

Draft Report on a consistent approach to migration and copper switch-off

09 December 2021

Table of Contents

Executive Summary	3
1 Introduction and objective	5
2 Overview of the SMPOs' copper switch-off	6
2.1 General overview	7
2.2 The SMPOs' plans to switch off their copper network	8
2.3 The current status of the SMPOs' copper switch-off	10
3 Rules set by the NRAs for the migration process and copper switch-off	10
3.1 Type of procedure, level and scope of the rules	11
3.2 Stakeholder involvement	12
3.3 NGA rollout and notice period	13
3.4 Legacy copper-based wholesale access products	15
3.5 Alternative wholesale access products	17
3.6 Migration costs	19
3.7 Information of the SMPO and monitoring	20
3.8 Further rules	21
3.9 Permission to close MDFs	22
4 Further aspects of the migration process and copper switch-off	22
5 A consistent approach to migration and copper switch-off	23
5.1 Type of procedure	23
5.2 Level (granularity) of the rules	24
5.3 Scope of the rules	24
5.4 Stakeholder involvement	24
5.5 Notice period	25
5.6 Alternative wholesale access products	26
5.7 Legacy copper-based wholesale access products	27
5.8 Migration costs	27
5.9 Information of the SMPO and monitoring	28
5.10 Further rules	28
5.11 Permission to close MDFs	29
6 Conclusions	29
7 Abbreviations for countries	31
8 Further abbreviations	31
9 List of Figures	32

10	List of Tables	33
	Annex Basic data of the report (as of June 2021)	37
Annex 1:	Basic data used in section 2.....	37
Annex 2:	Basic data used in section 3.....	63
Annex 3:	Basic data used in section 4.....	123

Executive Summary

The requirements concerning the capabilities of electronic communications networks are constantly increasing and the response towards that demand is to bring optical fibre closer and closer to the end-user. Therefore, the importance of the copper-based access network decreases and NRAs are increasingly confronted with the situation wherein the SMP operator (SMPO) wants to decommission its legacy copper-based access network and to close related network elements e.g. main distribution frames (MDFs).

The objectives of this report are: (i) to provide an overview of the current status of the SMPOs' copper switch-off and the SMPOs' plans to switch off their copper network in the future; (ii) to analyse in detail the rules set by the NRAs for the migration process and copper switch-off; and (iii) to examine also further aspects of the migration process and copper switch-off (e.g. the SMPO's framework for migration and copper switch-off). Finally, the report aims to identify a consistent approach to migration and copper switch-off.

The report shows that in 20 of the 32 European countries where the NRA provided data the SMPO has already announced that it plans to switch-off its legacy copper access network (e.g. close MDFs), in 13 of them the SMPO has already closed copper-based network elements (e.g. MDFs) and in 17 countries the NRA has already set rules for the migration process and copper switch-off.

A consistent approach to migration and copper switch-off results from the detailed analysis of the rules set by the NRAs in these 17 countries as follows.

- Type of procedure: The NRAs typically set the rules for the migration process and the copper switch-off in a market analysis procedure.
- Level (granularity) of the rules: The level (e.g. MDF or street cabinet) of the rules set by the NRA typically depends on which copper switch-off the SMPO pursues (e.g. closure of street cabinets already before or only after MDF closure).
- Scope of the rules: The rules set by the NRA apply to the SMPO and to the geographic area where the NRA imposed access remedies on the SMPO (in accordance with Art. 81(1) EECC).
- Stakeholder involvement: NRAs normally involve the stakeholders by means of a public consultation of the draft measures according to Art 23(1) of the EECC. Depending on national law (transposition of Art. 31(1) of the EECC), stakeholders are also party in the (market analysis) procedure which sets the rules for the copper switch-off. In certain circumstances further stakeholder involvement is appropriate.
- Notice period: The notice period typically is 6 to 12 months in case alternative network operators (ANOs) do not use any SMPO's copper-based wholesale access product, 1 to 3 years in case ANOs use Virtual Unbundled Local Access (VULA) or bitstream (same point of handover after copper switch-off) and 2 to 3 years in case ANOs use copper-based Unbundled Local Loop (ULL), however, depending on national circumstances the notice periods may be shorter or longer. The notice period tends to the shorter values in case the alternative wholesale access products are already available for all end-users at the beginning of the notice period, the number of copper-

based wholesale access lines is already small and in case ANOs have already gained significant experiences with the forced migration to an alternative wholesale access product.

- Alternative wholesale access products: The fibre-based wholesale access products imposed on the SMPO as a “usual” remedy in a market analysis procedure are typically sufficient for the copper switch-off. Depending on national circumstances, however, copper switch-off specific alternative wholesale access products may also be necessary. The alternative wholesale access products imposed on the SMPO depend on the SMPO's infrastructure (e.g. ducts, FTTH point-to-point fibre) and, therefore, differ between countries. Alternative wholesale access products of other network operators are also available to some extent in some countries.
- Legacy copper-based wholesale access products: The legacy copper-based wholesale access products are normally also imposed on the SMPO in a market analysis procedure. Typically, the SMPO has to provide the legacy copper-based wholesale access products until the copper is switched off (e.g. MDF closure).
- Migration costs: The NRAs typically apply price regulation to the legacy copper-based wholesale access products and the alternative wholesale access products in a market analysis procedure. In many cases there is no need for further rules on the migration costs. However, in order to avoid competitive distortions further rules on migration costs could be useful under specific circumstances.
- Information of the SMPO and monitoring: Typically, the SMPO has to inform ANOs, and in many cases also the NRA, on the migration process and copper switch-off e.g. to provide a detailed copper switch-off plan. Whether NRAs also monitor the migration process and copper switch-off depends on national circumstances, however, in many countries this is the case. The need for monitoring may also arise from the transposition of Art. 81 (2) EEC.
- Further rules: In the market analysis procedure, the NRAs typically also impose obligations on the SMPO (i) to publish a reference offer for the alternative wholesale access products; (ii) to offer the alternative wholesale access products with key performance indicators (KPIs) and service level guarantees (SLGs); and also (iii) a non-discrimination obligation. Many NRAs did also set specific rules which ensure a smooth migration for the end-users, however, this depends on national circumstances. There was no need to set specific rules with regard to the impact of the copper switch-off on the universal service.
- Permission to close MDFs: The SMPOs have the possibility to close MDFs if the rules set by the NRA are fulfilled and normally they do not need any further explicit formal permission.

1 Introduction and objective

The requirements concerning the capabilities of electronic communications networks are constantly increasing and the response towards that demand is to bring optical fibre closer and closer to the end-user. Therefore, the importance of the copper-based access network decreases and NRAs are increasingly confronted with the situation wherein the SMP operator (SMPO) wants to decommission its legacy copper-based access network and to close related network elements e.g. main distribution frames (MDFs).

The European Electronic Communications Code (EECC)¹ and the European Commission's Recommendation on Next Generation Access (NGA) of 2010,² which is currently being reviewed by the European Commission, already foresee rules for the migration from legacy infrastructure and the decommissioning of the copper-based access networks. According to Art. 81 of the EECC, SMPOs must notify the NRA in advance and in a timely manner when they plan to decommission parts of the network. The NRA has to ensure that the decommissioning process includes a transparent timetable and conditions, including an appropriate notice period for transition and the NRA also has to establish the availability of alternative products of at least comparable quality if necessary to safeguard competition and the rights of end-users.

BEREC's Common Positions on best practices in remedies on Markets 3a/2014, 3b/2014 and 4/2014³ include best practices with regard to the competition objective "Assurance of efficient migration processes from legacy to NGN/NGA network." BEREC already held an internal workshop on "migration from legacy infrastructures to fibre-based networks" in 2019 to enable NRAs to share their experiences with the migration.⁴

The report is built upon the experiences shared in this BEREC internal workshop and based on data provided by the NRAs of 32 European (including all 27 EU) countries. The objectives are: (i) to provide an overview of the current status of the SMPOs' copper switch-off and the SMPOs' plans to switch off their copper network in the future; (ii) to analyse in detail the rules set by the NRAs for the migration process and copper switch-off; and (iii) to examine also further aspects of the migration process and copper switch-off (e.g. the SMPO's framework for migration and copper switch-off). Finally, the report aims to identify a consistent approach to migration and copper switch-off.

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

² Commission Recommendation of 20 September 2010 on regulated access to Next Generation Access Networks (2010/572/EU)

³ BoR (12) 126, BoR (12) 127, BoR (12) 128

⁴ EE, ES, IT, NO, PT, SE

The report considers the planned and systematic switch-off process of copper-based nodes (like MDFs or SCs) and both types of copper switch-off, which differ with regard to the extent to which the copper network is switched off.

