Body of European Regulators for Electronic Communications

BEREC

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Assessment of the need to review the BEREC Common Positions on Markets 3a, 3b and 4

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1 Executive summary

BEREC decided to undertake a comprehensive assessment of the need to review the common positions (CPs) on Markets 3a, 3b and 4 as part of its work programme for 2017. This report sets out our initial assessment of the need to update the CPs in the light of market, technological and regulatory developments since 2012 (when the CPs were last updated). It also draws on the findings of the implementation monitoring BEREC conducted between 2014 and 2016, which reviewed whether National Regulatory Authorities (NRAs) had implemented and followed the best practices (BPs) in the CPs.

In summary, the report outlines that the CPs broadly remain fit for purpose to help NRAs to design appropriate remedies for Markets 3a, 3b and 4. However, it identifies some BPs that might usefully be updated or added, to reflect changes since 2012. The potential changes that are identified in this report are summarised in the conclusions chapter and in the table below.

Table 1: Overview of possible changes proposed to the Common Positions

Key	
	No change needed
	Minor change/updating proposed
	More significant change proposed

Section (competitive objective)	**Implementation monitoring**			**Market developments** [1]			**Technological developments**			**Regulatory framework**		
	3a	**3b**	**4**	**3a**	**3b**	**4**	**3a**	**3b**	**4**	**3a**	**3b**	**4**
Assurance of access												
Assurance of co-location at the delivery/access point and other associated facilities												
Level playing field												
Avoidance of unjustified first mover advantage												
Transparency												
Reasonable quality of access product – technical issues												
Reasonable quality of access products												

[1] The market developments chapter also recommends a change to the introduction of the CPs on Markets 3a and 3b.

– operational aspects												
Assurance of efficient and convenient wholesale switching												
Assurance of efficient migration processes from legacy to NGN/NGA network												
Fair and coherent access pricing												

An important consideration at this juncture is that the European Electronic Communications Code (EECC) is still in trialogue and could be subject to further change. As a result, this report has been prepared independent of BEREC's concurrent work being undertaken on the EECC. As a follow-on step, BEREC will host a workshop in H2 2018 to further discuss the preliminary conclusions of this report in light of the EECC - by which time we expect the EECC to be finalised (or at least in a more stable position). BEREC will then determine if it should conduct a full review and revision to the CPs in 2019.

2 Introduction

One of BEREC's key roles is to develop best practices and share these among National Regulatory Authorities (NRAs). The best way to achieve this and promote consistent regulatory approaches is through common positions. In 2012, BEREC revised the three common positions (CPs) initially developed by the European Regulators Group (ERG) in 2007. It published the updated CPs[2] on best practices in the application of remedies imposed to address significant market power (SMP) on the markets for:

- Wholesale (physical) infrastructure access (former Market 4/2007, i.e. Market 4 of the 2007 Recommendation on relevant markets)[3] – corresponding to the market for wholesale local access of the 2014 Recommendation (WLA, Market 3a/2014);[4]
- Wholesale broadband access (former Market 5/2007) – corresponding to the market for wholesale central access (WCA, Market 3b/2014); and
- Wholesale leased lines (former Market 6/2007) – corresponding to the market for wholesale high quality access at a fixed location (WHQAFL, Market 4/2014).

These CPs include several best practices (BPs) which are designed to achieve ten competition objectives (COs)[5]. While the ten COs are common to all three CPs, the BPs are tailored to each relevant market (although some are common across the three markets). BEREC considers there is no need to review the COs so this analysis of the CPs is structured with reference to these COs (i.e. from CO1 until CO10).

This document examines various reasons why the above-mentioned 2012 CPs may have to be updated. They are grouped in four categories:

(i) Implementation monitoring

In the years 2014 to 2016, BEREC produced a series of reports to monitor the implementation of the three CPs by NRAs.[6] These reports assess, for each BP, which NRAs have followed it, and in instances where some NRAs have not followed it, the reports provide some insight into the reasons. BPs which are mostly not followed by NRAs might be candidates for review.

(ii) Market developments

Market developments and NRAs' practical experience in imposing particular remedies may point to a need to review certain BPs. Examples here are duct access remedies applied in recent years, remedies related to business wholesale products and the treatment of cable operators or alternative FTTP operators.

[2] BoR (12) 126, BoR (12) 127, BoR (12) 128.
[3] Commission Recommendation 2007/879/EC from Dec. 17, 2007.
[4] Commission Recommendation 2014/710/EU from Oct. 9, 2014.
[5] The Common Positions do not alter, and are without prejudice to, the powers conferred, and obligations imposed, on the NRAs under the Framework Directive and the Specific Directives. They are therefore not a substitute for the responsibilities on the NRAs to show (among other things) that SMP remedies are based on the nature of the problem identified, proportionate and justified in light of the policy objectives laid down in Article 8 of the Framework Directive.
[6] BoR (14) 171, BoR (15) 199, BoR (16) 219.

(iii) Technological developments

A number of technological developments in the last few years have had an impact (or potentially could have an impact) on remedies appropriate to the markets considered in this report. Examples include VDSL vectoring and new standards of passive optical networks (PONs) which could facilitate wavelength unbundling.

(iv) Developments in the common regulatory framework

Regulatory framework developments in the last few years have also been considered. The ongoing review of the regulatory framework for electronic communications is obviously a major such development,[7] but as it has not been adopted by the EU legislative institutions, it has not been considered as part of this report's analysis. Other important developments that have occurred over the past few years are the following:

- the Recommendation on non-discrimination and costing methodologies of 2013[8],
- the new Recommendation on relevant markets of 2014[9], and
- the Broadband Cost Reduction Directive (BCRD) of 2014[10].

Based on an analysis of these areas, this document draws conclusions on whether (or not) it might be necessary to revise certain BPs. The CPs might need revisions if BPs are in tension with recent developments, if there is a gap in the current set of BPs, if BPs may be redundant, or if BPs may need further clarification. The report does not, at this stage, make concrete, definitive suggestions on *how* to revise these BPs but does identify possible areas for revisions and further assessment.

This report refers to the relevant markets using updated descriptions based on the Commission Recommendation on relevant markets of October 2014, in which the previous Market 4 (WLA) is referred to as Market 3a, the previous Market 5 (WBA) is referred to as Market 3b (WCA) and the previous Market 6 (WLL) is referred to as Market 4 (WHQAFL).

In this document, the term "may" is used when describing the possible need to update the CPs on Markets 3a, 3b and 4, since future developments could require changes not foreseeable today. The report makes initial suggestions for a future review of the CPs, rather than reaching definitive, prescriptive conclusions at this stage. Its findings should not therefore be interpreted as indicating any formal recommendation by BEREC on changes to the CPs.

[7] See, e.g., https://ec.europa.eu/digital-single-market/en/news/proposed-directive-establishing-european-electronic-communications-code
[8] Commission Recommendation 2013/466/EU from 11 September 2013.
[9] Commission Recommendation 2014/710/EU of October 2014.
[10] Commission Directive 2014/61/EU of 15 May 2014. The BCRD is covered in Chapter 4.

3 Implementation monitoring

3.1 Introduction

Over the last few years BEREC has undertaken a programme of work which involved looking at its 2012 Common Positions (CPs) for wholesale access Markets 3a, 3b and 4 in the European Commission (EC) recommendation of October 2014[11] and developed a methodology to monitor how NRAs are implementing these CPs. Thus, between 2014 and 2016, BEREC carried out three monitoring exercises of how NRAs have been implementing the CPs, which covered the full three-year cycle between market reviews.

In 2014 BEREC carried out its first monitoring exercise (Phase 1) and the report was adopted in December 2014. In 2015, BEREC carried out its second monitoring exercise (Phase 2) and the report was adopted in December 2015. In December 2016, BEREC published the final (Phase 3) of the three monitoring reports. Regulators are increasingly conducting their market reviews for Markets 3a and 3b together, given the latter's dependency on the outcomes of the former, as well as the fact that remedies in both markets share some common characteristics.

The key points in the Phase 3 report were:

1) Participants are following the broadest, or high level, best practices relating to each of the competition objectives;
2) Differences in terms of implementation are driven by the following factors:
   (i) State of competition in the market;
   (ii) The development of NGA;
   (iii) Basis of competition (e.g. whether based on active or passive access remedies);
   (iv) The NGA infrastructure adopted by the SMP and alternative operators (e.g. FTTC v FTTP);
3) Innovative approaches to regulation: vectoring; FTTP/VULA trade-offs; minimum quality of service standards; fixed-mobile convergence.

24 NRAs participated in the exercise for Markets 3a and 3b; 21 NRAs participated in the exercise for Market 4 (see Table of Annex 2 of the December 2016 report).

Following the 2017 Work Program, BEREC has reviewed the results of the monitoring with a view to applying any learnings to this wide-ranging scoping exercise and to assess whether there is a need to revise the CPs.

3.2 Conclusions

From the results of the CP monitoring exercise, it appears that some BPs are not being imposed by a number of NRAs - usually because they were not applicable, or because some NRAs considered that the obligation was not appropriate to their national market circumstances.

However, it is important to emphasise that we do not expect *all* NRAs to implement *all* the BPs in each of the three CPs. Instead, we expect NRAs to take upmost account of individual BPs

[11] Regarding relevant markets of electronic communications networks and services susceptible of ex ante regulation.

in shaping their remedies to achieve the ten COs (which all NRAs are expected to achieve). BPs should therefore be sufficiently flexible to allow adaptation to national circumstances.

Having reviewed the findings of the three implementation monitoring reports, we have not identified any BPs which require urgent revision. Our review of the implementation reports has found the CPs are generally fit-for-purpose in providing best practice guidance to NRAs on devising effective remedies to meet the competition objectives. While some individual BPs are not followed by all NRAs, most BPs are followed by most NRAs.

We have identified some parts of the CPs that merit revision in due course, as and when BEREC determines it is timely to update the CPs. Our key findings are (in order of the COs):

- Assurance of access - the BPs could more explicitly acknowledge that active remedies can sometimes be disproportionate in markets where passive remedies (e.g. duct access) are in place (though the BPs should continue to make clear it is for NRAs to determine if active and/or passive remedies are suitable to their national circumstances).
- Level playing field - the BPs could further highlight the availability of a range of remedies (including different degrees of functional separation, EoI, EoO and non-discrimination) in order to achieve the common competition objective of a level playing field.
- Avoidance of unjustified first mover advantage - minor changes to these BPs could provide more guidance to NRAs on how they ensure alternative operators have the ability to influence the decisions of SMP operators.
- Transparency - minor changes or clarifications to these BPs may be needed to increase the number of NRAs implementing them.
- Reasonable quality of access products (operational aspects) - there may be a case for reviewing the degree of presciption in this section because many NRAs have not applied some of the BPs (though it may become more relevant due to the emergence of new fibre products[12]).
- Assurance of efficient and convenient wholesale switching - there may be a case for reducing the degree of prescription in this section because many NRAs have not applied some of the relevant BPs (e.g. the requirements on bulk switching processes).
- Assurance of efficient migration process from legacy to NGN/NGA network - there may be a case for reducing the degree of prescription in this section of the CPs because many NRAs have not applied some of the relevant BPs, though they may become more relevant in the next few years.
- Fair and coherent access pricing - some of the BPs in this key section may merit revision, particularly those that relate to margin squeeze, NGA-based charge controls and volume discounts as many NRAs do not currently implement them.

