logically and legally separate. For example, even though the legal prohibitions mentioned in the proposed guidelines should stop ISPs from monitoring local network traffic, it may be difficult for end-users to detect such activity. Thus, in terms of data protection, the implications of positioning the NTP at Point C are significant because including local network traffic as part of the public internet raises several concerns. Ultimately, CDT and PK suggest point A as default NTP location in order to preserve end-users' sole control over local data.

Data protection may not be properly invoked to choose a model different from Option A

AIIP points out that as of nowadays both users and network operators have faced and are everyday (successfully) facing data protection issues, which has never brought any specific noteworthy and general disruption. Therefore, data protection may not be properly invoked to choose a model different from Option A.

Data protection is outcome of NTP location not part of its definition

Vodafone Group is of the view that the application of data protection requirements are an outcome of where the NTP location is, not a part of its definition.

With NTP at point C the possibilities to protect private data are limited

An individual (Hans-Peter Lehmann, HP. L.) expresses that the possibilities to protect private data are limited in case the ISPs do not allow to adjust firewall rules in their routers in order to allow end-users to using consumer oriented network attached storage devices or there might be even an extra charge by the operator for getting a router that is capable of adjusting firewall rules.

Potential privacy issues outside of the local network

An individual (Linus Lüssing, L. L.) elaborates on the different privacy related aspects and permanent access into private space that an ISP's electronic device (router or modem) operated in the customer's premises would disclose.

Compliance with legal prohibitions

Epicenter.works argues that the choice of CPE by end-users that is possible when the NTP is in locations A or B protects them to a greater extent against unauthorised access to the CPE, in cases where the legal prohibitions prove ineffective. BEREC should clarify the seriousness of restricting end-users' abilities when the NTP is chosen to be at point C, particularly in view of the fact that certain metadata (such as data on the acquisition of DHCP leases in the private network) cannot be protected by end-users by means such as encryption.

Therefore Epicenter.works suggests that in case of NTP at point C, it should be outlined that there is little protection from breaches of the legal requirement by the operator and that certain data, like metadata, cannot be protected by encryption. Homo Digitalis endorses Epicenter.works' suggestion regarding the addition of the new para. 108a, which aims to limit the adverse consequences for the privacy of end-users' communications caused by a NTP in location C.

Data protection no criterion

ETNO questions if data protection should be a criterion in the assessment of the NTP localisation. ETNO argues that the risk of access by the operator to the data of its customers referred to in the Guidelines appears to be unbalanced when compared to the wide access allowed to OTTs to customer data through apps and browsing on Internet.

Data protection best served at point C because network operator can ensure security better than end user.

According to PIKE and KIKE data protection require location of NTP at point C (or point B at least). When modem, router and media box are part of public network, operator can ensure the security and interoperability of that equipment. Data gathered in those devices will be better protected by operator than by end-user.

BEREC response

BEREC's response to the proposals from FSFE, CDT and PK, and AIIP that the Guidelines shall define point A as the default NTP location with regard to data protection is that the draft Guidelines foresee an NRA assessment and if the reasons mentioned by these stakeholder hold true point A will be the outcome of this assessment and, therefore, there is no need to define point A as the default NTP location.

BEREC does not agree with Vodafone Group that the application of data protection requirements are an outcome of where the NTP location is, not a part of its definition. As outlined in the draft Guidelines (para. 47), equipment at the customer premises is part of the

TTE unless there is an objective technological necessity for equipment to be part of the public network and data protection may result in such a necessity.

BEREC agrees with HP. L., that the possibilities to protect private data are limited in case the ISPs do not allow end-users to adjust the firewall rules in their routers, according to their needs, and adapted the Guidelines accordingly.

BEREC agrees also with L. L.'s view on potential privacy issues outside of the local network and adapted the Guidelines accordingly.