- Full copper switch-off (full decommissioning of the copper network): The full copper local loop of the legacy copper access network (between MDF and end-user) is migrated to an alternative access network (e.g. FTTH). The MDF but also other copper-based network elements like street cabinets (incl. MSAN, DSLAM) and copper-based access nodes (e.g. DSLAM, DPU) in the buildings of the end-users are no longer used and closed. The end-users have to migrate to a new service (including new CPE⁵), not based on copper (e.g. based on fibre⁶).
- Partial copper switch-off (partial decommissioning of the copper network): Part of the copper local loop of the legacy copper access network is migrated to an alternative access network (e.g. FTTC, FTTB). The MDF and, depending on the alternative access network, also other copper-based network elements are no longer used and closed. For example, street cabinets are no longer used and closed in case of migration to FTTB but not in case of migration to FTTC. The end-users not necessarily have to migrate to a new service, since the last part of the subscriber access line is still based on copper.⁷

The SMPOs are in the process of migrating their legacy copper access network (copper between MDF and end-user) to NGA (e.g. FTTC, FTTB, FTTH) already since more than a decade. One individual end-user after the other (voluntarily) chooses a service based on NGA. However, such a migration of an individual copper access line is not in the scope of the report.

The document begins with an overview of the current status of the SMPOs' copper switch-off and the SMPOs' plans to switch off their copper network in the future (section 2) and then analyses the rules set by the NRAs for the migration process and copper switch-off (section 3). Following this, further aspects of the migration process and copper switch-off are examined (section 4). In the last step, based on the analyses in the previous sections an attempt is made to identify a consistent approach to migration and copper switch-off (section 5). The document ends with conclusions (section 6) and the data on which the analyses are based on are provided in the annex.

2 Overview of the SMPOs' copper switch-off

This section begins with a general overview of the SMPOs' copper switch-off (section 2.1) and then considers the SMPOs' plans to switch off their copper network (section 2.2) and the

⁵ Customer Premises Equipment

⁶ In case of migration to FTTH, the conversion from voice over IP (VoIP) to POTS/ISDN needs to be done at the customer premises or is not necessary when IP phones are used (see BoR (16 (163), p. 6-7).

⁷ The conversion from voice over IP (VoIP) to POTS/ISDN can be done either at the customer premises or in the multi-service access node (MSAN) or is not necessary when IP phones are used (see BoR (16 (163), p. 6-7).

current status of the SMPOs' copper switch-off (section 2.3). It is based on data (as of June 2021) of the NRAs of 32 European countries (see Annex 1, Table 1 to Table 26).

2.1 General overview

Figure 1 provides a general overview of the SMPOs' copper switch-off. In two (NL, RO) of the 32 European countries where the NRA answered the questionnaire, there is currently no SMPO.⁸ In 20 countries the SMPO has already announced that it plans to switch-off its legacy copper access network (e.g. close MDFs) and in 13 of them the SMPO has already closed copper-based network elements (e.g. MDFs). In the other 10 countries where the NRA filled in the questionnaire, the SMPO has not (yet) announced that it plans to switch-off its legacy copper access network. In 17 countries the NRA has already set rules (e.g. in market analysis procedure) for the migration process and copper switch-off.

Did the SMPO already announce/inform that it plans to switch-off its legacy copper access network e.g. close MDFs?	
YES	20 BE CH EE ES FI FR GR HU IE IT LI LU ME MT NO PL PT SE SI SK ^{*)}
NO	10 AT BG CY CZ DE DK HR KO LT LV
Did the SMPO already close copper-based network elements (e.g. MDFs) ?	
YES	13 BE CH EE ES FI LI LU MT NO PL PT SE SI
NO	17 AT BG CY CZ DE DK FR GR HR ^{**)} HU IE IT KO LT LV ME SK
Did the NRA already set rules (e.g. in market analysis procedure) for the migration process and copper switch-off (e.g. closure of MDFs)?	
YES	17 BE CY CZ EE ES FR GR HR HU IT LI ^{*)} LU NO PL PT SE SI
NO	13 AT BG CH DE DK FI IE KO LT LV ME MT SK

^{*)} Partially ^{**)} In 2013, one MDF was switched off, but as a part of a pilot project.

Note: No SMPO in NL and RO

Source: BEREC

Figure 1: Overview of the SMPOs' copper switch-off

⁸ In Romania, markets 3a/2014 and 3b/2014 were deregulated and in the Netherlands, a national court annulled NRA's analysis of markets 3a/2014 and 3b/2014 in 2020.

2.2 The SMPOs' plans to switch off their copper network

This sub-section examines the following aspects of the SMPOs' copper switch-off plans:

- which copper-based network elements the SMPO will close;
- when will the SMPO close how many MDFs;
- whether the SMPO will not only close MDFs but also MDF locations;
- whether the SMPO pursues a full or a partial copper switch-off; and
- why the SMPO will switch off its copper network.

Figure 2 provides an overview of the SMPO's copper switch-off plans. In 18 countries the SMPO plans to close MDFs, in 15 of them also street cabinets (SCs) and in 11 of these 18 countries also other copper-based network elements.

The SMPO plans to close the following copper-based network elements ^{*)}															
MDFs	18														
	BE	EE	ES	FR	FI	GR	HU	IE	IT	LI	LU	MT	NO	PL	PT
SCs	15														
	BE	EE	ES	FR	FI	GR	HU	IE	LU	MT	NO	PL	SE	SI	SK
Other	11 ^{**)}														
	ES	FI	IT	LI	LU	MT	NO	PL	SE	SI	SK				

*) No information in two (CH, ME) countries

**) No information in four (EE, GR, HU, IE) further countries

Source: BEREC

Figure 2: Overview of SMPOs' copper switch-off plans

Figure 3 provides an overview of the SMPOs' MDF closure plans of the countries where the SMPO has already established such plans. In five countries the SMP has already announced when it will close all MDFs. In Liechtenstein, the SMPO will close all MDFs by 2024, in Hungary by 2025, in Sweden by 2026 and in Portugal and in France by 2030. In seven other countries, the SMPO informed when it will close how many MDFs. In three of them (IT, NO, ES) the SMPO plans to close in the next years several thousand MDFs, in one country (SI) 200 MDFs and in the other three countries (BE, GR, LU) the SMPO informed on the closure of up to about 30 MDFs so far. In Finland several network operators have SMP, their MDF closure plans differ and three small SMPOs already switched fully to fibre.

The closure of an MDF means that the MDF (and therefore also the copper-based subscriber access lines which end at the MDF) no longer will be used. However, this does not necessarily mean that also the MDF location will be closed. In case the SMPO closes also the MDF location, not only the MDF is no longer used but nothing at the MDF location is further used. This means that other wholesale access services (or retail services) provided at/from this location are no longer possible. This can be the case if the complete building is being sold. In 13 countries (BE, ES, FI, IT, LI, LU, MT, NO, PL, PT, SE, SI, SK) of the 18 countries in which the SMPO plans to close MDFs the SMPO informed that it will not only close MDFs but also MDF locations. In three (BE, IT, SI) of them, the SMPO will also close the MDF location in the

case of all MDFs it will decommission, in five other countries (ES, LI, NO, PT, SK) at least in case of half of the MDFs it will shut down.

Country	When will the SMPO close how many MDFs?										Also MDF locations?
	2021	22	23	24	25	26	27	28	29	2030	
LI				All							Yes - 54%
HU	6	490	2		All						No information
SE						All					Yes
PT						360				All	Yes - majority
FR										All	No
IT ^{*)}			6,600								Yes - 100%
NO		170						4,000 ^{**)}			Yes - 67%
ES ^{***)}	1,010	2,252	2,329	2,909	3,042	3,044					Yes ^{****)}
SI						200					Yes - 100%
BE				27							Yes - 100%
GR				19							Not yet clear
LU				5	9						Yes
FI	Several SMPOs, their plans differ, three small SMPOs already switched fully to fibre										Yes

*) See footnote 186

**) By 2026 to 2028; depending on the migration plan, MDFs may be closed earlier, even before 2026.

***) Current cumulative number of committed switched-off MDFs. The numbers will increase when new MDFs are announced.

****) All except OLT and core network locations

Note: In five countries (EE, IE, MT, PL, SK) this information is not (yet) available.

Source: BEREC

Figure 3: SMPOs' MDF closure plans

In 14 countries (BE, ES, FR, GR, HU, IE, LI, LU, MT, NO, PT, SE, SI, SK) in which the SMPO plans to close MDFs, the SMPO pursues a full copper switch-off and the end-users are migrated from the full copper local loop of the legacy copper access network to an alternative access network. The end-users are primarily migrated to FTTH in 11 countries (BE,⁹ ES, FR, HU, IE, LI, MT, PT, LU, SI, SK), and primarily to FTTH and FWA in two countries (NO, SE). The end-users are migrated to some extent to mobile networks in four countries (NO, PT, SE, SI¹⁰), to FWA in three countries (ES, IT, SK), to HFC in two countries (ES,¹¹ HU), and in only few cases to FTTB and in-building coax in one country (LI).

In three countries (BE, GR,¹² IT), the SMPO pursues a partial copper switch-off. The end-users are primarily migrated to FTTC (IT) or FTTN VDSL2 (BE). In Poland the SMPO considers both a full and a partial copper switch-off depending on the location. In one country (EE) in which the SMPO plans to close MDFs, information on the type of copper switch-off the SMPO pursues is not (yet) available.