The table below summarises the findings from reviewing BEREC's three implementation reports.

Table 2: Overview of possible changes in light of the monitoring exercise (sections where more substantive changes may be required are highlighted in bold).

[12] Implementation of the 2013 Recommendation is also relevant and is discussed in Chapter 6.

Competition objectives	**Market 3a**	**Market 3b**	**Market 4**
Assurance of access	**Yes**	**Yes**	**Yes**
Assurance of co-location at the delivery/access point and other associated facilities			
Level playing field	**Yes**	**Yes**	
Avoidance of unjustified first mover advantage	Yes	Yes	
Transparency	Yes		
Reasonable quality of access product – technical issues			
Reasonable quality of access products – operational aspects		Yes	
Assurance of efficient and convenient wholesale switching	Yes		Yes
Assurance of efficient migration processes from legacy to NGN/NGA network	Yes	Yes	Yes
Fair and coherent access pricing	**Yes**	**Yes**	

4 Market developments

4.1 Introduction

This chapter briefly identifies various market developments in some Member States that may have implications for market definition and resulting SMP determinations. These developments could have implications for remedies which may, in turn, mean that some of the best practices (BPs) would merit review. We consider the following developments:

- Limited alternative infrastructure deployment,
- Cable regulation,
- NGA roll-out and multiple sub-national networks,
- Duct and pole sharing, and,
- Market 4 developments.

The regulatory toolbox for the three markets under review is broad and allows NRAs to customize the application of ex ante regulation according to their national market situations. It is built upon the principle of the ladder of investment[13] which encourages and incentivises the development of competitive markets at progressively deeper levels of network infrastructure.

It is therefore necessary for each NRA to consider the applications of remedies, and hence the CPs, in their respective national context. In terms of infrastructure competition, market landscapes within and across the various Member States range from so-called digital "white" spots[14], to oligopolistic or emerging oligopolistic market structures with (a limited number of) alternative infrastructures, and from multiple sub-national markets, each with single SMP players, to a national market with the traditional incumbent holding SMP.

The following considerations do not replace the national market analysis of each NRA.

4.2 Limited alternative infrastructure deployment

This sub-chapter addresses markets which have no or limited infrastructure competition to the incumbent at the deeper network layers, i.e. limited alternative physical ECS network infrastructure in the access network (the last mile).

Alternative infrastructure networks, in addition to the incumbent, have mostly been deployed by cable operators and/or alternative telecoms operators where economic conditions allow commercially viable rollout, usually in urban areas. In some Member States, public utility companies and local municipalities have deployed alternative networks to varying degrees, sometimes to deliver on public policy objectives.

Investment in alternative physical networks offers alternative operators independence from the incumbent operator, not just in terms of prices for wholesale services, but also with regard

[13] See p. 10 of BoR (11) 43 BEREC Report on the Implementation of the NGA-Recommendation for further explanation of the ladder of investment.
[14] A digital white spot is an area where there is no basic broadband infrastructure with little likelihood that this will change in the immediate future. See EU Guidelines for the application of State Aid rules for broadband (2013/C25/01), http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:C:2013:025:0001:0026:EN:PDF

to the potential to innovate, for example on quality of service, network architecture and technology, and in the terms and conditions of contracts.

However, some geo-types[15] are such that their characteristics result in limited economies of scale for alternative operators. The consequence is that these geo-types are likely to have limited or no infrastructure competition. Many rural areas are still mostly served only by the incumbent telecoms operator (often using legacy infrastructure). In some cases, markets are served by cable operators as well (see section 4.3 below) although the footprint of cable operators is more limited in non-urban areas (with some exceptions observed in some countries). One of the main reasons for this lack of infrastructure competition is the relatively higher investment required per household passed in lower density areas - this makes sustainable competition based on the rollout of alternative physical infrastructures more economically challenging than in higher density areas.

Where there is a lack of current and prospective infrastructure competition, in order to ensure competitive outcomes for end-users, access based competition continues to be necessary, based on Market 3a and/or 3b wholesale products.

4.2.1 Potential implications on the Best Practices

We consider the current CPs to be broadly appropriate for NRAs to promote competition in markets with no or limited infrastructure competition. Any revision of the current CPs should continue to take into account that in some markets there is no effective competition based on alternative infrastructure.

Where (physical) infrastructure is newly rolled out, or existing civil engineering can be reused, there might be the potential for promoting long term infrastructure competition by multi-fibre deployment in a co-investment scheme. The CPs must therefore ensure that access based competition of this form in those markets is encouraged and not impeded.

4.3 Cable regulation

Cable operators are key players involved in NGA deployment in Europe. However, their coverage varies, often forming a patchwork of non-overlapping geographic footprints. When assessing the wholesale Market 3a in Member States, NRAs have generally concluded that the market is national, with the incumbent being designated with SMP based on having ubiquitous copper and/or fibre network infrastructure coverage (as well as a dominant position in terms of market share). The coverage of end-user services supplied by the incumbent is then usually national as well. As a result, when the relevant markets are determined to be national, in most countries cable operators with a more limited geographic footprint have not been designated with SMP, despite sometimes having a significant share of the corresponding retail market. Up to now, cable operators have been found to have a national footprint only in the Netherlands and Malta (although cable operators do *collectively* have national coverage in Belgium as well).

Even if a cable operator were found to have SMP in Market 3a, the technical configuration and capacity limitations of cable infrastructure does not currently lend itself to a viable wholesale (physical access) cable product. However, as the dividing line between Market 3a and Market

[15] Geo-types can take the form of regions or countries, and urban or rural areas.

3b bitstream products becomes more blurred (we note NRAs are increasingly conducting both market reviews together), bitstream cable products could serve as means for service providers to compete at the retail level.

The imposition of regulatory obligations through the SMP framework in either Market 3a or Market 3b would have to stem from a finding of single or joint dominance in a national or sub-national market. For example, where the coverage of cable infrastructure is not national, but nevertheless cable operators have significant retail market shares in those areas covered by their geographical footprint, an SMP finding for cable operators could result where relevant markets are defined at a sub-national level. Irrespective of whether the market is defined national or sub-national, in the current framework, finding joint dominance poses challenges for NRAs, as discussed later in this section.

Whilst the technical design of cable infrastructure may fall short of achieving full access remedies as recommended in the regulatory framework under Market 3a, one can also note that cable regulation has so far been imposed in three countries only:

- In the Netherlands, resale of the analogue television streams has been imposed but the intervention of the Court has resulted in the decision being withdrawn.[16]

- In Denmark, cable is owned by the incumbent and has been regulated together with copper and fibre as services provided by a single SMP operator. However, with reference to the Danish market decision on Market 3b of 17 August 2017, all obligations on the SMP operator (TDC) related to the TDC's coaxial network are withdrawn and will no longer be in force as of 17 November 2017.[17]

- In Belgium, telecom and media regulators have jointly analysed the retail broadcast market, geographically segmented according to the footprints of the different cable operators. Cable operators were found to have SMP and consequently, they have been subject to wholesale broadcast remedies to address competition issues in the associated retail markets (sharing video channels by Simulcrypt[18] with possibility to add own channels) and imposed as an ancillary service access to broadband (bitstream) for interactive video and triple play. As a consequence, alternative operators cannot access only the wholesale broadband services[19].

[16] More recently, ACM commissioned a study into the current and future access options on fixed infrastructures, which reported that whereas wholesale Layer 3 bitstream access products are technically feasible, physically unbundled products are not likely to be technically feasible until at least 2025 (https://www.acm.nl/nl/publicaties/publicatie/17463/Onderzoek-toegang-tot-vaste--telecommunicatienetwerken).

[17] DBA's market decision is based on the fact that TDC has presented a commercial agreement that offers alternative operators access to TDC's coaxial network (data-only). DBA concluded the commercial agreement (significantly lower prices and better conditions for the alternative operators) is sufficient and adequate to ensure the alternative operator's access to this infrastructure. If the commercial agreement no longer offers these terms, DBA has the possibility to make a supplementary decision to this notified decision on Market 3b. This is due to the fact that the coax network is already part of the product market on Market 3b and TDC is already designated as SMP operator on the relevant market.

[18] Simulcrypt uses different encryptions on the same video signal to permit several operators to share this video signal with independent Control Access System to manage end-users of each operator (e.g. sharing of satellite transponders).

[19] The NRA proposed to remove this limitation in the forthcoming market review.

NRAs may seek to determine whether or not competition is impeded where an ECS incumbent and a cable operator both hold a strong market position. To this effect, they might reach a finding that the incumbent and the cable operator hold joint dominance in a wholesale market.

To reach a finding of joint dominance NRAs would need to make the case that due to tacit collusion of the operators' behaviour, there are existing, or likely to exist, retail competition problems in some oligopolistic/duopolistic markets in the absence of wholesale (access) regulation on Market 3a and/or 3b. This issue forms part of the wider ongoing debate on potential amendments to the regulatory framework and the SMP guidelines on how NRAs should be able to address uncompetitive oligopolies, especially as markets continue to shift toward oligopolistic market structures, e.g. in markets in which cable network operators have ubiquitous network infrastructure coverage at a national or a sub-national level. In this context, BEREC has discussed in its report[20] and position paper[21] regulatory options to deal with joint dominance as well as instances of unilateral market power. While both situations lead to non-effective competition, joint dominance is linked to markets where there is tacit collusion, whereas unilateral effects arise in (oligopolistic) markets in the absence of explicit collaboration (cartel behaviour) or of tacit collusion. NRAs may have to impose the relevant remedies to prevent competitive harm in oligopolistic markets. BEREC therefore considers that NRAs need appropriate regulatory tools to impose obligations on non-competitive oligopolistic markets, such as where cable operators may be required to offer a wholesale bitstream product or frequency unbundling (where technically feasible) to allow competitors to have access to their infrastructure.

In other circumstances, separated wholesale markets may be defined if the NRA – in a forward looking perspective and given the results of the retail markets assessment - finds insufficient substitutability between the ECS incumbent's and the cable operator's wholesale products. NRAs would then have to assess whether there is one or more companies having SMP in the wholesale markets as defined.

4.3.1 Potential implications on the Best Practices

BEREC is of the opinion that the review of the CPs should consider amending the BPs to address – at a high level – the possibility that some NRAs could impose wholesale remedies on cable operators found to have SMP – inspite of the difficulties described - though prescriptive BPs would not be appropriate. This may include, depending on national market cicumstances and following the proportionality principle:

- For Market 3a: Access to cable networks could be added as amongst the remedies available in Market 3a, in case it is considered to be an equivalent of a physical access such as VULA products (if they meet the conditions set by the EC) or in the form of frequency unbundling (with a proviso about the technical feasibility or capacity limitations of frequency unbundling).