BEREC share Epicenter.works' view that the choice of CPE by end-users that is possible when the NTP is in locations A or B protects them to a greater extent against unauthorised access to the CPE, in cases where the legal prohibitions prove ineffective.

BEREC does not share PIKE's and KIKE's view that data gathered in modem, router and media box are better protected by network operators than by end-users, since then the network operators have access to the end-users' data.

With regard to ETNO's point whether data protection is an appropriate criterion, BEREC would like to point out the following. The draft Guidelines (section 3.3.4) show that the location of the NTP has an impact on data protection. Therefore, this criterion needs to be considered. End-users can use OTT services in case of any NTP location, therefore, it is not necessary that the Guidelines consider data protection in case of OTT services specifically.

3.3.5 Local traffic

Stakeholder responses

Handling of local traffic is best served by point A as the NTP

FSFE concludes from BEREC's analysis that the handling of local traffic is best served by point A as the NTP. FSFE agrees to this position and would like to encourage BEREC to communicate this more strongly.

In the view of CDT and PK, the legal and practical considerations recognised by BEREC in the proposed Guidelines also weigh strongly in favour of defining the NTP at point A, in terms of both the privacy concerns and the practical issues with separating local and outbound traffic.

Graphics too simplistic

The Dutch telecoms operators are of the view that the graphics used in para. 3.3.5, to illustrate and describe the different NTP definitions are too simplistic and unsophisticated.

No control of ISP over local traffic

The Dutch telecoms operators state that ISPs cannot control "local traffic" and local traffic is not part of the service provisioned by the ISP.

KIKE and PIKE state that there is no technical possibility of intercepting data sent between a modem and an end-user PC, TV set or printer, so police cannot request operator to access or grant access to those data. Also a problem of net neutrality in local traffic in NTP will not

appear. All data processed in modem, router and media box as local traffic will be generated only by end-user or those devices.

No criterion for suppoting NTP location A

ETNO is of the opinion that local traffic should not be a criterion supporting the location of the NTP in point A. Even if the NTP is considered to be point B (for example in shared networks) the NTP on customer side would usually provide a standardised Ethernet signal on which the customer can use any router chosen.

BEREC response

BEREC's response to FSFE's proposal to communicate more strongly that handling of local traffic is best served by point A as the NTP is that the draft Guidelines (para. 126b) already clearly state "*No objective technological necessity that modem or router must be part of the public network results from the criterion 'local traffic'*".

BEREC acknowledges the argument of the Dutch telecoms operators that ISPs cannot control "local traffic" and that it would even be impossible for ISPs to control so-called local traffic, such as a print job as well as KIKE's and PIKE's view that there is no technical possibility of intercepting data sent between a modem and an end-user PC, TV set or printer. BEREC would like to point out that NTP location C has the consequences that switching and routing of local traffic is done in the domain of the network operator as shown in Figure 4 in the draft Guidelines and, therefore, is a functionality provided by the public network. Therefore, it seems inevitable to consider this functionality as a service provided by the public network with all the legal consequences (e.g. legal interception, net neutrality). Public networks may not be able to fulfil these obligations and, hence, violate them. For these reasons, it is important to have this criterion in the Guidelines and to point out these issues.

With regard to KIKE's and PIKE's opinion that a problem of net neutrality in local traffic in NTP will not appear since all data process in modem, router and media box as a local traffic will be generated only by end-user or those devices, BEREC would like to clarify the following. As pointed out above, in case the NTP is located at point C it seems inevitable to consider switching and routing of local traffic as a service provided by the public network and then also the legal obligations with regard to net neutrality apply. For example, prioritisation of local traffic, although it may be common, may not be conform with the net neutrality obligations and, therefore, not allowed. This would have serious consequences and, therefore, it is necessary to have this criterion in the Guidelines.

BEREC's response to ETNO's opinion that local traffic should not be a criterion supporting the location of the NTP in point A is that the draft Guidelines (section 3.3.5) show that the NTP location has an impact on the legal and regulatory considerations around local traffic at customer premises. Therefore, this criterion needs to be considered.