⁹ In Belgium, the SMPO plans both, a full and partial copper switch-off. In case of the full copper switch-off, the end-user will be migrated to FTTH and in case of the partial copper switch-off to FTTN VDSL2.

¹⁰ Very few end-users are migrated to mobile LTE

¹¹ Of alternative network operators

¹² In Greece, the SMPO pursue in some cases a full copper switch-off and in more cases a partial copper switch-off.

In one country (FI) there are several SMPOs and the type of copper switch-off pursued by the SMPOs differ. The three major SMPOs migrate to FTTB and cable in the larger cities and to mobile (4G, 5G and 5G FWA) in suburban areas and sparsely populated areas. Small local SMPOs migrate to FTTB/FTTH.

The main reason why the SMPOs switch off their copper-based access networks is cost reduction. It is not economically viable to keep both the copper-based access network and the next generation access networks. The copper network is becoming increasingly obsolete, has progressively fewer active end-users and, therefore, high maintenance costs per active end-user. In addition, the SMPO may sell assets (e.g. central sites buildings, copper cables) which generates income.¹³ The reasons why the SMPO migrates from the copper-based access network to next generation access networks are primarily the demand for high speed services and the modernisation of their access network.¹⁴

2.3 The current status of the SMPOs' copper switch-off

In the 13 countries in which the SMPO has already closed copper-based network elements (see Figure 1), the current status of the SMPOs' copper switch is as follows. In Estonia, 70% of copper exchanges were switched off at the end of 2018, according to WIK (the NRA does not collect this data).¹⁵ In Sweden, the SMPO has already closed 60% of its MDFs, in Spain 9%, in Norway 6%, in Belgium 5%, in Slovenia 3% and in Portugal 0.5%.¹⁶ The SMPO started the MDF closure in 2008 in Finland (Telia in 2008, other SMPOs in 2015), 2009 in Sweden, 2012 in Belgium, 2015 in Spain, 2016 in Norway and Slovenia, and 2019 in Portugal. In three countries (LI, LU, MT), the SMPO has not yet closed MDFs but street cabinets (LU, MT) and other copper-based network elements (LI, LU).¹⁷

3 Rules set by the NRAs for the migration process and copper switch-off

This section analyses the rules set by the NRAs for the migration process and copper switch-off based on the data (as of June 2021) in Annex 2 (Table 27 to Table 89) with regard to:

- type of procedure, level and scope of the rules;
- stakeholder involvement;

¹³ The copper switch-off may, however, entail decommissioning costs for the SMPO, and also a loss of wholesale revenues if the alternative network is rolled out by another operator.

¹⁴ Natural disasters which destroy the existing copper-based infrastructure may act as a catalyst for this migration (e.g. in Portugal, the 2017 tragic fires led to replacement of copper by optical fibre cables).

¹⁵ WIK Study "Copper switch-off – A European benchmark", March 2019,

https://www.ftthcouncil.eu/documents/Reports/2019/Copper_switch-off_analysis_12032019_short.pdf

¹⁶ In Finland and Poland, the SMPO(s) already closed MDFs, however, no information is available how many MDFs have already been closed.

¹⁷ In Switzerland, the SMPO has already begun with the copper switch-off several years ago and has already made progress. However, the NRA does not monitor the switch-off in detail.

- NGA rollout and notice period;
- copper-based wholesale access products;
- alternative wholesale access products;
- migration costs;
- information of the SMPO and monitoring;
- further rules; and
- permission to close MDFs.

Figure 1 shows that in 17 of the 32 countries where the NRA filled-in the questionnaire, the NRA has already set rules for the migration process and copper switch-off. In 10 of them (BE, EE, ES, LI, LU, NO, PL, PT, SE, SI), the SMPO plans to switch-off its legacy copper access network and it has also already closed copper-based network elements (e.g. MDFs). In four other countries (FR, GR, HU, IT), the SMPO also plans to switch-off its legacy copper access network, however, it has not yet closed copper-based network elements. In three countries (CY, CZ, HR), the SMPO does not (yet) plan to switch-off its legacy copper access network.

In five countries (CH, FI, IE, ME, MT) the NRA has not (yet) set rules for the migration process and copper switch-off although the SMPO has already announced that it will switch off its copper-based access network (CH, FI, IE, ME, MT) and the SMPO has also already closed copper-based network elements (CH, FI, MT).¹⁸

3.1 Type of procedure, level and scope of the rules

In 14 countries (BE, CY, CZ, EE, ES, FR, GR, HR, HU, IT, LU, PL, PT, SI) the NRA set the rules for the migration process and copper switch-off in a market analysis procedure as follows: in all of them on market 3a/2014, in seven of them (BE, CY, FR, HR, IT, LU, PL) also on market 3b/2014 and in two of them also on market 4/2014 (BE, FR). The decisions were taken in 2009 (modified 2016 and 2021) in Spain, 2011 (updated 2017) in Slovenia, 2016 in Greece, 2017 in Cyprus, Estonia, Hungary and Portugal, 2018 in Belgium (M3a, M3b) and Czech Republic, 2019 in Belgium (M4), Croatia, Italy, Luxembourg and Poland, and 2020 in France.

In one country (LI), the NRA set the rules in an approval of an amendment of the reference offer for copper access lines in 2018 and in another country (NO), the NRA set the rules in the 2020 decision “Obligation to maintain access to copper-based access networks” which amended the decisions in markets 3a/2014 and 3b/2014. In one further country (SE), a court of law decision set a rule (SMPO does not have to offer alternative access to its network e.g. based on fibre, FWA, etc.) in 2007 and a supervisory case overruled a rule set by NRA in

¹⁸ In Switzerland the legislature has not issued any rules for the copper switch-off and there are also no plans to introduce such rules. In Finland national law defined some rules that guide the NRA. In Montenegro the SMPO announced that it plans to switch off the copper network only very recently (May 2021). In Malta alternative network operators do not use local loop unbundling, carrier select/pre-select and/or wholesale line rental of the SMPO's copper network, nevertheless, the NRA is in communication with the SMPO.

market analysis on 3a/2014. SMPO has to inform ANOs only 18 months in advance, and not 5 years as foreseen by the NRA, for future copper dismantling plans.

The NRAs set the rules for the copper switch-off at the level (granularity) of the MDF in 11 countries (BE, CY, ES, FR, GR, HR, HU, IT, LU, PT, SI), also at the level of the street cabinet in seven countries (CY, ES, FR, GR, HU, LU, SI) and also at another, mostly still finer granularity in four countries (ES, FR, LU, SI) and in one country (LI) only at this finer granularity.¹⁹ In five countries (CZ, EE, NO, PL, SE), the copper switch-off rules apply to the entire copper access network and do not refer to a certain level as e.g. MDF or street cabinet.

In all 17 countries the NRA set the rules for the copper switch-off in the area where the incumbent (or another operator) has SMP and access remedies have been imposed on the SMPO, and not only in a part of this area or additionally also in other areas (where no network operator has SMP or no access obligations has been imposed on the SMPO).

3.2 Stakeholder involvement

In 16 of the 17 countries in which the NRA already set the rules for the migration process and copper switch-off the NRA involved the stakeholders. In 15 of them (not LI) the NRA held a public consultation, in three countries (ES, PT, SI) stakeholders were also party in the market analysis procedure which set the rules, in one country (IT) the NRA held also a technical forum with stakeholders before the market analysis, in two countries (FR, SE) in addition the NRA was in continuous dialog with stakeholders and in one other country (SI) the NRA involved stakeholders also with a dedicated questionnaire. In Liechtenstein the SMPO was party in the procedure for the approval of an amendment of the reference offer for copper access lines.²⁰ In Poland the NRA did not involve stakeholders when it set the rules.

The SMPOs expressed the following main concerns:

- in seven countries (ES, HR, HU, IT, NO, PT, SI) the SMPOs considered the notice period foreseen by the NRA as too long;
- in one country (NO) the SMPO also argued that the NRA does not have the legal basis to impose the proposed obligation;
- in one other country (ES), the SMPO was of the opinion that the proposed framework makes network migration difficult and requested an automatic extension if not all end-users are migrated in time;

¹⁹ In Spain the NRA set rules for the closure of copper terminal boxes on request, in Luxembourg for switching-off individual NTPs/addresses, in Slovenia for decommissioning copper lines when used by ANOs and in France for the closure of shared access points. In Liechtenstein the rules are set at the level of the building of the end-user and only implicitly (but not explicitly) at the level of the MDF i.e. the SMPO is allowed to close the MDF after the copper-based access lines of all buildings of the end-users which end at the MDF are no longer used.

²⁰ In Liechtenstein, the SMPO operates the passive network infrastructure (e.g. ducts, fibre) which is vertically separated from the service provision and it reached an agreement with the service providers (including the incumbent) on the copper switch-off (see section 4). The NRA approved the reference offer for copper access lines based on this agreement.