[20] http://berec.europa.eu/eng/document_register/subject_matter/berec/reports/5581-berec-report-on-oligopoly-analysis-and-regulation
[21] http://berec.europa.eu/eng/document_register/subject_matter/berec/opinions/7029-berec-views-on-non-competitive-oligopolies-in-the-electronic-communications-code

- For Market 3b: A cable bitstream access product could be defined using the existing best practice principles. An additional BP addressing non-discrimination for cable accces could be useful.[22]

4.4 NGA roll-out and multiple sub-national networks

The regulatory framework, and the associated CPs were developed when most markets were characterised by having one dominant incumbent providing services over a legacy network. NGA roll-out by alternative operators using their own physical infrastructure might result in a different market structure with many regional network owners. This is already the case in some of the Nordic countries where there has been a rapid expansion of local networks by local and regional entities, such as municipality-owned corporate entities and electricity companies.[23]

4.4.1 Competition issues and regulatory challenges

NGA network deployment usually takes place on either a regional basis, or by starting in the most economically attractive dense urban areas, and then gradually spreading out to less economically attractive areas. This might give rise to many infrastructure owners with varying geographical distribution, sometimes as a patchwork of non-overlapping fibre networks. In markets with a high degree of FTTP deployment, the incumbent's copper network might be becoming increasingly obsolete and on the cusp of being phased out.

The replacement of a nationally defined market characterised by an incumbent with national (copper) coverage by many locally defined NGA geographic markets (in which the former incumbent's competitive position might vary markedly) could result in NRAs identifying multiple single SMP operators in many sub-national markets within its territory.

This might call for a simplified procedure for imposing remedies on multiple SMP operators in sub-national markets. This should continue to retain the rigour and legal certainty of the SMP framework but make the regulatory overhead for NRAs and operators more practicable and proportionate. The inherent diversity of market structures in these sub-national markets with varying degrees of NGA roll-out might require flexible and varied remedies. Tools to address potential competition problems such as access to fixed networks would not be different in character to those required in national markets but the level of regulatory prescription could vary. To this end, the task for NRAs in applying the SMP framework to many sub-national markets, that might be characterized by different degrees of competition at wholesale and retail markets, and in which the different operators may or may not be vertically integrated, could be more complex.

The BPs primarily focus on vertically integrated SMP operators with a presumed incentive based on their market power and in the absence of ex ante access remedies to deny access or raise rivals' costs in the downstream segment. In the case of wholesale-only operators, different competition issues might arise, but the inefficiencies arising from monopoly pricing power would still be present and the power to distort downstream competition (in the absence

[22] For example, it might be mentioned in BP12 that when an SMP operator imposes a fair use policy (such that it limits the amount of data one user can down- and/or upload in a given time frame to avoid congestion on shared access) on an access seeker's retail customers, the NRA should ensure the compliance of this measure with non-discrimination principles, i.e. there is no discrimination encompassing the terms of the fair use policy as it is applied to the customers of all downstream/retail CPs including the SMP operator's retail unit.

[23] In Sweden for example, there are around 180 municipal networks, which altogether are responsible for 60% of the existing broadband infrastructure, as well as a few private networks operating in several regions of the country.

of non-discrimination requirements) could result in adverse effects for consumer welfare. Therefore, in the context of wholesale-only operators, it may be necessary for NRAs to focus on querying if the operators, absent regulation, would offer the “right” access products at the “right” price, in a transparent way to the entire potential market.

A development towards more sub-national markets might also give rise to SMP operators which are considerably smaller and more geographically localised than the historic incumbent. This might pose additional questions as to both the nature and extent of remedies which would be most appropriate and proportionate to promote the COs put forward in the CPs.

4.4.2 Potential implications on the Best Practices

With the advent of sub-national markets and associated market structures, for example those characterised by many different SMP-operators and/or oligopolistic dynamics, NRAs might benefit from further guidance on which BPs might be most suitable given relevant aspects of market structures (e.g. wholesale-only or small regional operators). There might also be reasons to assess and provide guidance on whether, in certain circumstances, similar SMP remedies could be implemented on multiple SMP operators by NRAs using a simplified procedure. In the interests of proportionality for both NRAs and SMP operators, this could make it easier for downstream CPs wishing to buy access products in multiple sub-national markets.

In a market environment where multiple operators compete during the roll-out of NGA networks, information about the plans of incumbents might facilitate tacit collusion, and thus harm competition. For instance, requiring the SMP operator to inform competitors about ”the planning and status of network roll-out” (BoR (12) 127, BP 25) might induce anti-competitive market sharing. The CPs should state that NRAs consider the risk of collusion, if and when they put together the requirements for operators to share potentially strategically important information, and if necessary, require that such information cannot be used for non-operational purposes. The regulatory framework needs to continue to balance a mechanism that simplifies and incentivises cooperation for network investment while protecting/promoting competition.

The time for notice before decommissioning MDFs set out in Market 3a BP 40 is five years, a period that might seem disproportionate in markets where fibre roll-out is extensive and the importance of copper networks is steadily declining. On the other hand, a longer notice time might benefit competition, if the notice gives competitors a chance to plan projects of their own on a level playing field. We therefore suggest this BP merits review when the CPs are revised.

The imposition of SMP remedies in this type of market structure should also be assessed by considering the effect on the market of any imposed symmetric regulation, as well as any relevant non-SMP regulation e.g. BCRD (see below).

4.5 Duct and pole sharing developments

Civil works account for a significant proportion of the costs of NGA roll-out. Re-use of existing ducts and poles of incumbents can significantly reduce the costs of NGA roll-out for alternative operators. In some Member States, regulatory intervention governing duct and pole access (DPA) has been a major driving factor underpinning the success of NGA deployment.

4.5.1 Duct access and BCRD

The Market 3a CP proposes that NRAs should consider an obligation to set-up a database of all ducts of the operator(s) designated with SMP. Technical characteristics (e.g. duct profiles) and available capacity for the cable medium (e.g. fibre) should be considered to form part of any such database. As the deployment of additional network infrastructure requires a long-term view, providing information about future planned ducts (that enables competing operators to participate in deploying their own NGA infrastructure) is an appropriate requirement.

In light of the emergence of different market structures such as oligopolies or regional NGA service providers, NRAs should consider whether information requirements that will populate a database of planned and current duct availability and technical characteristics should be limited to just the SMP operator, or be extended to include other ECN providers.

The Broadband Cost Reduction Directive (BCRD) requires the relevant competent authority to make information available through a Single Information Point (SIP). The BCRD seeks to reduce the cost of high-speed broadband deployments by increasing transparency on, and enabling access to, existing physical infrastructure, including to non-ECN-infrastructure, deployable for high-speed broadband networks. NRAs consider the BCRD complementary to the existing (SMP) framework. Transposition into national law has taken place relatively recently or is still in progress. Its implementation was analysed in a separate BEREC report in 2017.[24]

It is possible to identify areas that could overlap between the infrastructure access remedies imposed under SMP regulation (and referenced in the CPs) and the obligations applicable under the transposition of the BCRD into national laws (although the transposition of elements of the regulatory framework and the BCRD may be included in the same legal statute).

However, there is a major difference between the two regimes. The BCRD creates a series of rights and obligations which it envisages will allow commecial negotiations to take place to assure access to infrastructure. The NRA's role is dispute resolution where disagreements take place, and there are tight time limits which apply to the resolution of any disputes which necessarily limit the degree of investigation that will take place.[25] SMP regulation is clearly different - it allows the NRA to put in place ex ante regulation to require a particular form of access to be provided and to specify the terms. So it is likely that SMP regulation allows an NRA to provide significantly more certainty about duct access than the BCRD does. More certainty may later be achieved under the BCRD through decisions on a series of disputes, but this will take time. In any case, the remedies imposed by some NRAs on SMP operators take a more stringent form than the remedies that the BCRD allows for. For example:

- Asymmetric SMP access remedies to physical infrastructures (ducts, poles), and in particular the time periods to provide the wholesale services and penalties (SLAs, SLGs), are specified in the regulated wholesale offers, but not directly in the BCRD;
- Asymmetric SMP remedies entail the supply of information regarding the infrastructures (e.g. location, type) - the duct database imposed by some NRAs on the SMP operator in Market 3a (referenced in the WLA CP) is likely to provide more

[24] BoR (17) 245.
[25] The BCRD provides member states with discretion as to define who and what is the national dispute settlement body; this can either be in the form of the NRA itself, or a separate competent body.

detailed information (e.g. regarding duct occupation and availability[26]) than the minimum information to be provided in the SIP[27] as required by the BCRD;

- The price of access to ducts and poles imposed by some NRAs on the SMP operator is frequently a cost-oriented price, while the BCRD foresees "*fair and reasonable terms and conditions, including price*"[28]. This does not exclude a cost-orientated price but a determination of what is reasonable could depend on the particular circumstances of the dispute;
- In practice, access prices and conditions stemming from the BCRD may only be determined through a dispute resolution mechanism presided over by the relevant competent authority, whereas they tend to be more prescriptive when their provenance is the regulatory framework. This is because there is likely to be a range of prices that could be reasonable, so it may be more difficult to set a specific charge under BCRD.

Notwithstanding its less prescriptive nature, it is recognized that the BCRD has a broader scope in terms of the entities covered because it addresses any ECN operator, irrespective of whether it holds SMP or not (and also non-ECN operators). In addition, the scope of physical infrastructure regulated in the BCRD is sometimes wider than in the wholesale offers; while the BCRD allows for access to physical infrastructure irrespective of its location[29], in some countries the SMP wholesale offers only provides access to physical infrastructure located in urban areas.

In this context, the BCRD brings into the fore new considerations when the CPs are updated. It is, however, noted that the SMP obligations are considered to provide access seekers with more certainty than the remedies permitted under the BCRD, and that the CPs are based on the SMP framework which prevails.

4.5.2 Pole access

The Market 3a CP refers to asymmetric access remedies to civil engineering infrastructures owned or managed by the SMP operator. It focuses mainly on duct access obligations. However, the rollout of networks by (mainly NGA) operators no longer occurs only in urban areas but increasingly in rural or (more) remote areas where access to poles could serve as a more cost-effective and easier way to deploy than duct access.

To reflect this, the relevant BPs in the WLA CP might be updated to explicitly mention potential remedies regarding pole access. In the absence of pole access regulation, the SMP operator in more remote areas will likely be the only operator with wholesale local access infrastructure.

[26] This information can give alternative operators the possibility to perform themselves the feasibility analysis of occupation of the infrastructures by their cables, without waiting for a response from the SMP operator.
[27] See article 4(1) of BCRD.
[28] Regarding this matter, following an NRA proposal to withdraw the duct access obligation because it considered that the transposition of BCRD would be sufficient, the European Commission noted the current regulatory obligations on access to ducts in such Member State do not include a price control obligation (only an obligation to provide access on reasonable terms). It thus invited this NRA to re-consider whether the lack of such an obligation gives consistent buy-or-build signals to alternative operators, given that cost-oriented duct prices are integrated in the price controls for other forms of regulated access to be imposed on the SMP operator, and whether access on reasonable terms to be negotiated case-by-case, without a requirement of a clear reference offer, will be sufficient to promote infrastructure competition, wherever economically efficient, through access to passive infrastructure.
[29] *"(14) With a view to improving the deployment of high-speed electronic communications networks in the internal market, this Directive should lay down rights for public communications network providers to access physical infrastructure irrespective of its location under fair and reasonable terms consistent with the normal exercise of property rights. The obligation to give access to the physical infrastructure should be without prejudice to the rights of the owner of the land or of the building in which the infrastructure is located".*

An adequate access offer could enable alternative operators to deploy their own networks and thereby compete on a sustainable basis in the retail market in these remote areas.