3.3.6 Fixed-line services based on wireless technology

Stakeholder responses

No reason why mobile NTP would not apply

In para. 127 and para. 138, VTKE is of the view that there is no reason why the mobile network NTP (the air interface) would not apply to such stationary applications.

L. L. argues that the guidelines should be clearer that para. 3.3.6 is about pricing/contract models and not about a technological necessity for the router to be operated by an ISP to allow internet access over a mobile network. Non-mobility cannot be fully ensured, neither by the ISP nor by the customer. As a whole, the considerations of para. 3.3.6 should be removed though.

Point A is best NTP location

CDT and PK support Point A as the best location for the NTP even for fixed wireless internet access services in which there is no wire termination point at the customer's premises. TTE makers can produce home equipment capable of interoperability with multiple fixed wireless network providers. ISPs should be discouraged from requiring specific, proprietary TTE for fixed wireless service unless there are compelling technical reasons to do so.

Control over CPEs may be necessary

In the view of AIIP, in case of wireless fixed access control over CPEs may be necessary in order to provide transmitting transparent capacity between e.g. BTS and the antenna at the location of the final customer. NTP located at point B perfectly fits the case of Fixed Wireless Access as the NTP terminates the electromagnetic signals originating from the network, so it must be compatible to the rest of the network, following specific process to keep the network elements up to the same level of software features. The NTP should be located at point C, when router and modem are integrated and there are critical issues related to the use of equipment chosen by the end-user with reference to the proper functioning of the network and the services offered.

In case of networks based on fixed-wireless access, the NTP should be located at point C

A stakeholder's view regarding fixed wireless technologies is that the NTP should be located at point C, namely "the interface at the end-user's side of the CPE which provides not only network termination but also further functionalities (e.g. routing, WLAN)". The main reasons are that the FWA technologies imply a strong customization compared to the defined international standard. This leads to a difficulty for the end-users to retrieve in the retail market the appropriate terminal equipment, which are by the way rather costly, and to the fact that the access Internet service provided on FWA technologies is implemented on heterogeneous technologies based on different standards, frequencies and radio protocols. Furthermore, there is a need to ensure the integrity of radio equipment and avoid interferences between services.

The stakeholder states that this approach has been followed by the Italian NRA, which has introduced a waiver for the FWA technologies to its decision adopted in 2018.

BEREC response

BEREC's response to VTKE's view that there is no reason why the mobile NTP (the air interface) would not apply to such stationary applications is that section 3.3.5 does not consider mobile services but instead considers fixed-line services based on wireless technology, i.e. a service with a fixed NTP (and not with a mobile NTP). The draft Guidelines (para. 138a), however, also clearly states "*In case it is necessary to enable fixed-line services based on wireless technology […]*". Therefore, if there is not a need that the service provides a fixed NTP, then this criterion do not apply and a mobile NTP is possible. This also holds true with regard to L. L.'s comments. Non-mobility could e.g. be ensured if the antenna is mounted on the façade of the end-user's building as it is the case in certain types of fixed wireless access.

BEREC notes CDT's and PK's comment that point A is the best location for the NTP even for fixed wireless internet access services.

BEREC acknowledges AIIP's opinion that in case of wireless fixed access control over CPEs may be necessary. BEREC points out that the NRA assessment foreseen in the draft Guidelines (section 3.3.6), needs to analyse the impact of different NTP locations and may take into account the AIIP's considerations.

BEREC's response to the stakeholder's view that in case of fixed wireless technologies the NTP should be located at point C and that also the Italian NRA introduced a waiver for the FWA technologies to its decision adopted in 2018 is that this may also be the outcome of the NRA assessment foreseen in the draft Guidelines (section 3.3.6).