- in one country (FR) the SMPO similarly requested a straightforward procedure; and
- in one further country (CZ) the SMPO proposed that the notification period shall only apply to FTTH/B but not to FTTC.

The ANOs' main concerns and views were as follows:

- in five countries (BE, CY, CZ, ES, IT) ANOs considered the notice/notification period as too short, in one other country (NO) that the NRA shall not reduce it;²¹
- in four countries (GR, NO, SE, SI) ANOs were concerned with regard to the wholesale replacement products;
- in four countries (ES, GR, IT, SI), ANOs expressed concerns with regard the migration costs, the SMPO shall take over at least some of these costs;
- in two countries (ES, IT) ANOs expressed the view that the SMPO shall only be allowed to close MDFs/exchanges after all end-users migrated to fibre (no forced migration);
- in one country (ES), ANOs pointed out that the continuity of retail services needs to be ensured and that permission for closure should be granted for each MDF individually;
- in one country (GR) ANOs addressed the topics of transparency and monitoring of KPIs and suggested that the NRA shall coordinate the procedure; and
- in one other country (FR) the ANOs requested a strong control over the fulfilment of the criteria.

The main concerns of consumer organisation were as follows: in two countries (NO, SE) they pointed out that (i) for some end-users alternatives to the copper access are not available, and (ii) the reduced quality and robustness of the replacement products (mobile).

3.3 NGA rollout and notice period

In six (CZ, FR, HU, IT, LI, LU) of the 17 countries in which the NRA already set the rules for the migration process and copper switch-off the NRA permits copper switch-off only in case a certain NGA rollout is reached. A precondition for the copper switch-off in France is a 100% FTTH rollout at the end of the notice period, in Liechtenstein a 100% FTTB rollout²² at the beginning of the notice period and in Italy a 100% NGA coverage (FTTC, FTTH or FWA in marginal cases) also at the beginning of the notice period. In Hungary the area of the copper switch-off has also to be covered by the alternative NGA network, however, percentages of homes passed or subscriptions that need to be reached are not defined. In the Czech Republic the SMPO is allowed to close copper lines only if they are replaced by an optical line and in

²¹ In Liechtenstein the ANOs and the incumbent considered the notice period to be short, creating time pressure for the migration, however, they accept the proposal of the SMPO and did not request a formal procedure before the NRA.

²² The rule for migration is set on building level: As soon a building is connected with FTTB access, the notice period starts. The SMPO may switch-off at the end of the notice period. In practice the SMPO executes switch-offs in larger lots of buildings that are beyond the notice period.

Luxembourg a precondition is the availability of fibre unbundling (ULL) or virtual unbundled access (VULA) over fibre.

In 11 countries (BE, CY, EE, GR, HR, NO, PL, PT, SI, ES, SE) the rules set by the NRA permit copper switch-off independent of whether the SMPO already reached a certain NGA rollout. In Spain the first set of rules (2009) demanded a certain NGA roll out as a safeguard measure, in order to avoid damage to competition by strategic exchange closures. However, this condition was removed in 2016, as the growth of FTTH was so strong that copper could no longer compete with fibre, the trend to migration to FTTH was clear and, therefore, the risk of strategic closures disappeared. In Portugal the SMPO has to provide detailed and timely information on the SMPO's copper access network development and the migration rules depend on the impact on the SMPO wholesale customers' (e.g. percentage of copper lines to deactivate). In Croatia, the SMPO did not show significant intentions for copper switch-off due to low utilization of its newly deployed FTTH network and the SMPOs copper network allows NGA speeds without significant investments due to relatively short loops.

Figure 4 provides an overview of the notice period the NRA imposed on the SMPO with regard to migration process and copper-switch-off.²³ In eight countries (BE, ES, HR, HU, IT, LU, PL, SI) the notice period differs depending on the copper-based wholesale access product used by the ANOs. Typically, the notice period is longest in case of copper-based ULL, shorter in

Notice period	Copper-based wholesale access product used by ANOs		
	Copper-based ULL	Bitstream and/or VULA ^{*) **)}	No copper-based wholesale access product ^{*) **)}
3 Months			PL
6 Months	EE	EE, SI	EE, ES, HR, HU, SI
1 Year	CZ, LI	BE, CZ, ES, IT ^{***)}	BE, CZ, LU
18 Months	IT ^{***)}		
2 Years	BE, ES, HU, IT (w.a.) ^{****)} , PL, SI	HU, IT (w.a.) ^{****)} , PL	IT (w.a.) ^{****)}
3 Years	CY, FR, PT (eWA)	FR	FR
5 Years	HR ^{****)} , LU, PT	HR ^{****)} , LU	

^{*)} In CY no notice period (existing ANOs are not affected), however, information obligations; ^{**) N/A in LI, PT}

^{***)} The final MDF closure takes place 12 months after the end of the notice period (after a technical migration process of 12 months)

^{****)} Except migration procedure is agreed between SMPO and ANOs

Legend: eWA ... equivalent wholesale access; w.a. ... white areas

Source: BEREC

Figure 4: Notice period

case of copper-based VULA or bitstream and still shorter in case no copper-based wholesale access product is used by ANOs. The notice periods are in this sequence in Luxembourg 5/5/1 years, in Croatia 5/5/0.5 years, in Hungary 2/2/0.5 years, in Poland 2/2/0.25 years, in Belgium

²³ The notice period shown in Figure 4 is a minimum notice period, the SMPO is free to announce the copper switch-off with a longer notice period (except in Hungary).

2/1/1 years, in Spain 2/1/0.5 years, in Slovenia 2/0.5/0.5 years and in Italy 1.5/1 bitstream/-years.²⁴

In three countries (CZ, EE, FR) the notice period does not depend on the copper-based wholesale access product used by ANOs. The notice period is in France three years, in the Czech Republic one year and in Estonia six months. In three other countries (CY, LI, PT²⁵), only copper-based ULL is relevant with regard to the notice period. In three further countries (GR, NO²⁶, SE²⁷) the notice period is not relevant (NO, SE) or not yet set in detail (GR).²⁸

In one country (EE) the notice period is also less than one year in case where copper-based ULL is used by ANOs (six months). However, in this country the number of copper-based ULL used by ANOs is very low.

In 14 countries (BE, CY, CZ, EE, ES, FR,²⁹ HR, HU, IT, LI, LU, PL, SI) the notice period does not depend on whether the SMPO provides a fully equivalent wholesale access product while in one country (PT) this is the case. Two countries (BE, CY) informed on the reason why the notice period does not depend on the provision of a fully equivalent wholesale access product which is that this is a general requirement. In Portugal the notice period is only three years in case the SMPO does provide a fully equivalent wholesale access product, otherwise the notice period is five years.

3.4 Legacy copper-based wholesale access products

After the copper switch-off the SMPO's wholesale access products based on the copper loops which are decommissioned are no longer available. For example, in case the SMPO migrates its legacy copper-based access network (copper between MDF and end-user) to FTTH (or FWA/mobile), then after the copper switch-off all SMPO's copper-based wholesale access products (e.g. copper ULL, copper VULA, copper bitstream) are no longer available. However, in case the SMPO migrates its copper-based access network to FTTC, then e.g. SMPO's VULA and bitstream are still available based on FTTC, but no longer based on the full copper loop. Therefore, the SMPO's legacy copper-based wholesale access products, which are no longer available after copper switch-off, depend on the alternative access network to which the SMPO migrates its legacy copper access network. In addition, this depends on the copper-

²⁴ In Italy in case of white areas, the notice period is 2 years independent from the copper-based wholesale access products used by ANOs.

²⁵ In Portugal, in addition MDF with collocated operators (also in case they do not use copper-based ULL)

²⁶ In Norway, the NRA imposed on the SMPO the obligation to maintain the access to copper-based access networks until 2 September 2025.

²⁷ In Sweden a court of law decided that the SMPO does not have to offer alternative access to its network (e.g. fibre, FWA, etc).

²⁸ In Finland the rules for the copper switch-off were set by the government and parliament and the notice period is 6 months (independent from the copper-based wholesale access product used by ANOs).

²⁹ In France, a fully equivalent wholesale access product needs to be available on the FTTH network at least one year before the MDF closure by the SMPO, however, this access product does not need to be provided by the SMPO itself.

based wholesale access products the SMPO were obliged to offer by the NRA before the copper switch-off.

In 15 of the 17 countries which already set rules for the copper switch-off the situation is as follows (see Figure 5). Copper-based ULL is no longer available in 15 countries, (certain³⁰) copper-based VULA with local point of handover (PoH) in six countries, (certain³⁰) copper-based VULA with regional/national PoH in five countries, (certain³⁰) copper-based bitstream with regional/national PoH in 12 countries and other copper-based wholesale access products (e.g. WLR, CS, CPS) in three countries.