Wholesale access to poles can be given at a similar level of wholesale service provision as ducts, since in both cases these are infrastructures intended to support the installation of operators' cables – in the first case aerial and in the second case underground.

It could be appropriate and necessary to define some of the procedures specifically associated with access to poles. This might include referencing Equivalence of Inputs (EoI) in relation to pole access.

4.5.3 Potential implications on the Best Practices

Duct and pole access could be mentioned as possible access remedies on Market 3a (not just as products to reach the access point as it is currently the case, see BPs 9,12 and 28). This might include referencing EoI for pole access.

The CPs might also be revisited to take into consideration possible implications stemming from the BCRD. However, the CPs continue to be based on the SMP framework, including the additional requirements on duct and pole access which NRAs can apply in this regard.

4.6 Market 4 developments

In recent years, there have been several market developments that may have an impact on the remedies described in the CP for Market 4[30].

The EC has described Market 4 as *"Wholesale high-quality access provided at a fixed location"* (WHQAFL). Operators are using Market 4 based wholesale access for delivering high-quality broadband access to business end-users and to connect nodes in their own networks.

The most relevant developments are:

1) IP routers with Ethernet interfaces are replacing ATM switches in operators' networks.
2) Operators are gradually phasing out legacy transmission services, including traditional analogue leased lines and TDM-based leased lines.
3) Fibre – instead of copper – is gradually becoming the main medium for delivering high quality wholesale access (WHQAFL) services to business end-users.
4) Growth in demand for high capacity mobile backhaul services.

4.6.1 The phasing out of legacy services

An important relevant development in the last few years is the replacement of ATM switches by IP routers with Ethernet interfaces in networks. Another relevant development is the gradual phasing out of traditional analogue leased lines and TDM-based leased lines. These legacy services are reaching the final phase of their life cycle and are being replaced by new services, like Dense Wavelength Division Multiplexing (DWDM), Dark Fibre, etc.

[30] BoR (12) 126

The phasing out of a technology can have a major impact on the (regulated) wholesale products that are being offered on the market. However, within the current CP on Market 4, BEREC is taking account of the remedies on the objective "*assurance of efficient migration processes from legacy to new NGA/NGN network"* to deal with phasing out issues. Therefore, this report finds that the current CP on Market 4 already includes remedies to address the phasing out of legacy services and we have not identified any necessary changes.

4.6.2 Fibre as the main carrier for delivering WHQAFL

Fibre is gradually becoming the main carrier for delivering WHQAFL services to end-users at the expense of copper based WHQAFL services. The technical characteristics of a fibre line exceeds that of a copper line (lower latency, greater reliability, higher broadband speeds, etc.). Business end-users are more often requiring higher quality (and higher bandwidth) services from operators for the delivery of high quality broadband services. Therefore, it is logical that fibre is becoming the main carrier for WHQAFL services due to its superior technical characteristics. Finally, when a provider uses wholesale inputs based on Market 4 as connectivity components in its own network, as distinct from use of wholesale inputs to make direct connections to end users' premises, it is more likely than not that fibre will be the preferred medium.

However, this market development will not require changes to the BP remedies in the CP on market 4 as it is already taken into account.

4.6.3 Growth in demand for mobile backhaul services

BEREC acknowledges the increasing importance of high capacity backhaul infrastructure due to the growth of data traffic in both fixed and mobile networks. In fixed networks, having reliable high capacity fibre backhaul infrastructure in place continues to be vital for operators to fulfil the increasing requirements of end users with regard to speed and quality. Fixed backhaul infrastructure is also of paramount importance in a mobile context. Other than the wireless radio access connecting end-users' devices to base stations, cellular networks increasingly rely on fixed infrastructure for backhaul and transit purposes. Mobile backhaul is therefore increasingly overlapping with both fixed access and backhaul, creating the potential for greater synergies between mobile and fixed backhaul implementation.

The need for fibre line mobile backhaul becomes particularly relevant in the context of the development of new and smaller cell mobile wireless access technologies, such as 5G. Some 5G-enabled services will have very large bandwidth requirements and will require lower latency than current mobile technologies. With shorter transmission ranges, 5G will also result in greater cell densification and consequently an increased number of backhaul links connecting those base stations to the core network. BEREC's medium-term strategy is to continue to assess the need for further NRA guidance regarding fibre backhaul for mobile in the context of 5G.[31]

The BEREC report[32] on fixed mobile convergence points to different regulatory solutions being employed at the current stage. To date, no NRA has opted for the definition of a separate

[31] See BoR (17) 175 BEREC Strategy 2018-2020
http://berec.europa.eu/eng/document_register/subject_matter/berec/annual_work_programmes/7310-berec-strategy-2018-2020
[32] BoR (17) 187 BEREC Report on the convergence of fixed and mobile networks.

market for (mobile) backhaul. NRAs have often chosen to extend relevant remedies – initially imposed on (fixed) Markets 3a/3b and 4 – by making them also applicable for mobile purposes (e.g. access to terminating segments of leased lines, access to ducts, access to dark fibre or LLU access). The CPs already make reference to these remedies, but any review of the CPs should consider if any revisions to the BPs are needed, in light of this market development.

4.7 Conclusions

In summary, this chapter on market developments suggests a revision of the CPs may include the following changes:

- Cable regulation – Referencing the possibility of cable access regulation in the CPs on Markets 3a and 3b, including a new BP addressing non-discrimination with regard to cable access in the CP on Market 3b (Market 3a: CO1; Market 3b: CO1, CO3);
- Duct and pole access – DPA could be expanded as possible access remedies on Market 3a (not just as products to reach the access point), possibly including EoI for pole access. Any revision might also take into consideration possible implications of the BCRD, but the CPs continue to be based on the SMP framework, including additional requirements on SMP operators which NRAs can impose in this regard (Market 3a: CO1, CO3, CO5);
- Sub-national markets – To address sub-national markets characterised by a high number of local SMP operators the CPs on Markets 3a and 3b could reference that remedies may vary according to the capabilities and resources of the relevant operators, while continuing to adhere to the principles of proportionality. A simplified procedure for imposing remedies may also be appropriate. (Introductions to CPs on Markets 3a and 3b);
- When stipulating information sharing requirements, NRAs might consider the risk of tacit collusion (Market 3a, 3b and 4: CO4);
- The BPs referencing the notice period for decommissioning legacy networks might be made more flexible to take account of competition and consumer needs in the relevant markets (Market 3a: CO9).

Table 3: Overview of possible changes to the CPs in light of market developments (sections where more substantive changes may be required are highlighted in bold).

Competition objectives	**Market 3a**	**Market 3b**	**Market 4**
Introduction	**Yes**	**Yes**	
Assurance of access	**Yes**	**Yes**	
Assurance of co-location at delivery/access point & other associated facilities			
Level playing field	Yes	Yes	

Avoidance of unjustified first mover advantage	Yes	Yes	Yes
Transparency	Yes		
Reasonable quality of access products – technical issues			
Reasonable quality of access products – operational aspects			
Assurance of efficient and convenient wholesale switching			
Assurance of efficient migration processes from legacy to NGN/NGA network	Yes		
Fair and coherent access pricing			

5 Technological developments

5.1 Background

This section analyses the need to adapt the CPs due to the following technological developments (in order of importance and impact of the need to update the CPs) since the publication of the CPs at the end of 2012:

- Layer 2 wholesale access products;
- Vectoring;
- Wavelength unbundling;
- Migration from traditional leased lines to Ethernet services;
- Migration of the traditional voice telephony network to an NGN; and
- Software-Defined Networking (SDN) and Network Functions Virtualisation (NFV).

Annex 1 provides a short description of these technological developments.

The migration of the traditional voice telephony network to NGN and SDN/NFV may not typically have an impact on the review of the CPs on Market 3a, 3b and 4.

5.2 Competition Objectives

5.2.1 Assurance of access

WLA market

The CP on Market 3a describes the access products which NRAs should consider imposing on Market 3a in BPs 5-8. It may be necessary to update these BPs in order to take into account the technological developments, in particular the following information:

- The conditions for the imposition of Layer 2 wholesale access products on Market 3a which are defined in Common Position 1 of the BEREC Common Position on Layer 2 wholesale access products.[33]
- The use of vectoring (VDSL2 vectoring, G.fast) on copper-based subscriber access lines and its impact on sub-loop and/or full-loop unbundling.[34]
- The possibility of wavelength unbundling based on the new PON standard “NG-PON2” which was standardised by the ITU-T (G.989.2) at the end of 2014.

Due to the above mentioned technological developments it may be necessary to restructure the sub-section “access products at specific access points” as follows and to include in these topics the information described below:

- Physical unbundling of local (sub-)loop;
  - Fibre unbundling;
  - Copper unbundling;
- The use of vectoring and its impact on physical unbundling;
- Wavelength unbundling;

[33] BoR (16) 162, p. 6.
[34] BoR (14) 122.

- Layer 2 wholesale access products.

Physical unbundling of local (sub) loop

BP6 and BP7 describe physical unbundling of fibre (BP6) and copper (BP7) and there may be the need to adapt these BPs in order to align them with the changes occurring due to vectoring, wavelength unbundling and L2 wholesale access products. For example, with regard to physical unbundling of copper loops at the MDF (BP7a) it may be necessary to amend the wording of this remedy from "NRAs should impose unbundled access…" to "NRAs should consider imposing" because, for example, vectoring (see below) and national circumstances may mean other remedies are more appropriate.

The use of vectoring (VDSL2 vectoring[35], G.fast) and its impact on physical unbundling

A new BP may be needed in order to cover "vectoring", which, in outline, might set out:

1) That NRAs may consider enabling an operator to use vectoring exclusively or to enable multi-operator vectoring and
2) Which aspects, in case of an exclusive use of vectoring, the NRAs should consider.

The latter may include:[36]

- whether a single operator is enabled to use vectoring exclusively on the sub-loop or maybe also on the full loop (subject that vectoring is implemented on the last mile);
- whether both the SMP operator and alternative network operators can use vectoring exclusively (symmetric approach[37]) or whether this is only possible for the SMP operator (asymmetric approach);
- whether a single operator has the possibility to use the complete frequency spectrum on the (sub-)loop exclusively or only a part of the frequency spectrum;[38]
- whether the right is given to the SMP operator to refuse local (sub) loop unbundling (SLU/LLU) on a case-by-case basis (e.g. per street cabinet or central office) or whether the SLU/LLU obligation is entirely lifted on the national market;
- if a case-by-case approach applies, which conditions an SMP operator has to fulfil in order to be allowed to refuse SLU/LLU requests of alternative network operators (e.g. to offer a Layer 2 wholesale access product – Ethernet – as an alternative to physical unbundling);
- whether an SMP operator will also get the right to terminate existing SLU/LLU and which conditions it has to fulfil;
- whether the possibilities to use vectoring exclusively and the conditions which have to be fulfilled are the same for an alternative network operator as for the SMP operator or whether there are differences as well as the procedure used to allocate vectoring areas to alternative operators and the SMP operator.

[35] This includes vectoring in case of VDSL2 profile 35b (also known as "VPlus" and "SuperVector").
[36] These aspects were considered relevant in an analysis of regulatory decisions regarding vectoring in the EU. For a more detailed description see BoR (14) 122.
[37] On certain loops the SMP operator can use vectoring exclusively, on other loops an alternative network operator and on further loops a different alternative operator.
[38] E.g. above the ADSL2plus frequency spectrum of 2.2 MHz (frequency sharing).