3.3.7 Missing Criteria

Hybrid access technologies

In ETNO's view, business models, where a combination of fixed and mobile networks is offered, are mostly based on proprietary solutions of vendors of the relevant equipment, thus specification of TTE is either not possible, due to the proprietary specifications used or developments would lead to continuous changes in the specifications. The examples of hybrid services in para. 3.3.6 are described in such a way that it could be read that the conclusion on the location of an NTP is made solely based on the separate characteristics of the underlying separate network technologies. It would be preferable to use an approach whereby operators can flexibly use the underlying technologies to offer a separate 'hybrid NTP'.

Impact of NTP definition on competition between networks of different technologies

In ETNO's opinion, it is likely that different technologies have their specific issues in relation to defining an NTP. Especially in fixed broadband markets various access technologies are available, used by various operators that compete in the retail markets. Therefore, it is of importance that BEREC includes potential competitive and economic aspects of choices to be made in approaches for defining NTP's in its analysis. ETNO believes that the framework in part 3.3 of the draft Guidelines should include an analysis of the competitive aspects of decisions for different technologies.

The Dutch telecoms operators are concerned that there is no analysis of the effect, how different types of access networks relate to each other and what would the effect be of defining the NTP in a certain way. Furthermore, the analytical framework does not contain any considerations to review competitive aspects in respect to technologies that are competing in the market.

Open Access

BREKO argues that bitstream access will be the dominant access product in PON and can be offered in parallel to different service providers, e. g for IP-TV, VoIP, Internet. Bitstream access is an Ethernet-based access product out of which service providers can develop their service offers on the next layer. For PON operators, granting bitstream access allows for a faster uptake of their networks and is an important factor for making PON projects viable. This requires a NTP at the ONT and thus point B.

The FTTH Council Europe argues that usually the ONT (modem) exhibits a standardized Ethernet interface at the CPE side, allowing for a variety of CPE developments irrespective of the particular optical transport standard interpretation of the manufacturer of the OLT or the optical transport system (GPON, NG-PON or XGPON) used by the active network operator.

Dansk Energi considers that NTP is required at the ONT and thus point B, which provides the best opportunities and freedom for service providers to deliver products that best suit their business. Support of multi-customer installations is only possible at point B.

Dansk Energi states that for PON and NTP at point B network operators can make operational tools available for service providers, e. g. troubleshooting.

Differences between different network topologies and the investments made in the networks

Vodafone Group states that differences between different network topologies and the investments made in the networks should be one of the factors taken into account when establishing the NTP.

NTP and fulfilment of regulatory obligations

In ETNO's view, the NTP definition may impair operators' ability to fulfil regulatory obligations, such as related to privacy, security, transparency on functionalities and QoS (including transparency thereof).

DRM and copyright issues

In ETNO's view, one of the major reasons why providers are only offering IPTV services over set-top boxes they provide themselves is related to DRM and copyright issues. Therefore, if BEREC opts to include a specific analysis of specific services – rather than restricting the scope of the Guidelines, ETNO considers it necessary to include additional elements in the analysis, such as copyright.

Digital sovereignty of the end-user (freedom of action and choice) and Eco aspects / costs for the end-user

The stakeholders ALLNET.ITALIA, Altroconsumo, Assoprovider, BHE Bundesverband Sicherheitstechnik e.V, Confartigianato Antennisti Elettronici, Federation OPTIME, Free Modem Alliance, AIIP, MDC and VdS Schadenverhütung GmbH state that, in Model A, end-users have by far the greatest digital sovereignty. They can act independently and select and connect without restriction from a large number of innovative products on the market the terminal that best meets their wishes and needs. Whereas model B clearly limits the end-users digital sovereignty and with model C the end-users' digital sovereignty is completely restricted.

The aforementioned stakeholders point out that, connecting two devices in series (e.g. routers behind modems), would mean a significant increase in power requirements, which will result in additional costs to the end-user and would also double the amount of electrical waste and electronic equipment.