SMO's copper-based wholesale access products no longer available after copper switch-off (e.g. MDF closure)															
Copper-based ULL	15														
	BE	CZ	EE	ES	FR	GR	HR	HU	IT	LI	LU	NO	PL	PT	SI
(Certain) Copper-based VULA with local PoH ^{*)}	6														
	BE	CZ	GR	HR	HU	SI									
(Certain) Copper-based VULA with regional/national PoH ^{*)}	5														
	BE	CZ	GR	HR	SI										
(Certain) Copper-based bitstream with regional/national PoH ^{**)}	12														
	BE	CZ	EE	ES	FR	GR	HR	HU	IT	LU	NO	SI			
Other	3														
	ES ^{***)}	IT ^{****)}	LI ^{*****)}												

*) Copper-based VULA does not exist in EE, ES, FR, LI and LU

**) Copper-based bitstream does not exist in LI

***) All other copper-based WAP as WLR or 2M leased lines

****) WLR, CS/CPS and analog leased lines *****) HFC-coax channels

Source: BEREC

Figure 5: SMPO's copper-based wholesale access products no longer available after copper-switch-off

In the other two countries which already set rules for the copper switch-off the situation is as follows. In Cyprus the SMPO has not yet announced that it plans to switch-off its copper access network but after copper switch-off the SMPO's copper based wholesale access products will no longer be available. In Sweden a court of law decided that the SMPO does not have the obligation to offer wholesale access products.

In 12 of the 17 countries which already set rules for the copper switch-off the SMPO has to offer the legacy copper-based wholesale access products until the copper is switched off (e.g. MDF closure). In four other countries (ES, FR, LU, SE) this is not the case and in one (GR) this will be examined in the new round of market analysis and is not yet decided. In Spain, after the notice period the SMPO must stop commercial offers on copper, and a guard period

³⁰ Whether only certain or all are no longer available after the copper switch-off depends on the alternative network to which the SMPO migrates to. In case the SMPO migrates to FTTH, all copper-based VULA/bitstream are no longer available, in case the SMPO migrates to e.g. FTTC only FTTEEx-based based VULA/bitstream are no longer available (see previous paragraph).

of 6 months follows in which still existing copper services must be maintained until their migration. In France, the SMPO has to provide the legacy copper-based wholesale access products until the copper is switched off (technical closure), however, it is allowed to stop selling new legacy copper-based wholesale access products already earlier (commercial closure) if some criteria are met such as completeness of FTTH deployments, presence of certain services and transparency/non-discrimination. In Luxembourg the SMPO does no longer have to offer legacy copper-based wholesale access products at a certain address as soon as it offers at this address fibre ULL (provided that fibre in-house cabling is available or feasible). In Sweden, as already mentioned above, the SMPO does not have the obligation to offer wholesale access products.

3.5 Alternative wholesale access products

Certain or all SMPO's copper-based wholesale access products are no longer available after the copper switch-off (see section 3.4) and, therefore, the ANOs have to migrate to alternative wholesale access products.

Figure 6 provides an overview of the alternative wholesale access products the SMPO has to offer. The SMPO has to provide duct access in 11 countries, copper sub-loop unbundling in five countries, fibre unbundling in nine countries, VULA with local PoH also in eight countries, VULA with regional/national PoH in three countries and bitstream with regional/national PoH

Alternative wholesale access products the SMPO has to offer											
Duct access	11										
	BE	CY	EE	ES	FR	GR	HR	IT	LI	PT	SE ^{*)}
Copper SLU	5										
	CY	GR	HU	IT	PL ^{*)}						
Fibre ULL	9										
	CZ	EE	FR ^{***)}	HU	LI	LU	PL ^{*)}	NO	SE		
VULA with local PoH	8										
	BE	CY	CZ	ES	GR	HU	IT	LU			
VULA with regional/national PoH	3										
	GR	HR ^{*)}	NO								
Bitstream with regional/national PoH	9										
	BE	CY	CZ	EE	ES	GR	HR	IT	PL ^{*)}		
Other	3										
	HU	IT ^{*)}	NO								

Note 1: All alternative wholesale access products are imposed as a "usual" remedy on a regulated market except: *) imposed specific in case of copper switch-off **) based on BCRD ***) obligation based on symmetric regulation

Note 2: In Slovenia a general rule applies (no certain product)

Note 3: In Lichtenstein fibre ULL is planned (not yet imposed)

Source: BEREC

Figure 6: SMPO's alternative wholesale access products

in nine countries. The SMPO has to offer also other wholesale access products in three countries, in Hungary terminating (coaxial) segment of HFC networks, in Italy FWA wholesale

service (similarly to bitstream), however, only in marginal cases where fibre is not available, and in Norway also FWA. In Slovenia the SMPO has to provide an equivalent (or better) wholesale access product (except duct access) in case an at least technological equivalent open access network is available, however, it does not have the obligation to provide a certain wholesale access product.

In 12 countries (BE, CY, CZ, EE, ES, GR, HU, LI, LU, NO, PT, SE) the alternative wholesale access products are imposed on the SMPO as a “usual” remedy on a regulated market (in Figure 6 not marked with an asterisk) and not only in case of a copper switch-off, however, in one of them (SE) one alternative wholesale access product (duct access) results from the Broadband Cost Reduction Directive (marked with two asterisks).³¹ In three countries (FR, HR, IT) alternative wholesale access products are imposed on the SMPO also as a “usual” remedy on a regulated market (not marked with an asterisk), but one alternative wholesale access product is imposed in two of them (HR, IT) only in case of a copper switch-off (marked with an asterisk) and in the other (FR) as an obligation based on symmetric regulation (marked with three asterisks). In one other country (PL), all alternative wholesale access products are imposed on the SMPO only in case of a copper switch-off (marked with an asterisk).

With regard to the question whether the alternative wholesale access products are fully equivalent or have at least a comparable quality as the copper-based wholesale access products which are no longer available after the copper switch-off the situation is as follows. The passive alternative wholesale access products (duct access, copper SLU, fibre unbundling) do not provide an electronic communications service with a certain quality, enable ANOs to deploy their own active equipment and, therefore, ANOs have the maximum choice with regard the quality of their end-user services.³² The active wholesale access products are considered to be fully equivalent or have at least a comparable quality as follows: VULA with local PoH in all eight countries (BE, CY, CZ, ES, GR, HU, IT, LU), VULA with regional/national PoH in one (HR) of the three countries,³³ bitstream with a regional/national PoH in five (BE, CZ, ES, IT, PL) of the nine countries and the other wholesale access products in two (HR-terminating segment HFC, IT-FWA) of the three countries.³⁴

In 11 countries (BE, ES, CY, CZ, GR, HR, HU, IT, NO, PL, SI) the NRA set the following further rules with regard to the alternative wholesale access products the SMPO has to provide. The SMPO has to publish a reference offer for the alternative wholesale access products, to offer

³¹ Directive 2014/61/EU of the European Parliament and of the Council of 15 May 2014 on measures to reduce the cost of deploying high-speed electronic communications networks

³² However, the quality of ANO's end-user services also depends on certain access conditions such as provisioning time or repair time.

³³ In Norway, a formal assessment of VULA fibre with regional/national PoH has not yet been carried out, however, in meetings the ANOs informed that they consider it fully equivalent or having at least a comparable quality to copper accesses.

³⁴ In Norway a preliminary assessment of FWA considers it not fully equivalent.

the alternative wholesale access products with key performance indicators (KPIs) and service level guarantees (SLGs) and the SMPO also has a non-discrimination obligation.

In six (ES, FR, GR, HR, IT, SI) of the 17 countries which already set rules for the copper switch-off alternative wholesale access products are also available by other operators than the SMPO. In three (FR, IT, SI) of them fibre unbundling is available, in one (HR) of them fibre sub-loop unbundling, in four (ES, GR, IT, SI) of them VULA and in two (ES, HR) of them bitstream. In all six countries these wholesale access products are available based on FTTH, in one country (GR) also on FTTC and in one country (IT) also on FWA. In five of these countries (ES, FR, HR, IT, SI) these wholesale access products are available at least at some MDFs and in the remaining country (GR) at the street cabinets where ANOs deployed NGA with vectoring.

3.6 Migration costs

In five (BE, CY, ES, IT, SE) of the 17 countries in which the NRA already set rules for the copper switch-off it also set rules with regard to the migration costs. The NRA set in one (IT) of them several specific rules, in two (BE, CY) of them general rules and in the other two (ES, SI) countries the rules apply only in specific cases.

In Italy the SMPO has to cover the following costs (i) the deactivation of old/legacy wholesale access product and activation of new/alternative wholesale access product, (ii) additional costs for decommissioning of co-location ANOs' sites, and (iii) costs for co-location in new local exchange and for interconnection equipment's to migrate customers. In addition, during migration until the local exchange is switched-off, the price of the NGA "substituting" wholesale service is equalized to the wholesale price of the "substituted" copper service.

In the other two countries (BE, CY) the NRA set general rules. In Cyprus the termination of the physical access in (i) areas of optical network deployment, and in (ii) areas where vectoring is applied presupposes the free migration of the subscribers of the ANOs to virtual access products. In Belgium each network operator needs to bear its own costs when a building is closed. However, the NRA's review process includes also migration costs and in previous cases, the SMPO always proposed to execute the migration at zero cost for the ANOs.