Wavelength unbundling

A new BP may be needed in order to cover the topic "wavelength unbundling" which should describe that the NRAs may consider imposing wavelength unbundling in case of the possibility of fibre unbundling does not exist and where the SMP operator has an FTTH network based on passive optical networks, particularly if it deploys NG-PON2.[39]

Layer 2 wholesale access products

A new BP may be needed in order to cover the topic "Layer 2 wholesale access products" (Ethernet) which might describe that NRAs should impose a Layer 2 wholesale access product on Market 3a in accordance with the Common Position 1 of the BEREC Common position on Layer 2 wholesale access products.[40]

In the beginning of the sub-section "access products at specific access points" (1st and 2nd paragraph), minor changes may be necessary in order to align this text with the changes proposed above.

CP on Market 3b

It may not be necessary to change the section "assurance of access" in the CP on Market 3b since it is already in line with the BEREC CP on Layer 2 wholesale access products. According to this CP, whether the imposition of a Layer 2 access product (with regional/national PoH) in Market 3b is appropriate and preferable to other forms of access, such as a Layer 3 access product (IP), highly depends on national circumstances such as the demand of alternative operators, the existence and use of a Layer 3 access product, whether a Layer 2 access product is imposed on Market 3a, etc.[41] The CP on Market 3b already covers Layer 2 wholesale access products and also Layer 3 wholesale access products (see BP2) and foresees, similarly to the BEREC CP on Layer 2 wholesale access products, that whether NRAs should impose bitstream access products based on Layer 3 or Layer 2 depends on the extent to which this is reasonable and relevant (see BP5).

CP on Market 4

The CP on Market 4 uses in the section "assurance of access" the term "wholesale leased line" and it may be appropriate to update this term to the EC's 2014 Recommendation terminology. Moreover, it could include a new BP which describes that:

- different types of access products may be imposed on Market 4 depending on the market situation; and
- to list examples of access products such as wholesale leased lines with traditional or Ethernet interfaces, and high quality Ethernet bitstream products.

[39] Or another PON technology which may become available in the future and enables wavelength unbundling.
[40] BoR (16) 162, p. 6
[41] See BoR (16) 162, section 2.2, p. 6

5.2.2 Reasonable quality of access product – technical issues

CP on Market 3a

The CP on Market 3a provides in the section “reasonable quality of access product – technical issues” information about the characteristics of the access product which should be available to the alternative operators (BP30, BP31) and it may be necessary to extend this information and also include:

- In case wavelength unbundling is imposed on the SMP operator, information about the characteristics of this access product (e.g. the wavelengths available for alternative operators).
- In case a Layer 2 wholesale access product is imposed on the SMP operator, the information that:
  - The characteristics of the Layer 2 wholesale access product depend on specific national circumstances (as, for example, the demand of retail customers of alternative operators and the technical capabilities in the network of the SMP operator) and therefore may vary between Member States.
  - The technical characteristics of the Layer 2 wholesale access product should fulfil the Common Positions 3 to 12 of the BEREC Common position on Layer 2 wholesale access products (BoR (16) 162).

CP on Market 3b

The CP on Market 3b lists product characteristics and requires that the access product should have some or all of these characteristics (BP24) in the section “reasonable quality of access product – technical issues”. It may be necessary to include also the following information:

- In case a Layer 2 wholesale access product is imposed on the SMP operator, the technical characteristics of the Layer 2 wholesale access product should fulfil the Common Positions 3 to 12 of the BEREC Common position on Layer 2 wholesale access products (BoR (16) 162).

CP on Market 4

The technological developments may not require changes in the section “reasonable quality of access product – technical issues” in the CP on Market 4.

5.2.3 Fair and coherent access pricing

CPs on Market 3a and 3b

It may be necessary to include in this section the information that, in case a Layer 2 wholesale access product is imposed on the SMP operator, the pricing of this product should fulfil the Common Positions 2 of the BEREC Common position on Layer 2 wholesale access products (BoR(16) 162).

CP on Market 4

The technological developments may not require changes in the section “fair and coherent access pricing” in the CP on Market 4.

5.3 Conclusions

The technological developments analysed may result in the need to update the following CPs: the CP on Market 3a due to Layer 2 wholesale access products, vectoring and wavelength unbundling, the CP on Market 3b due to Layer 2 wholesale access products and the CP on Market 4 due to the migration from traditional leased lines to Ethernet services. [42]

The following sections of the CPs are relevant: assurance of access (Market 3a, Market 4), reasonable quality of access product – technical issues (Market 3a, Market 3b) and fair and coherent access pricing (Market 3a, Market 3b).

Table 4: Overview of possible changes to the CPs in light of technological developments (sections where more substantive changes may be required are highlighted in bold).

Competition objectives	**Market 3a**	**Market 3b**	**Market 4**
Assurance of access	**Yes** (l, v, w)		Yes (e)
Assurance of co-location at the delivery/access point and other associated facilities			
Level playing field			
Avoidance of unjustified first mover advantage			
Transparency			
Reasonable quality of access product – technical issues	**Yes** (l, w)	**Yes (l)**	
Reasonable quality of access products – operational quality/aspects/issues			
Assurance of efficient and convenient wholesale switching			
Assurance of efficient migration processes from legacy to NGN/NGA network			

[42] According to the current draft BEREC work programme 2018, BEREC will examine in 2018 Layer 2 wholesale access products imposed on Market 4. Depending on the results of this project a further need to update the CP on Market 4 may arise (e.g. with regard the competitive objective “Reasonable quality of access product – technical issues”).

Fair and coherent access pricing	Yes (l)	Yes (l)	
Annex 1			

Legend: e … Ethernet service, l … Layer 2 wholesale access product, v … vectoring, w … wavelength unbundling
Source: BEREC

For a literature reference, please see Annex 2.

6 Developments in the common regulatory framework

6.1 Background

The aim of this section is to analyse the need to revise any of the CPs on Market 3a, 3b and 4 due to the following developments in the common regulatory framework, since the latest update of the CPs in 2012:

i) 2013 Commission Recommendation on consistent non-discrimination obligations and costing methodologies (hereinafter, the 2013 Recommendation);
ii) 2014 Commission Recommendation on relevant markets (hereinafter, the 2014 Recommendation);

In September 2016 the EC published its proposal for establishing the European Electronic Communications Code (EECC). The draft EECC proposes updates and amendments of the rules for the imposition and revision of regulatory obligations. It is unclear when the EECC will be finally adopted by the European legislature, though we expect it to occur in the first half of 2018. Taking into account the transition period it is unlikely that NRAs will have to apply the new legislation before the end of 2019/20. Therefore, BEREC consider it appropriate to analyse the impact of the proposed Code on the CPs only after the framework has been agreed and adopted by the European Parliament and the European Council, rather than in this report. We intend to then hold a workshop in the second half of 2018 to discuss and reflect on the potential impact of the framework on any further changes required to the BPs. The next step would be to update the CPs, and reflect possible changes in light of the EECC, in 2019.

BEREC notes that when reviewing BPs, the non-binding nature of the 2013 and 2014 Recommendations should be taken into account. We also note the 2013 Recommendation relates to the CPs for Markets 3a and 3b only.

6.2 Competition Objectives

6.2.1 Assurance of access

In accordance with the Explanatory Note that accompanies the 2014 Recommendation, there have been several technological developments, which impacted on the relevant markets defined in the 2007 Recommendation. For that reason, the 2014 Recommendation considers that it is necessary to re-assess the product characteristics and boundaries of the wholesale broadband access markets.

Market 3a

The 2014 Recommendation explains that access to a FTTH, FTTB or FTTC/VDSL (either point-to-point or point-to-multipoint) network should be considered as functionally equivalent to traditional copper LLU. In relation to DSL acceleration techniques, such as VDSL vectoring, the 2014 Recommendation determines that this ongoing technical development has the potential to impact both the identification of the relevant network access components used to provide broadband services and the delineation of the wholesale access markets thereof. Therefore, the 2014 Recommendaton says NRAs should include in the WLA market all access

products available at the physical layer in a point-to-point FTTH architecture, in a point-to-multipoint FTTH architecture or in FTTC/VDSL scenarios.

Moreover, in order to identify the boundaries of Market 3a, the 2014 Recommendation establishes that "from a forward-looking perspective and in view of the different patterns of CATV rollout and upgrade (e.g. to DOCSIS 3.1 networks) in the Union, NRAs should continue assessing the substitutability of CATV-based networks, with regards to a possible inclusion in the WLA market. Regarding the services provided over LTE, it cannot be ruled out that they could prove sufficiently substitutable to fixed wholesale local access services. However, it is questionable that this evolution will happen in the given timeframe".[43]

The current CP on Market 3a, within the best practices on "Assurance of access", already takes into account the scope for NRAs to encourage infrastructure competition over fibre architectures (e.g. FTTH/B and FTTC).

Regarding VDSL scenarios and CATV technologies (cable), according to the 2014 Recommendation and in the light of conclusions reached in chapter 4 (Market developments)[44], and chapter 5 (Technological developments)[45], related to cable technologies and vectoring (VDSL vectoring and G.fast) respectively, both VDSL scenarios ("Vectoring") and cable technologies could potentially be included in the BP "Assurance of access" as an access product in Market 3a, following a market analysis addressing national circumstances (so as not to repeat the analyses on technological and market developments, see pages 12 and 24-25).

On the other hand, in relation to access products at specific access points, physical unbundling is usually considered the preferred access remedy in Market 3a, as it ensures alternative operators' ability to differentiate and innovate their retail offers. Nevertheless, wherever fibre physical unbundling is not technically or economically feasible in Market 3a, NRAs have therefore been imposing virtual wholesale access products (VULA or Layer 2 WAP with local point of handover -PoH[46]), which can offer equivalent functionality to copper sub-loop unbundling, as a more proportionate remedy (without prejudice to future technological developments, which may allow physical unbundling under appropriate conditions).

In this regard, the 2014 Recommendation considers that any such non-physical or virtual wholesale access products should be presumed to be part of Market 3a, if the products fulfil the following conditions cumulatively: (i) access occurs locally; (ii) access is generic and provides access seekers with a service-agnostic transmission capacity uncontended in practice; and (iii) access seekers need to have sufficient control over the transmission network to consider such a product to be a functional substitute to LLU and to allow for product differentiation and innovation similar to LLU.

[43] Commission Staff Working Document: Explanatory Note accompanying the EC Recommendation on relevant product and service markets withing the electronic communications sector susceptible to ex ante regulation, p. 44 (https://ec.europa.eu/digital-single-market/en/news/explanatory-note-accompanying-commission-recommendation-relevant-product-and-service-markets).

[44] In relation to cable, chapter 4 points out that "*it could be added* on *with the proviso that frequency unbundling is feasible if sufficient free capacity exists".*

[45] "*A new BP may be needed in order to cover the topic "vectoring"* -VDSL2 vectoring- *(...)"*

[46] According with BoR (15) 33 *"Common characteristics of Layer 2 Wholesale access products in European Union"*.