VTKE suggests that NRAs shall take into account the ecological and digital sovereignty aspects into account when defining the location of the NTP.

FSFE states that every other NTP location than point A would seriously hamper end-users digital sovereignty and ecological footprint.

An individual states that digital sovereignty from ISPs are fundamental values that are also covered by Regulation 2015/2120 and Directive 2008/63/EC.

Freedom of choice, independence from ISPs

An individual and FSFE state that every other NTP location than point A would seriously hamper end-users freedom of choice and independence from ISPs.

Change of network operator (switching)

ALLNET.ITALIA, Altroconsumo, Assoprovider, Confartigianato Antennisti Elettronici, Federation OPTIME, Free Modem Alliance, AIIP and MDC express the view that if the interfaces of a modem or router were the NTP(s) (model B or C), switching provider would force the end-user to also switch the obligatory modem or IAD. The requirement to replace the router when switching provider forces the end-user to reconfigure not only the router but, more importantly, all devices in the home network connected to it. This can be extremely complex, even for technically experienced end-users. End-users with less experience may be daunted by the technical effort and therefore avoid switching provider in the first place.

Further criteria

VTKE suggests that NRAs shall take into account the following assessments when defining the location of the fixed NTP:

- End-user friendliness and simplicity
- Harmonization and standardization in European telecommunication
- Markets for European tech companies
- Competition and innovation

FSFE states that every NTP location other than point A would seriously hamper end-users switching costs.

Transitional phase for implementing NTP definition

The Dutch telecoms operators note that it is important that the implementation of the definition of the NTP-location considers a reasonable term for providers to modify their processes. BEREC should recommend NRAs to investigate what transitional phase is reasonable and proportionate.

BEREC response

BEREC agrees with ETNO that the topic 'hybrid' access technologies is relevant. Services based on both a fixed-line and a wireless connection may have two NTPs, an NTP where the fixed-line connection is provided and an NTP where the wireless connection is provided. The NRA assessment taking into account all criteria (sections 3.3.1 to 3.3.6) has to be applied also in case of such services. BEREC adapted the Guidelines accordingly.

With regard to the topic 'open access' of BREKO, FTTH Council Europe and Dansk Energi, BEREC would like to point out that this is also a relevant aspect that needs to be considered. BEREC is of the view that open access needs to be taken into account in case of all criteria of the NRA assessment (and not as a separate criterion) and adapted the Guidelines accordingly.

BEREC agrees also that the fulfilment of regulatory obligations as pointed out by ETNO is important, but BEREC notes that the regulatory obligations of the operator are also limited by the reach of its network. The draft Guidelines require that the definition of the NTP location needs to be conformant with the legal provisions (section 3.1) and, therefore, take this aspect already into account. It needs to be taken into account in case of all criteria of the NRA assessment.

BEREC shares ETNO's view that DRM systems need to be considered. An important point with regard to DRM systems is to ensure interoperability between TTE and public network. BEREC therefore adapted the Guidelines accordingly.

In respect of ETNO's opinion to consider also potential competitive and economic aspects and of Vodafone Group's opinion to consider also differences between different network topologies and the investments made in the networks, BEREC would like to clarify the following. The draft Guidelines (para. 47) foresee that equipment at the customer premises is part of the TTE unless there is an objective technological necessity that it needs to be part of the public network. The choice of technology for that network is done solely by the network operator, and the objective technological necessities to be considered follow from this decision. The topics proposed by ETNO and Vodafone Group thus do not constitute an objective technological necessity for defining the NTP location and, therefore, need not to be considered in the Guidelines. This holds also true for the further topics suggested by VTKE.