In Spain the rules apply only in the specific case of closure of smaller units than street cabinets (which need explicit permission) and in this case the migration is free (in areas with access obligations). In Sweden the rule only applies if the SMPO did not inform in advance as stipulated in SMP decision (18 months) and then the SMPO has to reimburse ANOs for net book value.

The other 12 countries (CZ, EE, FR, GR, HU, HR, LI, LU, NO, PL, PT³⁵, SI) did not set specific rules for the migration costs. In one country (SI) the SMPO already offers free migration in

³⁵ Nevertheless, ANACOM understands that it is necessary to ensure that any costs of change would not be passed indiscriminately and disproportionately to ANOs, as it could constitute a double penalty for them.

case of copper switch-off. In three countries (EE, HU, PT) the number of copper-based wholesale access lines which are in use is already small and, therefore, rules with regard to migration costs are considered not to be necessary. In three countries (HR, LU, PT) the notice period is five years and in this period most of the investment costs related to the use of existing wholesale access products are already recovered. In one country (FR) the NRA did not set a whole set of specific rules regarding migration costs, however, access to the SMPO's copper local loop is cost oriented and some other rules apply. In one country (ES) the NRA did not set further rules on migration costs since several alternatives are available after copper is switched-off: regulated offers, commercial offers and own deployment. In one country (LI) the SMPO and the service providers agreed on the terms and the NRA has not been called upon to settle or decide disputes. In one country (GR) the NRA will consider migration costs in the new round of market analysis.

3.7 Information of the SMPO and monitoring

In 12 (BE, ES, CY, FR, GR, HR, HU, IT, LU, NO, SE, SI) of the 17 countries in which the NRA already set rules for the copper switch-off the SMPO has the obligation to provide information to the NRA and the ANOs. The SMPO has to provide to the NRA and ANOs a detailed copper switch-off plan in three countries (FR, HR, NO), information on the timing of the migration in six countries (BY, CY, GR, HU, IT, SI), on the MDFs or geographical area affected by the copper switch-off in six countries (ES, HU, IT, LU, SE, SI), on the alternative wholesale access products in five countries³⁶ (BE, CY, ES, HU, IT), on the copper-based wholesale access products which will be withdrawn and the wholesale access point in one country (HU), on certain specific aspects in case of migration to a new node in one country (HR) and detailed information on the FTTH network and planned coverage of alternative networks to copper in one country (ES). In one country (LI) the SMPO has the general (not migration specific) obligation to provide to the NRA (not the ANOs) annual information in the framework of the statistical data collection.

In three countries (CZ, PL, PT) the SMPO has to inform the ANOs as follows. Information on the planned copper switch-off is to be provided not later than at the beginning of the notice period in two countries (CZ, PL) and, in case of relocation of copper loops for reasons attributable to the SMPO, detailed information on the relocation within a specific time frame is to be provided in one country (PT). In two countries (HR, HU) the SMPO has to inform its end-users. In both countries SMPO has to inform the end-users in case (substantial) features of the retail service change.

In one country (LI) the SMPO has to inform the owners of the buildings on planned construction activities, the notification period and the replacement of old access lines. In one country (FR) the SMPO has to inform also the public about criteria it considers for closure and, every

³⁶ This can be a specific information obligation for switch-off areas or a generally available information of the individual reference offers.

semester, about closure trajectory. In another country (GR) the NRA will examine rules on the information the SMPO has to provide in the forthcoming market analysis.

The SMPO voluntarily provides further information to the NRA in four countries (CY, HR, LI, PT), to ANOs in three countries (CY, LI, PL), to the SMPO's end-user in two countries (ES, SI) and to other entities in two countries (LI, SE). The SMPO informs the NRA periodically on the status of the migration process (PT), the planned changes in the network (HR), the progress of the FTTH project (LI) and the deployment of fibre optic network (CY). The SMPO informs the ANOs on locations, migration conditions, alternatives etc. (PL), also on the deployment of fibre optic network (CY) and provides ANOs regular updates of data base for planned and finished FTTH connections (LI). The SMPO informs its end-users about the planned closure date (ES) and encourages end-users to switch to the new optical network (SI).

In nine countries (CY, ES, FR, HU, IT, LI, LU, SE, SI) the NRA does monitor the migration process. The NRA monitors the migration process based on the information the SMPO has to provide (see above)(HU), the progress of the copper switch-off (LU, SE) including compliance with the deadlines (LU) and feedback from the stakeholders (SE), all received closure notifications, their characteristics and evolution including publishing a list of exchanges in the switch-off process for general public use (ES), the development of indicators on e.g. copper ULL and fibre ULL (LI), the future closure program the SMPO has to present before any technical closure (FR) and the announcements about the copper switch-off (SI).

In the other countries in which the NRA already set rules for the copper switch-off, the NRA does not monitor the migration. Reasons for that are that the NRA has always the possibility to intervene in case migration issues occur (BE), the copper switch-off is not yet widespread (CZ), the number of copper-based wholesale access lines which are in use is already very small (EE, PT) and the NRA does not have a legal basis (PL).

3.8 Further rules

In several countries the NRA set further rules for the copper switch-off. In eight countries (CY, ES, FR, HR, IT, LI, PL, SI) the NRA set specific rules which ensure a smooth migration for the end-users. The NRA's rules foresee in Cyprus a free migration of the end-users (see section 3.6) and timely information for ANOs (see section 3.7), in Italy that the copper switch-off is only permitted in case of 100% NGA coverage and an adequate notice period (see section 3.3), in Liechtenstein that the copper switch-off is only permitted in case of 100% FTTB (on building level) and the notice period was set according to the agreement the SMPO reached with the service providers (see sections 3.2 and 3.3), in Spain the SMPO must facilitate migration to available alternative wholesale offers and offer a guard period³⁷ (six months) in case copper is still in use after the notice period, in Poland that information about migration

³⁷ The guard period (six months) begins after the notice period, in case copper is still in use. During the guard period new copper-based end-users are no longer possible and the still existing copper-based end-users must be migrated.

needs be provided at least two years in advance and the longest end-user contracts are two years, in France and in Croatia a notice period of three (FR) and five (HR) years which ensures a smooth migration, in Slovenia an undisturbed transfer of the end-users to adequate or better technological solution by the SMPO.

In three countries (BE, CZ, PT) the NRA pointed out that the NRA has the possibility to intervene in case end-user issues occur, however, this was not the case so far. In one country (HU) the NRA considers the general obligation of non-discrimination between SMPO's retail and wholesale end-users as sufficient and in one other country (EE) end-user issues are not a topic since the number of copper-based wholesale access lines still in use is very low.

In two countries (FR, IT) the NRA did allow the SMPO a copper switch-off to some extent for test purposes. In France the NRA allows a shorter notice period for tests which offer the opportunity to raise any concerns about migration (technical difficulties or difficulties linked to communication). In Italy the NRA approved a trial among operators (wholesale and retail level) for a duration of six months. In other countries NRAs informed that tests were not (yet) relevant (BE), there was no request for a test so far (CY), and that the SMPO carried out a pilot project on its own initiative (PT).

No other specific rules for the copper switch-off were set by the NRAs, with the exception of one country (ES). Indeed, in Spain the NRA set the rules that copper switch-off does not change the availability of any wholesale PoH (for VULA and bitstream), 2 Mbps leased lines on copper must be migrated to fibre, and the migration framework also considers exceptional circumstances as e.g. in case after the guard period³⁷ end-users are still connected based on copper.

The NRAs explained why specific rules with regard to the impact of the copper switch-off on the universal service were not necessary as follows. The universal service obligation is technologically neutral (CY, CZ, ES, HR, SI) or no operator is designated to provide the universal service (BE, EE, PT, SE).

3.9 Permission to close MDFs

In all 17 countries in which the NRA already set rules for the copper switch-off, the SMPO has the possibility to close MDFs if the rules set by the NRA are fulfilled and the SMPO does not need any further explicit formal permission except in one country. In Italy the SMPO needs for each MDF an explicit permission to close it, since MDF closure is only possible if 100% NGA coverage and at least 60% NGA take-up are achieved already at the beginning of the notice period and the NRA formally verifies whether this is the case.

4 Further aspects of the migration process and copper switch-off

This section examines the following further aspects of the migration process and copper switch-off based on the data (as of June 2021) in Annex 3 (Table 90 to Table 93):

- the SMPO's framework for migration and copper switch-off;
- incentives for end-users; and
- migration issues.