The CP on Market 3a currently references best practice with regard to unbundled access to the copper loop and to the fibre loop in the case of FTTH. Consequently, according to the conclusion in chapter 5 in relation to this access product [47] and the 2014 Recommendation, we need to update the CP [BP1 to BP15d] in order to include virtual wholesale access products (VULA), in situations where fibre physical unbundling is not currently possible, or where the existence of sub-loop unbundling would not allow the realisation of benefits achieved by using vectoring technologies.

Market 3b

The 2014 Recommendation establishes that, "where several non-physical access products are offered along the value chain, the key characteristics of such non-physical or virtual access products should be assessed in order to draw clear boundaries between the WLA, the WCA, and the high-quality access market". In cases where NRAs decide that non-physical or virtual access products with an improved quality of service could be used as an input for the provision of retail products for non-residential customers (as long as these do not fall within the boundaries of the wholesale Market 4), this remedy could be included in Market 3b.

Furthermore, the 2014 Recommendation also foresees that, "given the upgrade of CATV networks to DOCSIS 3, which is expected to continue, it may become increasingly appropriate to include CATV bitstream in the relevant product market, especially when sub-national geographic markets have been defined".[48]

Regarding VULA (non-physical or virtual access products), following the conclusions reached in chapter 5 about this access product, it is not necessary to change best practices on "assurance of access" since it is in line with the BEREC Common position on Layer 2 wholesale access products. Regarding cable technologies, chapter 4 considers how the CPs in Markets 3a and 3b might be updated to address the possible imposition of remedies on cable operators with SMP.

Market 4

A range of wholesale local access products have been used to provide mass market (i.e. retail) services to residential and non-residential customers. Retail high-quality services are normally provided over leased lines using copper-based or fibre-based connections, because business customers demand a high quality of service in terms of dedicated capacity, symmetric bandwidth and other service level agreements (including for example a guaranteed time to repair). Retail services demanded by the mass-market (e.g. broadband access) at fixed locations are provided through of a variety of wholesale unbundled and broadband access products (e.g. Cooper-based DSL networks LLU and SLU or bitstream services and fibre networks FTTC, FTTB or FTTH).

However, the 2014 Recommendation considers that some businesses customers could find their needs satisfied with standardized services (bundles) or would occasionally benefit from

[47] *"A new BP may be needed in orden to cover the topic "Layer 2 wholesale access products" which should describe that NRA should impose a Layer 2 wholesale access products on market 3a in accordance with the Common Position 1 of the BEREC Common Position on Layer 2 wholesale access products (BoR (16) 162,p.6)".*

[48] Commission Staff Working Document: Explanatory Note accompanying the EC Recommendation on relevant product and service markets withing the electronic communications sector susceptible to ex ante regulation, p. 46 (https://ec.europa.eu/digital-single-market/en/news/explanatory-note-accompanying-commission-recommendation-relevant-product-and-service-markets).

a high-quality product with mass-market offerings. The products we find at both ends of the chain belong to the same market, as they are both constrained by the same product. For that reason, each NRA would have to specify whether in their respective Member State the high-quality retail market is a market for bundles and identify the services of which it consists.

In addition, NRAs need to ensure that alternative operators are able to offer bundled services at retail level by having access at the wholesale level to all kinds of relevant inputs, such as traditional interface leased lines, Ethernet-based leased lines and broadband access products, which fulfil certain quality characteristics and may differ, according to the level of service, bandwidth and other characteristics.

The current CP on Market 4 already foresees, in general terms, that NRAs should impose the appropriate and proportionate combination of access products that properly reflect their national circumstances (BP 1), so it may not be necessary to amend the referred CP in this respect. Nevertheless, BP 1 only refers to the provision of wholesale leased lines (terminating segments), as assurance of access.

In accordance with the 2014 Recommendation and the conclusions of chapter 5 about the objective "assurance of access" provided for in the CP on Market 4, other types of access products not supported by terminating segments of leased lines should be considered for inclusion in a revised CP on Market 4 [BP1 to BP6]. For example, access to bitstream for business customers, which is not included in Market 3b (e.g. in Market 4, Spain (CNMC) has already required Telefónica, as the SMP operator, to provide to other operators with reasonable access to high quality bitstream service for business customers).

6.2.2 Level playing field

The 2013 Recommendation highlights the importance to ensure "*true equivalence of access by strictly applying non-discrimination obligations and employing effective means to monitor and enforce compliance*".

It may be necessary to update the BPs on level playing field in order to take into account the principles set out in the 2013 Recommendation, in particular with regard to the following information:

- Ensuring equivalence of access to prevent non-price related discriminatory behaviour;
- Ensuring technical replicability of the retail offer of the SMP operator on the basis of the regulated wholesale access products

Since the 2013 Recommendation aims to achieve effective non-discrimination, it defines guidelines to implement an equivalence of input (EoI) model, "*which ensures a level playing field between the SMP operator's downstream businesses […] and third-party access seekers*".[49] In particular, through the recommended model, NRAs should prevent non-price related discriminatory behaviour by a vertically integrated operator with SMP in Markets 3a and 3b.

In light of these guideliens, the BPs on equivalence of access may merit review, but should continue to allow each NRA to adopt the equivalence of access model which it considers as

[49] § 7-10 of the 2013 Recommendation (pp. 23-24).

being the more appropriate in achieving the level playing field objective, taking into account national specificities.

CP on Market 3a

Phases 1, 2 and 3 of the monitoring exercise have shown that NRAs adopt different approaches to achieve effective non-discrimination on non-pricing issues through the implementation of an equivalent access model.

The BPs on level playing field that are impacted by the 2013 Recommendation may need to be updated. BP17 and BP18 address general non-discrimination remedies while BP19, which refers to a general best practice on equivalence, may need to be further elaborated to take into consideration the 2013 Recommendation, to minimize opportunities for discrimination.

CP on Market 3b

The monitoring exercises have shown that NRAs have adopted different approaches to ensure a level playing field between the SMP operator's downstream business and a third-party access seeker. The 2013 Recommendation might be reflected in amendments to BP13, which also refers to a general best practice on equivalence.

6.2.3 Avoidance of unjustified first mover advantage

In order to remedy competition issues that may arise when SMP operators have an incentive to discriminate in favour of their own downstream arms, the CPs on Markets 3a, 3b and 4 suggest that unjustified first mover advantage should be resolved through, *inter alia*, the implementation of a regime which ensures the (technical and economic) replicability of the new downstream services introduced by SMP players.

With regard to technical replicability, the 2013 Recommendation states that – irrespective of the exact equivalence model imposed by the NRA – NRAs should ensure that alternative access seekers can technically replicate the retail offer of the SMP operator on the basis of the regulated wholesale input which access seekers receive. Specifically, paragraph 11 states that "*NRAs should require SMP operators subject to a non-discrimination obligation to provide access seekers with regulated wholesale inputs that allow the access seeker to effectively replicate technically new retail offers of the downstream retail arm of the SMP operator, in particular where EoI is not fully implemented*".

This aspect of the 2013 Recommendation might be reflected in the CPs on Markets 3a and 3b, for example, by including the following:

- SMP operators should provide third party operators with regulated wholesale inputs that allow them to effectively replicate technically new retail offers of the downstream retail arm of the SMP operator;
- Internal and alternative operators should have access to the same technical and commercial information regarding the relevant regulated wholesale input. The relevant information should be provided in accordance with lead-times defined on a case-by-case basis;
- When assessing the technical replicability of the SMP operator's new retail offer, the NRA should take into account:
    i) whether the corresponding wholesale input(s) for ordering, delivery and repair are made available at a reasonable period before the SMP operator

(or its downstream retail arm) launches its own corresponding retail service; and,

ii) the availability of corresponding SLAs and KPIs;

- NRAs should specify a technical replicability procedure in case the test is carried out by either the SMP operator or the NRA;
- If technical replicability of the new retail offer is not ensured, NRAs should require the SMP operator to amend the relevant regulated wholesale input(s) in a way that ensures technical replicability;
- If a retail offer, which is not technically replicable, would result in significant harm to competition, the NRAs should require the SMP operator to cease or delay the provision of the relevant retail offer pending compliance with the requirement of technical replicability.

Economic replicability, as intended by the 2013 Recommendation, does not impact the competition objective of "Avoidance of unjustified first mover advantage". Ensuring economic replicability is seen as a safeguard to non-discrimination when NRAs consider relaxing price regulation of wholesale NGA-based access products.

In fact, the 2013 Recommendation allows a certain degree of pricing flexibility to promote efficient investment and innovation and recommends that NRAs implement an economic replicability test under certain conditions. Thus, the relevant best practices to reflect economic replicability are those on fair and coherent access pricing.

Market 3a

The best practices on technical replicability [BP21 to BP25] may need to be updated, specifying when an NRA is expected to carry out a technical replicability test to reflect the 2013 Recommendation in relation to ensuring that new retail offers of the downstream retail arm of the SMP operator can be technically replicated.

Market 3b

To the same end, best practices [BP15 to BP20], which address the unjustified first mover advantage competition issue in Market 3b, may need to be reviewed in order to take into account information contained in the 2013 Recommendation with regard to technical replicability of new retail offers of the downstream retail arm of the SMP operator.

6.2.4 Reasonable quality of access products – operational quality/aspects/issues

The section refers to the competition issue arising from SMP operators having an incentive to discriminate in favour of their own downstream operations in relation to the quality of wholesale access products.

The 2013 Recommendation considers that KPIs, SLA and SLGs should be used by NRAs in order to detect discriminatory behaviour with respect to the delivery and quality of the SMP operator's regulated wholesale access product in Markets 3a and 3b.

To take into consideration the 2013 Recommendation, NRAs are expected to use KPIs in order to monitor effective compliance with the non-discrimination obligation. The 2013 Recommendation set out the following conditions:

- NRAs should measure performance at least in relation to the key activities in the provisioning cycle, covering all its stages (*i.e.* the ordering process, the delivery or provision of the service, the quality of service including faults and fault repair times, and migration by access seekers between different regulated wholesale inputs);
- KPIs should also allow comparison between services provided internally to the downstream arm and externally to third operators;
- Where KPIs are agreed between SMP operator and alternative operators, they should be regularly updated and published;
- In case of non-compliance with KPIs, NRA should undertake measures in order to ensure compliance.

KPIs should be complemented by SLAs and SLGs. Imposing SLAs ensures that access seekers are provided with an agreed quality of service, whereas the use of corresponding SLGs acts as a deterrent against discriminatory behaviour. NRAs should be closely involved in the development of SLAs, for instance, by approving the SLAs developed by the SMP operator as part of a regulatory reference offer.

It may be necessary to assess whether and where the CPs on Markets 3a and 3b may need to be adjusted to include these topics in a general way.

Market 3a

Since the CPs currently suggest NRAs should impose generic requirements on SMP operators to provide KPIs, as a means of monitoring non-discrimination and compliance obligations, these BPs [BP34, BP34a and BP34b] might be updated to take into consideration the criteria set out in 2013 Recommendation.

Alongside KPIs, the section on reasonable quality of wholesale access products addresses BPs on SLAs [BP32 - BP32d] and on SLGs [BP33 - BP33d]. With specific regard to SLAs, the BPs may be further refined in order to assess consistency between KPIs and SLAs/SLGs.

Market 3b

Similarly, the BPs on KPIs [BP27 - BP27c], SLAs [BP27 - BP27c], and SLGs [BP27 - BP27c] might be updated to take into consideration the criteria set out in 2013 Recommendation.