With regard to the topic digital sovereignty of the end-user raised by ALLNET.ITALIA, Altroconsumo, Assoprovider, BHE Bundesverband Sicherheitstechnik e.V, Confartigianato Antennisti Elettronici, Federation OPTIME, Free Modem Alliance, AIIP, MDC, VdS Schadenverhütung GmbH, VTKE, FSFE and an individual, BEREC would like to point out

the following. The draft Guidelines (para. 47) foresee the maximum digital sovereignty of the end-user since they define that equipment at the customer premises is part of the TTE and only in case there is an objective technological necessity that it needs to be part of the public network it is not part of the TTE.

ALLNET.ITALIA, Altroconsumo, Assoprovider, Confartigianato Antennisti Elettronici, Federation OPTIME, Free Modem Alliance, AIIP and MDC point out that in case the NTP is not located at point A changing the network operator (switching) is more difficult for the end-user. As mentioned above, the draft Guidelines foresee that the NTP is located at point A unless there is an objective technological necessity for equipment to be part of the public network.

BEREC agrees with the Dutch telecoms operators that a transitional period may be appropriate in case the NTP location defined by the NRA differs from the current situation and adapted the Guidelines accordingly.

4 Location of the mobile NTP

Stakeholder responses

Guidance provided in the Guidelines is sufficient

GSMA agrees with BEREC's assessment that there is no need to provide further guidance on the mobile NTP location.

No unique answer regarding the localisation of the NTP in mobile networks

GSMA is of the view that there is no unique answer regarding the localisation of the NTP in mobile networks and illustrate this with three examples. Example 1: In case of mobile phones connected to a cellular network, the NTP is the radio modem in the system on a chip (not the SIM-card). Example 2: For fixed-wireless broadband access and mobile broadband access services, the NTP would also be at the radio modem, but the physical location depends on whether the radio modem is separated from (e.g. a dongle or a stand-alone modem) or embedded in an end-user device (e.g. laptops with embedded SIM or eSIM capability and a radio modem). Example 3: For IoT connectivity, there is a broad range of devices that connect to a public electronic communications network and they need to be analysed with regard to the NTP location, in particular 5G technology such as slicing. The NTP is not likely to be the SIM card. The NTP cannot always be the air.

Vodafone Group does not agree with para. 141 of the Guidelines. Network topologies in mobile networks vary because of the physical points on which they terminate is present in different devices. Vodafone Group refers to the detailed GSMA response on this point (s. above).

NTP would have to be considered to be the SIM or its eSIM variant

In view of AIIP, the term 'NTP' is defined in the EECC (Art. 2(9)) as "*the physical point at which an end-user is provided with access to a public communications network*" and therefore the NTP would have to be considered to be the SIM (Subscriber Identity Module) or its eSIM variant.

5G

A stakeholder argues that future developments in 5G networks may lead to scenarios where the NTP of public mobile networks may be situated within equipment, e. g. due to network slicing. Here, NRA should assess developments on a case by case basis.

Network-related equipment on customer premises

The Dutch telecoms operators consider radio equipment meant to provide coverage or services of mobile electronic communication networks which makes use of radio spectrum for which the operators have the exclusive right, as part of the domain of the network operator. Therefore, repeaters and similar devices on the customer premises must remain part of the public network.

Mobile broadband

Eir states that, in order to avoid abuse of subscription services, the provision of specific equipment by the network operator may be justified.

BEREC response

BEREC welcomes that GSMA agrees with BEREC's assessment that there is no need to provide further guidance on the mobile NTP location.

BEREC's response to the view of GSMA, Vodafone Group, AIIP and a further stakeholder on the location of the mobile NTP is that the various parts of equipment they mention process signals or information after the mobile network has already been accessed and, therefore, these parts of equipment are not part of the mobile network but part of end-user equipment.

With regard to the Dutch telecoms operators' view that small base stations or repeaters at the location of the end-user need to be part of the public network, BEREC would like to clarify that network equipment such as base stations and repeaters provided by the operator do not become part of the private network of the end-user just because they are installed at the customer premises. This does not interfere the end-users being able to (continue to) use their own mobile equipment.