In 17 countries the NRA already set rules for the migration process and copper switch-off (see section 3). In six of them (HU, IT, LI, PT, SI, SE) the SMPO established a framework for migration and copper switch-off and in all six countries it is consistent with the rules set by the NRA. In Italy the SMPO published a general plan for decommissioning recently and also a general procedure to migrate customers (including massive migration), which is currently under approval process by NRA. In Liechtenstein the SMPO reached an agreement with the service providers on the notice period, alternative wholesale access products and the migration costs. In Portugal the SMPO's framework foresees a copper switch-off process that will take place in several phases until 2030. In Sweden the SMPO's framework is a result of previous experiences from the past years. In France, the SMPO expects publishing a general plan for decommissioning in Q4 2021.

In six countries (BE, LI, NO, PT, SE, SI) the SMPO and/or ANOs set incentives for their end-users after the SMPO announced the copper switch-off in order that their end-users migrate voluntarily and to avoid a forced migration. In Belgium, the SMPO proposed in previous cases a waiving of (certain) migration costs for ANOs (and, in some cases, free customer premises equipment (CPE) when necessary). In Liechtenstein the service providers offer competitive fibre-based end-user services and free of cost installation of in-house fibre cabling. In Norway various introduction offers were used (e.g. reduced price on end-user equipment). In Portugal the potential benefits of the new networks are available at the same price. In Slovenia migrating end-users are offered the same discount as new end-users and in Sweden in some cases end-users were offered some sort of introductory offers.

In none of the 17 countries in which the NRA already set rules for the migration process and copper switch-off the NRA reported that issues occurred during the migration process (e.g. exceptional circumstances outside of the foreseen process). Several NRAs informed that they do not have information with regard to this.

5 A consistent approach to migration and copper switch-off

This section aims to identify a consistent approach to migration and copper switch-off based on the results of the analysis of the rules set by the NRAs for the migration process and copper switch-off (section 3). Therefore, this section considers the same topics as section 3.

5.1 Type of procedure

The experiences show that it is appropriate that the NRAs set the rules for the migration process and the copper switch-off in a market analysis procedure. However, (at least) in the following two circumstances it may be necessary that the NRA takes a decision on the copper switch-off outside and already before the next market analysis procedure, in particular since

according to Art. 67(5a) of the EECC the period between market analysis procedures is now up to five years (and no longer three years as previously): (i) The NRA did not yet set rules for the copper switch-off and the SMPO notifies to the NRA that it plans to switch off its copper-based access network according to Art. 81 of the EECC shortly after a market analysis decision; and (ii) The NRA already sets rules for the copper switch-off in the last market analysis procedure, however, it is necessary to amend these rules since the SMPO's copper switch-off plan or other relevant circumstances changed significantly. In addition, a court of law may set rules for the copper-switch-off or overrule the rules set by the NRA, however, this is outside the NRA's control.

5.2 Level (granularity) of the rules

The rules for the copper switch-off may be set at a certain level (granularity) or in general. The most appropriate level (granularity) depends on the copper switch-off the SMPO pursue. The MDF level is appropriate in case the SMPO plans to close complete MDFs (before it already closed all street cabinets in the MDF area³⁸), the street cabinet level is appropriate if the SMPO plans to close street cabinets before closing the MDF to which they are connected to and a still finer granularity is appropriate if the SMPO plans to close other copper-based network elements before it closes the street cabinet and MDF to which they are connected to (e.g. DSLAM or DPU in the building of the end-user). A general copper switch-off level is appropriate if the rules set by the NRA are appropriate for all levels (no need to distinguish between levels as e.g. MDF, street cabinet), the SMPO did not (yet) inform at which level it plans to switch off the copper based access network or if the NRA set the rules for the copper switch-off already before the SMPO announced the copper switch-off.

5.3 Scope of the rules

The NRA has to apply Art. 81 of the EECC when it sets the rules for the migration process and copper switch-off after the SMPO notified to the NRA that it plans to close its copper-based access network in the geographic area in which the NRA imposed access remedies on the SMPO.³⁹ Therefore, the scope of the rules must be such that they apply to the SMPO and to the geographic area where the NRA imposed access remedies on the SMPO.

5.4 Stakeholder involvement

NRAs have the obligation to give interested parties the opportunity to comment on the draft measures when they intend to take measures e.g. set rules for the copper switch-off, according to Art. 23(1) of the EECC. NRAs typically launch a public consultation in order to ensure this. Therefore, the NRA involves the stakeholders when it set the rules by means of a public consultation of the draft measure.

³⁸ Or at the same time when the SMPO plans to close all street cabinets in the MDF area.

³⁹ The NRA may, however, already set rules for the migration process and copper switch-off before the SMPO notified to the NRA that it plans to close its copper-based access network.

In accordance with Article 31(1) of the EEC, any user or undertaking providing electronic communications networks or services or associated facilities who is affected by a decision of the NRA, as e.g. a decision on copper switch-off, has the right of appeal against that decision to an appeal body. Therefore, depending on national law, stakeholders are also party in the (market analysis) procedure which sets the rules for the copper switch-off.

In certain circumstances further stakeholder involvement is appropriate. In case technical details of the migration as e.g. a comprehensive wholesale services substitution matrix⁴⁰ needs to be developed, the NRA may hold a technical forum, or in case of uncertainties e.g. in case a court of law also sets rules for the copper switch-off or overrules the rules set by the NRA, a continuous dialog with the stakeholders may be appropriate.

5.5 Notice period

The NRAs need to find the right balance between the different needs of the stakeholders which typically are as follows.

SMPOs want to switch-off their copper-based access networks in order to reduce costs since it is not efficient to keep both the copper-based access network and the next generation access networks. For this reason, SMPOs typically prefer a short notice period. On the other hand, ANOs have to migrate within the notice period their end-users which are still connected to the copper access network to the alternative access network and an alternative wholesale access product and, therefore, typically prefer a comparatively longer notice period. The end-users of both, the SMPO and the ANOs, which are still connected to the copper access network also need to migrate within the notice period to a new end-user service based on the alternative access network, at least in case of a full copper switch-off, and, therefore, may also prefer that the notice period is not too short.

The notice period typically depends on whether or not ANOs use (e.g. in the area of an MDF) a SMPO's copper-based wholesale access product. If this is not the case ANOs do not have to migrate to an alternative wholesale access product and the notice period (to close this MDF) is rather short. Experiences show that typically a notice period of 6 to 12 months could be sufficient. However, under certain circumstances it may be longer e.g. in case of a copper switch-off in white areas⁴¹ where NGA is not available and the end-users need to be migrated e.g. to FWA.

In case ANOs use a copper-based wholesale access product, the notice period is significantly longer since they have to migrate their end-users still connected to the copper-based access network to the alternative access network and an alternative wholesale access product.

⁴⁰ Which legacy copper-based wholesale access product will be replaced by which alternative wholesale access product

⁴¹ 'White areas' are those in which there is no broadband infrastructure and it is unlikely to be developed in the near future (see paragraph 66, Communication from the Commission, EU Guidelines for the application of State aid rules in relation to the rapid deployment of broadband networks, 2013/C 25/01)

The notice period typically depends on which copper-based wholesale access product ANOs use. If ANOs use VULA or bitstream with a PoH still available after copper switch-off (e.g. regional/national PoH) they have the possibility to continue to use this wholesale access product and solely have to migrate to a different type of access line (e.g. FTTC/B/H). Therefore, in this case typically a notice period of 1 to 3 years is sufficient.

In case ANOs use copper-based ULL, they have to migrate to a different alternative wholesale access product as e.g. duct access, fibre unbundling or VULA based on fibre and, therefore, need more time for the migration. In this case a notice period of typically 2 to 3 years is appropriate.

However, depending on national circumstances the notice periods may be shorter or longer than the above-mentioned typical notice periods.

The following factors tend to shorter notice periods (the lower value in the range of the notice period given above). In the area where the SMPO wants to switch off its copper access network, alternative wholesale access products based on fibre are already available for all end-users at the beginning of the notice period, the number of copper-based wholesale product access lines still used by ANOs is already small and in case ANOs have already gained significant experiences with the forced migration of end-users to the alternative access network and the alternative wholesale access product. If this is not the case, the notice period tends to be longer, also in cases where a forced migration of end-users shall be avoided as much as possible.

5.6 Alternative wholesale access products

The NRAs typically set the rules for the migration process and the copper switch-off in a market analysis procedure (see section 5.1). In this market analysis procedure, the NRAs normally impose on the SMPO (also) the obligation to offer certain wholesale access products independent of the copper switch-off as a “usual” remedy on a regulated market. The SMPOs already rolled out NGA since many years, therefore, these wholesale access products typically (also) need to be based on fibre (e.g. FTTC and/or FTTB and/or FTTH) and/or include duct access (which enable ANOs to deploy fibre), if ducts are (widely) available. These fibre-based wholesale access products imposed on the SMPO as a “usual” remedy in a market analysis procedure are typically also sufficient for the copper switch-off. There is no general need to impose on the SMPO the obligation to provide alternative wholesale access products only in case of copper switch-off. However, there are also circumstances where copper switch-off specific alternative access products need to be imposed on the SMPO. For example, in case of white areas⁴¹ in which fibre is not available, alternative wholesale access products may also be needed (e.g. FWA), or in case the fibre rollout is primarily driven by symmetric regulation.