6.2.5 Fair and coherent access pricing

The 2013 Recommendation recommends NRAs adopt a costing methodology that leads to cost oriented copper and NGA wholesale access price. Paragraphs 30-37 indicate that when "cost orientation" is imposed on legacy and NGA access services the costing methodology should follow a forward looking CCA BU-LRIC+ approach. However, NRAs may continue to apply the costing methodology that they used at the time of entry into force of the 2013 Recommendation beyond 31 December 2016, if it meets the general objectives of consistency, predictability and price stability during the migration from legacy network to NGA network, and satisfies certain criteria[50]. In addition, paragraph 42 indicates that in those

[50] The existing costing methodology can be confirmed if: *i*) it should reflect a gradual shift from copper network to an NGA network; *ii*) it should apply an asset valuation method that takes into account that certain civil infrastructure assets would not be replicated in the competitive process; *iii*) it should guarantee that copper network prices do not fluctuate significantly and therefore will remain stable over a long time period; *iv*) it should require only minimal modifications with respect to the costing methodology already in place.

Member States where at the time of entry into force of the 2013 Recommendation the monthly rental price for the full unbundled copper local loop falls within the identified price band (8-10 €)[51], NRAs were permitted to continue to apply the existing costing methodology until 31 December 2016; they may apply it beyond that date if it satisfies the above mentioned criteria in accordance with paragraph 40.

Moreover, a certain degree of pricing flexibility for NGA-based access products is allowed in order to promote efficient investment and innovation. Recital 49 specifies, *inter alia*, that pricing flexibility "*would allow SMP operators and access seekers to share some of the investment risk by differentiating wholesale access prices according to the access seekers' level of commitment*". Recital 49 furthermore points out that pricing flexibility (at the wholesale level) could, in particular, be warranted to allow operators to address current consumer demand uncertainties and foster penetration of take-up of very high capacity networks. Such pricing flexibility should be accompanied by stricter application of the non-discrimination obligation through: *i*) implementation of equivalence of access; *ii*) ensured technical replicability, *iii*) an economic replicability test.

With specific regard to the last criterion, in order to prevent excess pricing flexibility of the relevant NGA-based regulated wholesale access products, the 2013 Recommendation requires NRAs to put in place obligations to ensure economic replicability of SMP operators' retail offers and therefore prevent them from engaging in margin squeeze practices.

Market 3a

In light of the 2013 Recommendation, BPs concerning the risk that alternative operators in the market may face uncertainty as to the price of wholesale network access, may need to be reviewed [BP41-BP48]. Depending on the approaches adopted by NRAs, the BPs might take into account: *i*) the recommended costing methodology to set cost oriented access price, *ii*) eventual exception to the implementation of the recommended bottom-up long-run incremental costs plus (BU LRIC+).

Moreover, to take account of the 2013 Recommendation (which foresees under certain conditions, a degree of pricing flexibility of regulated wholesale access prices on NGA networks) and NRAs best practice, the BPs may need to be reviewed in the light of the recommended economic replicability test [BP51-BP55].

Market 3b

Similarly, with regard to Market 3b, the BPs may need to be updated to take into consideration paragraphs of the 2013 Recommendation concerning: *i*) the implementation of the costing methodology to set cost oriented wholesale access prices [BP37-BP39] and *ii*) certain degree of pricing flexibility to foster demand of very high speed of broadband services [BP44-BP47].

6.3 Conclusions

The table below gives an overview of the sections of these CPs that may need to be updated due to developments in the common regulatory framework.

[51] Recital 41 specifies that the correct application of the costing methodology proposed in the 2013 Recommendation is "*likely to lead to stable copper access prices and a Union average monthly rental access price for the full unbundled copper local loop within a band between EUR 8 and EUR 10 (net of all taxes) expressed in 2012 prices (the price band)*".

Table 5: Overview of possible changes to the CPs in light of developments in the common regulatory framework (sections where more substantive changes may be required are highlighted in bold).

Competition objectives	**Market 3a**	**Market 3b**	**Market 4**
Assurance of access	**Yes[1]**		**Yes[1]**
Assurance of co-location at the delivery/access point and other associated facilities			
Level playing field	Yes[2]	Yes[2]	
Avoidance of unjustified first mover advantage	**Yes[2]**	**Yes[2]**	
Transparency			
Reasonable quality of access product – technical issues			
Reasonable quality of access products – operational quality/aspects/issues	Yes[2]	Yes[2]	
Assurance of efficient and convenient wholesale switching			
Assurance of efficient migration processes from legacy to NGN/NGA network			
Fair and coherent access pricing	Yes[2]	Yes[2]	

Legend

1 - CPs should be reviewed in the light of the 2014 Recommendation on relevant markets

2 - CPs may be reviewed in the light of the 2013 Recommendation, depending on the approaches adopted by NRAs

7. Conclusions

The monitoring of the implementation of the CPs by BEREC in the last few years concluded that NRAs are following the broadest or high level best practices relating to each of the competition objectives. Differences in terms of the implementation are driven by the following factors:

(i) The state of competition in the market and changes in market structure;
(ii) The development of NGA;
(iii) The basis of competition (e.g. active or passive competition); and
(iv) NGA infrastructure adopted by the SMP operator and alternative operators (e.g. FTTC v FTTP).

BEREC's review of the **implementation reports** has found the CPs are generally fit-for-purpose in providing best practice guidance to NRAs on devising effective remedies to meet the competition objectives. While some individual BPs are not imposed by all NRAs, most BPs are imposed by most NRAs.

BEREC however considers that the following parts of the CPs require further attention and may need to be revised in due course:

- Assurance of access: The BPs could more explicitly acknowledge that active remedies can sometimes be disproportionate in markets where passive remedies (e.g. duct access) are in place (though the BPs should continue to make clear it is for NRAs to determine if active and/or passive remedies are suitable to their national circumstances). The CPs should also continue to recognise there may be Member States where access at a very deep level of the infrastructure is difficult to realize.
- Level playing field: The BPs could further highlight the availability of a range of remedies (including different degrees of functional separation, EoI, EoO and non-discrimination) in order to achieve the common competition objective of a level playing field.
- Avoidance of unjustified first mover advantage: Minor changes to these BPs could provide more guidance to NRAs on how they ensure alternative operators have the ability to influence the decisions of SMP operators.
- Transparency: Minor changes or clarifications to these BPs may be needed to increase the number of NRAs implementing them.
- Reasonable quality of access products – operational issues: There may be a case for reviewing the degree of prescription in this section given that many NRAs have not applied some of the relevant BPs (though it may be become relevant due to the emergence of new fibre products).
- Assurance of efficient and convenient wholesale switching: There may be a case for reducing the degree of prescription in this section given that many NRAs have not applied some of the relevant BPs (e.g. the requirements on bulk switching processes).
- Assurance of efficient migration process from legacy to NGN/NGA network: There may be a case for reducing the degree of prescription in this section of the CPs given that many NRAs have not applied some of the relevant BPs, though they may become more relevant in the next few years.

- Fair and coherent access pricing: Some of the BPs in this key section may merit revision, particularly those that relate to margin squeeze, NGA-based charge controls and volume discounts as many NRAs do not currently implement them.

The outcome of the analysis of **market developments** brings to the fore the following key proposals to update the CPs:

- Cable regulation: It is suggested to update the CPs on Markets 3a and 3b (CO1) to allow for the possibility that NRAs identify that (coax) cable can be one of the regulated technologies to which the existing best practices may apply.
- Countries with a high number of sub-national SMP operators: It is suggested to mention in the introductions to the CPs on Market 3a and 3b that regulation needs to be proportionate and that remedies may vary according to the capabilities and resources of the operators concerned. A simplified procedure for imposing remedies may also be appropriate.
- Duct and pole access: The CP on Market 3a (CO1, CO5) could be expanded to reference duct and pole access as possible access remedies (not just as products to reach the access point), including referencing EOI for pole access. We may also review the BP on the infrastructure database (CO5, BP28) in light of the BCRD, though the CPs should retain additional requirements on SMP operators.

Our analysis of **technological developments** suggests we may update the CPs as follows:

- Layer 2 wholesale access products: It is proposed to update the CPs on Market 3a (CO1, CO6, CO10) and Market 3b (CO6, CO10) and to include a reference to the BEREC Common Position on Layer 2 wholesale access products (BoR (16) 162) in order to take this BEREC document into account.
- Vectoring: The proposal is to update the CP on Market 3a (CO1) and include key findings at a general level of the BEREC report on vectoring (BoR (14) 122) and to refer to this BEREC document.
- Wavelength unbundling: It is suggested to update the CP on Market 3a (CO1, CO6) and include general results of the BEREC report on new forms of sharing PON (BoR (17) 182[52]) and also to refer to this BEREC document.
- Migration from traditional leased lines to Ethernet services: It is proposed to update the CP on Market 4 (CO1) and include the information that different types of access products may be imposed on the SMP operator and list examples of these access products.

The analysis of the developments in the common **regulatory framework** highlights the possibility of updating the CPs as follows:

- 2013 Recommendation on non-discrimination: It is proposed to consider updates to all three CPs in order to reflect the main elements of this Recommendation (EoI vs. EoO, technical replicability test, economic replicability test, etc.) and to include references to this Recommendation, taking account of NRA best practice.
- 2014 Recommendation on relevant markets: The names of the markets should be updated. As mentioned above (technological developments), it is proposed to update

[52] BoR (17) 182 New Forms of Sharing Passive Optical Networks Based on Wavelength Division Multiplexing.

the CP on Market 4 (CO1) and include the information that different types of access products may be imposed and also to update the CP on Market 3a (CO1) by referring to the BEREC Common position on Layer 2 wholesale access products (BoR (16) 162).

The draft of the European Electronic Communications Code (EECC) is not taken into account since it may still be subject to significant change.

With regard to the timing of the full review of the CPs, there seem to be three options:

(i) Updating the CPs in the close future (in 2018) without taking into account the EECC;
(ii) Holding a BEREC workshop in the second half of 2018 to reflect on any developments in the EECC. New rules of the EECC could then be taken into account as we revise the CPs in 2019. However, there would not yet be any best practice of NRAs with regard to them;
(iii) Updating the CPs after the EECC has been transposed in the Member States and a first round of market analysis has undertaken by NRAs. This would mean, however, delaying the update until 2023 or later.

In this context, option (ii) with a focus on the areas identified for updating the CPs in this report, looks the most practical approach in the circumstances. Not taking into account the EECC at all does not seem to be sufficiently future proof. An update which takes into account best practices of NRAs based on the implementation of the revised EECC, on the other hand, would only be possible after several years.

Hence, we plan to hold a BEREC workshop in H2 2018, after the EECC is finalised and ahead of conducting a possible review and revisions of the CPs in 2019.

The table below provides an overview of the potential revisions to the CPs that we have identified in light of this initial assessment. At this stage, these findings should not be interpreted as indicating any formal recommendation by BEREC on changes to the CPs.

Table 6: Overview of the possible changes proposed to the Common Positions

Key	
	No change needed
	Minor change/updating proposed
	More significant change proposed

Section (competitive objective)	**Implementation monitoring**			**Market developments** [53]			**Technological developments**			**Regulatory framework**		
	3a	**3b**	**4**	**3a**	**3b**	**4**	**3a**	**3b**	**4**	**3a**	**3b**	**4**
Assurance of access												

[53] The market developments chapter also recommends a change to the introduction of the CPs in Markets 3a and 3b.