Concerning eir's opinion that the provision of specific equipment by the network operator may be justified, BEREC cannot see any substantiation of eir's claim and, therefore, BEREC does not foresee the present situation to change where end-users have the possibility to use their own mobile equipment.

5 Annex

Stakeholder responses

Add an example for the dual play service telephony and Internet access

VTKE suggests to add an example for the dual play service telephony and Internet access.

BEREC response

BEREC would like to point out that the annex solely illustrates for several (retail) services that the location of the NTP has an impact on whether an equipment is part of the public network or part of the TTE and the list of examples is already rather long. Therefore, BEREC suggests not to include further examples.

Abbreviations

AIIP	Italian Internet Service Provider Association
ANGA	Association of Private Cable Networks Operators
API	Application Programming Interface
B2B	Business-to-business
BEREC	Body of European Regulators for Electronic Communications
BREKO	German Broadband Association
BTS	Base Transceiver Station
BUGLAS	Federal Association of Fiber Optic Connection
CATV	Cable Television
CDT and PK	Center for Democracy & Technology and Public Knowledge
CET	Central European Time
CPE	Customer Premises Equipment
DECT	Digital Enhanced Cordless Telecommunications
DHCP	Dynamic Host Configuration Protocol
DOCSIS	Data Over Cable Service Interface Specification
DSL	Digital Subscriber Line
ECTA	European Competitive Telecommunications Association
EECC	European Electronic Communications Code
ENISA	European Network and Information Security Agency
ETNO	European Telecommunications Network Operators
ETSI	European Telecommunications Standards Institute
EU	European Union
FSFE	Free Software Foundation Europe
FTTH	Fiber-to-the-home
FWA	Fixed Wireless Access
FXS	Foreign Exchange Service
GPON	Gigabit Passive Optical Network
GSMA	Global System for Mobile Communication Association
HFC	Hybrid Fiber-coaxial
IAD	Integrated Access Device
IAS	Internet Access Service
IoT	Internet-of-Things
IPTV	Television over Internet Protocol
ISP	Internet Service Provider
IT	Information Technology
ITU	International Telecommunications Union
KIKE	Polish Chamber of Ethernet Communications
LAN	Local Area Network
MDC	Movimento Difesa del Cittandino
NG-PON	Next-Generation Passive Optical Network
NRA	National Regulatory Authority
NSA	National Security Agency
NTP	Network Termination Point

OEM	Original Equipment Manufacturer
OLT	Optical Line Termination
ONT	Optical Network Termination
OPTIME	Osservatorio Permanente per la Tutela in Italia del Mercato dell'Elettronica
OTT	Over-the-top
P2MP	Point-to-multipoint
P2P	Peer-to-peer
PBX	Private Branch Exchange
PC	Personal Computer
PIKE	Polish Chamber of Electronic Communications
PON	Passive Optical Network
PSTN	Public Switched Telephone Network
QoS	Quality-of-Service
SIM	Subscriber Identity Module
SPT	Supervised Premises Transceiver
TE	Terminal Equipment
TTE	Telecommunications Terminal Equipment
TV	Television
USB	Universal Serial Bus
VATM	Association of the Providers of Telecommunication- and Value-Added-Services
VoIP	Voice-over-Internet Protocol
VTKE	Alliance of Telecommunications Terminal Equipment Manufacturers
WLAN	Wireless Local Area Network
XGPON	10-Gigabit-capable Passive Optical Network

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Consumer organisation

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MDC

TTE manufacturer

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Confidential contribution
Confidential contribution
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Association of network operators

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CableLabs
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Italian Internet Service Provider Association (AIIP)
Assoprovider
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Freifunk Hamburg
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Other associations

FTTH Council Europe
Epicenter.works
BHE Bundesverband Sicherheitstechnik e.V.
Dansk Energi
Free Modem Alliance (FMA)
Confartigianato Antennisti Elettronici

Non-profit organization

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