Assurance of co-location at the delivery/access point and other associated facilities												
Level playing field												
Avoidance of unjustified first mover advantage												
Transparency												
Reasonable quality of access product – technical issues												
Reasonable quality of access products – operational aspects												
Assurance of efficient and convenient wholesale switching												
Assurance of efficient migration processes from legacy to NGN/NGA network												
Fair and coherent access pricing												

Annexes

8 Annex 1: Description of technological developments

8.1 Layer 2 wholesale access products

In recent years, several incumbent operators rolled out NGA networks in order to provide higher bandwidths to end-users. This leads to situations in which access to physical infrastructure was not considered sufficient to ensure effective competition at the retail level. Therefore, several NRAs have imposed access to (active) Layer 2 (Ethernet) wholesale access products as a remedy on the wholesale local access market (Market 3a/2014) and/or the wholesale broadband access market (Market 3b/2014). In some cases Layer 2 wholesale access products on the wholesale broadband access market were already imposed before the NGA rollout started.

From a regulatory perspective, the conditions under which Layer 2 wholesale access products should be imposed, the pricing of Layer 2 wholesale access products and the technical characteristics Layer 2 wholesale access products are of interest. BEREC defined a common position on these aspects which is based on common characteristics of Layer 2 wholesale access products identified in a previous piece of work.[54]

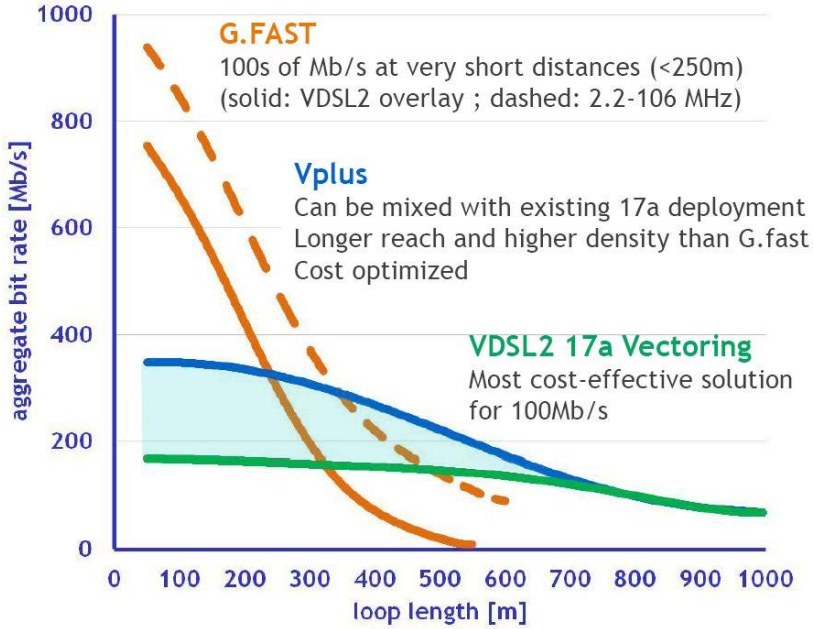
8.2 Vectoring

Vectoring is a technology standardised in 2010[55] used on VDSL2 subscriber access lines, which significantly increases the achievable bandwidths on copper lines and has been rolled out by operators in several EU Member States in the last few years. For several operators it is attractive that this significant increase of bandwidths can be achieved based on a further use of the existing copper access network infrastructure and therefore at relatively low costs compared to a full FTTP roll-out.

However, vectoring has also, at least from a regulatory point of view, a significant drawback. It is necessary that a vectoring system controls all VDSL2 lines of a cable (binder), otherwise the increase of bandwidth achieved with vectoring is reduced significantly. Therefore, several NRAs took regulatory decisions which enable a single operator to use vectoring exclusively on the subscriber access line. In principle, a multi-operator vectoring solution is also possible but currently it still has to overcome several challenges.[56]

In 2014 and 2015 two further technologies, G.fast and the new VDSL2 profile 35b (terms used by vendors are e.g. “Vplus” or “SuperVector”), which use vectoring were standardised. Figure 1 gives an overview of the achievable aggregate bandwidth of VDSL2 vectoring (profile 17a), Vplus (VDSL2 profile 35b with vectoring) and G.fast.[57]

[54] See BoR (16) 162 and BoR (15) 133
[55] ITU-T G.993.5 (April 2010)
[56] See BoR (14) 122
[57] The aggregate bandwidth is the sum of downstream and upstream bandwidth.



Source: Alcatel-Lucent (2015)

Figure 1: Achievable aggregate bandwidth of different technologies

8.3 Wavelength unbundling

At the end of 2014 a new standard of passive optical networks (NG-PON2) was standardised (ITU-T Rec. G. 989.2) which make it possible that several network operators can use the same fibre infrastructure and operate on top of it their own wavelength. Therefore, NG-PON2 allow to unbundle the fibre infrastructure of the SMP operator on the basis of wavelengths, i.e. wavelength unbundling. Wavelength unbundling is of interest from a regulatory perspective, since it provides alternative operators with more flexibility and freedom in the design of products compared to Layer 2 wholesale access products.[58]

8.4 Migration from traditional leased lines to Ethernet services

In recent years several network operators in Europe started to migrate their transport networks from SDH based networks to packet-based, typically Ethernet-based transport networks which has an impact on the demand for leased lines. Leased lines typically are used by alternative network operators to build their own network and by enterprises to communicate between different sites or with other companies. Due to the migration to Ethernet-based transport networks and the general trend to Ethernet interfaces alternative network operators and enterprises increasingly demand Ethernet services instead of leased lines with traditional interfaces (e.g. PDH, SDH)[59] and therefore the demand of the latter decreases considerably.

8.5 Migration of the traditional voice telephony network to an NGN

In recent years several operators in Europe started to migrate their networks to Next Generation Networks (NGN)/all-IP networks. This migration also typically includes the migration to Ethernet-based transport networks. A main driver for this is the fundamental

[58] See BoR (17) 182.
[59] E.g. E1 (2 Mbps), E3 (34 Mbps) or STM-1 (155 Mbps).

change of the traffic from previously being dominated by voice to meanwhile being dominated by data. Therefore, previously the voice telephony and transport networks were optimised for voice (i.e. circuit switching and the use of TDM) and to some extent also data was carried over these networks. Now the networks are optimised for data traffic (i.e. packet switching, Ethernet and IP) and voice is increasingly transported over these networks.

The migration of the traditional voice telephony network to an NGN replaces the traditional telephone exchanges (e.g. LEX) by IP-based voice platforms (e.g. IMS) and this migration may also have an impact on both boundaries of the network, the interconnection with other networks and the access to the network provided to the subscribers.

The interconnection for voice services may also be migrated to IP, since then no longer a conversion from TDM to IP is necessary and all voice traffic can stay completely on IP. Several operators therefore demand IP-based interconnection for voice services instead of TDM-based interconnection for voice services. If there is a mutual commercial interest, operators will migrate to IP-based interconnection for voice services on a voluntary basis. However, in other cases regulatory intervention may be necessary.[60]

The access networks also need to be migrated to IP and for this network operators have two options. Either the technology used on the subscriber access line is migrated (from POTS/ISDN) to IP (VoIP) or the traditional technologies (POTS/ISDN) are continued to be used on the subscriber access line and the conversion to IP is done in the multi-service access node at the central office.[61] Different migration strategies may be used by the network operators, issues during the migration phase may occur and the migration may have an impact on the voice services for the end-users as well as on the wholesale services offered by the network operator.[62]

8.6 SDN and NFV[63]

SDN and NFV aim to transform the way that network operators design and operate networks.[64] In the view of Arthur D. Little and Bell Labs, SDN and NFV could be as significant as the introduction of IP networks themselves.[65] It is also expected that future 5G mobile networks will heavily rely on SDN and NFV.

NFV transforms network architectures by evolving standard IT virtualisation technology to consolidate a large and increasing variety of purpose-built hardware appliances used in the networks today onto industry standard high volume servers, storage and switches and implements network functions in software. NFV transforms network operations because the software can dynamically be moved to, or instantiated in, various locations in the network as required, without the need for installation of new equipment.

SDN is a new architecture where network control is logically centralized (decoupling of control and data planes), directly programmable and the underlying network infrastructure is abstracted from the applications.

[60] See BoR (15) 196.
[61] In case of FTTC at the street cabinet and in case of FTTB in the building of the end-user.
[62] See BoR (16) 163.
[63] See BoR (16) 97.
[64] SDN and NFV are also possible in cable networks.
[65] See Athur D. Little, Bell Labs (2015).

SDN and NFV are highly complementary but not dependent on each other. Ultimately, NFV and SDN will become less distinguishable as independent topics, being subsumed into a unified software-based networking paradigm. Many possibilities exist for how to combine SDN and NFV and it needs to be seen which combination(s) will actually be implemented in networks.

However, to date SDN and NFV are still in their early days of development and deployment and far away from realising their full potential. Therefore, today there is no common view on solutions based on SDN and NFV that will be offered in the future. Future networks based on SDN and NFV depend, on the one hand, on the interests and objectives of the involved network operators, vendors and other partner organisations which together develop SDN and NFV and, on the other hand, what solutions they can find and are seen as appropriate by them. Currently, this is not foreseeable. As a consequence, it is rather unclear whether and to what extent the potential of SDN and NFV will be realized.

9 Annex 2: Literature for chapter 5

Alcatel-Lucent (2015): Exploring the boundaries of G.fast, presentation of Paul Spruyt at the Ultra-Fast Broadband Seminar, The Hague, 16.-19. June 2015

Arthur D. Little, Bell Labs (2015), Reshaping the future with NFV and SDN. The impact of new technologies on carriers and their networks, 2015
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10 Annex 3: Abbreviations

BoR	Board of Regulators
BP	Best Practice
CP	Common Position
FTTB	Fibre-To-The-Building
FTTC	Fibre-To-The-Cabinet
FTTH	Fibre-To-The-Home
FTTN	Fibre-To-The-Node
FTTP	Fibre-To-The-Premise
IMS	IP Multimedia Subsystem
IP	Internet Protocol
ISDN	Integrated Services Digital Network
LEX	Local Exchange
LLU	Local Loop Unbundling
MPoP	Metropolitan Point of Presence
NFV	Network Functions Virtualisation
NGN	Next Generation Network
NRA	National Regulatory Authority
OLT	Optical Line Termination
PoH	Point of Handover
PON	Passive Optical Network
POTS	Plain Old Telephone Service
P2P	Point-to-Point
P2MP	Point-to-Multipoint
SDN	Software-Defined Networking
SLA	Service Level Agreement
SLG	Service Level Guarantee
SLU	Sub-Loop Unbundling

SMP	Significant Market Power
TDM	Time Division Multiplexing
VDSL	Very high speed Digital Subscriber Line
VULA	Virtual Unbundled Local Access
WBA	Wholesale Broadband Access
WCA	Wholesale Central Access
WDM	Wavelength Division Multiplexing
WHQAFL	Wholesale High Quality Access at a Fixed Location
WLA	Wholesale Local Access