The type of alternative wholesale access products the SMPO has to provide depends on national circumstances (see BoR (16) 171, p. 33-40). Duct access is imposed primarily in case ducts are (widely) available, fibre unbundling primarily in case the SMPO's FTTH network is

based on point-to-point fibre (not on PON⁴²) and already rolled out to a relevant extent, and active wholesale access products as e.g. VULA are of particular importance in case duct access and fibre unbundling are not possible or only to a limited extent.

The alternative wholesale access products also depend on the alternative access network to which the SMPO migrates its legacy copper access network). For example, in case the SMPO migrates to FTTC, copper-based alternative wholesale access products are possible e.g. copper SLU, VULA and bitstream based on FTTC (but not based on the full copper loop). In case the SMPO migrates to FTTH (or FWA/mobile), then no copper-based wholesale access products are possible.

Alternative wholesale access products (e.g. fibre unbundling, VULA based on fibre) could also be available from network operators other than the SMPO. However, whether this is the case and to what extent depends on national circumstances and may also vary within a country depending on the geographic region.

5.7 Legacy copper-based wholesale access products

The NRAs typically imposed in a market analysis procedure on the SMPO the obligation to provide also copper-based wholesale access products (e.g. physical copper unbundling, bitstream or virtual unbundling based on copper access). After the copper switch-off, these copper-based wholesale access products are no longer available and the ANOs have to migrate to alternative wholesale access products in due time before the copper switch-off. For each of the legacy copper-based wholesale access product ANOs need an appropriate alternative wholesale access product (see section 5.6).

Typically, the SMPO has to offer the legacy copper-based wholesale access products until the copper is switched off (e.g. MDF closure). However, SMPOs may be allowed to stop selling legacy copper-based wholesale access products already earlier and only have the obligation to continue to provide the legacy copper-based wholesale access products on the lines to which the existing end-users are connected to until the copper switch-off.

5.8 Migration costs

Both the legacy copper-based wholesale access products and the alternative wholesale access products are typically imposed on the SMPO in a market analysis procedure (see sections 5.6 and 5.7) and, therefore, the NRAs normally also apply price regulation to these products.

In many cases there is no need that the NRA sets further rules on the migration costs. For example, in case (i) the SMPO already offers free migration from the legacy copper access

⁴² In case of PON fibre is shared between several end-users and, therefore, fibre unbundling is not possible. Only the last segment of the fibre-based subscriber access line, from the last splitter to the end-user is a dedicated fibre, only used by one end-user. Therefore, fibre unbundling is limited to this last segment of the PON.

network to the alternative access network; (ii) the number of copper-based wholesale access lines which are still in use is already (very) small; (iii) the notice period is long (e.g. 5 years) since then ANOs already recovered most of the investment costs related to the use of the existing copper-based wholesale access products and the end-users have sufficient time to migrate voluntarily to an end-user service based on the alternative access network; or (iv) alternative wholesale access products are available from several network operators and rules imposed on the SMPO with regard to the migration costs would unduly influence the other alternative wholesale access products and bias competition in the market.

However, in order to avoid competitive distortions it could also be useful under specific circumstances and in the national context that the NRA sets further rules on the migration costs as e.g. that the SMPO covers some migration costs (see section 3.6).

5.9 Information of the SMPO and monitoring

The NRAs typically set the rule that the SMPO has to inform ANOs, and in many cases also the NRA, on the migration process and copper switch-off. For example, the SMPO may have to provide a detailed copper switch-off plan including information on the timing of the migration, on the MDFs or geographical area affected by the copper switch-off, on the alternative wholesale access products and on the legacy copper-based wholesale access products. The SMPO may also provide voluntarily further information.

Whether NRAs also monitor the migration process and copper switch-off depends on national circumstances. In many countries this is the case. Monitoring examples are (i) the progress of the copper switch-off, (ii) the received closure notifications, their characteristics and evolution, (iii) compliance with the deadlines, (iv) the development of indicators (e.g. copper ULL, fibre ULL), (v) feedback from stakeholders, and (vi) announcements or plans on future copper switch-off. National circumstances why NRAs do not monitor the copper switch-off are, for example, that the copper switch-off is not yet widespread, the number of legacy copper-based wholesale access lines which are in use is already very small, no legal basis at national level or that the NRA considers it sufficient to intervene in case migration issues occur. The need for monitoring may also arise from the transposition of Art. 81 (2) of the EEC Directive.

5.10 Further rules

The NRAs normally impose on the SMPO the obligation to offer alternative wholesale access products in a market analysis procedure (see section 5.6). In this market analysis procedure, the NRAs typically impose on the SMPO also that it has (i) to publish a reference offer for the alternative wholesale access products, (ii) to offer the alternative wholesale access products with key performance indicators (KPIs) and service level guarantees (SLGs), and also (iii) a non-discrimination obligation.

NRAs did also set specific rules which ensure a smooth migration for the end-users. Examples of such rules are: (i) free migration of the end-users and timely information for ANOs; (ii) 100% NGA coverage needs to be achieved already at the beginning of the notice period or at the end of the notice period for commercial closure and a sufficient long notice period; (iii) a guard period³⁷ (e.g. six months) in case copper is still in use after the notice period; (iv) information

on migration needs to be provided earlier than the longest duration of the end-user contracts; or (v) a long notice period (e.g. five years). However, some NRAs did not impose such specific rules on the SMPO since, e.g. (i) the number of copper-based legacy wholesale access lines still in use is already very low; (ii) it is considered to be sufficient to intervene in case of end-user issues occur, which was not the case so far; or (iii) the general obligation of non-discrimination between SMPO's retail and wholesale end-users is considered to be sufficient.

No NRA set specific rules with regard to the impact of the copper switch-off on the universal service. The reasons are, for example, that the universal service obligation is technologically neutral or that no network operator is designated to provide the universal service.

5.11 Permission to close MDFs

The SMPOs have the possibility to close MDFs if the rules set by the NRA are fulfilled and normally they do not need any further explicit formal permission.

6 Conclusions

In conclusion, the overview of the current status of the SMPOs' copper switch-off (see section 2) shows that in 20 of the 32 countries where the NRA provided data the SMPO has already announced that it plans to switch-off its legacy copper access network (e.g. close MDFs), in 13 of them the SMPO has already closed copper-based network elements (e.g. MDFs) and in 17 countries the NRA has already set rules for the migration process and copper switch-off.

A consistent approach to migration and copper switch-off results from the detailed analysis of the rules set by the NRAs in these 17 countries as follows.

- Type of procedure: The NRAs typically set the rules for the migration process and the copper switch-off in a market analysis procedure.
- Level (granularity) of the rules: The level (e.g. MDF or street cabinet) of the rules set by the NRA typically depends on which copper switch-off the SMPO pursues (e.g. closure of street cabinets already before or only after MDF closure).
- Scope of the rules: The rules set by the NRA apply to the SMPO and to the geographic area where the NRA imposed access remedies on the SMPO (in accordance with Art. 81(1) of the EECC).
- Stakeholder involvement: NRAs normally involve the stakeholders by means of a public consultation of the draft measures according to Art 23(1) of the EECC. Depending on national law (transposition of Art. 31(1) of the EECC), stakeholders are also party in the (market analysis) procedure which sets the rules for the copper switch-off. In certain circumstances further stakeholder involvement is appropriate.
- Notice period: The notice period typically is 6 to 12 months in case ANOs do not use any SMPO's copper-based wholesale access product, 1 to 3 years in case ANOs use VULA or bitstream (same PoH after copper switch-off) and 2 to 3 years in case ANOs use copper-based ULL, however, depending on national circumstances the notice periods may be shorter or longer. The notice period tends to the shorter values in case the alternative wholesale access products are already available for all end-users at the

beginning of the notice period, the number of copper-based wholesale access lines is already small and in case ANOs have already gained significant experiences with the forced migration to an alternative wholesale access product.

- Alternative wholesale access products: The fibre-based wholesale access products imposed on the SMPO as a “usual” remedy in a market analysis procedure are typically sufficient for the copper switch-off. Depending on national circumstances, however, copper switch-off specific alternative wholesale access products may also be necessary. The alternative wholesale access products imposed on the SMPO depend on the SMPO’s infrastructure (e.g. ducts, FTTH point-to-point fibre) and, therefore, differ between countries. Alternative wholesale access products of other network operators are also available to some extent in some countries.
- Legacy copper-based wholesale access products: The legacy copper-based wholesale access products are normally also imposed on the SMPO in a market analysis procedure. Typically, the SMPO has to provide the legacy copper-based wholesale access products until the copper is switched off (e.g. MDF closure).
- Migration costs: The NRAs typically apply price regulation to the legacy copper-based wholesale access products and the alternative wholesale access products in a market analysis procedure. In many cases there is no need for further rules on the migration costs. However, in order to avoid competitive distortions further rules on migration costs could be useful under specific circumstances.
- Information of the SMPO and monitoring: Typically, the SMPO has to inform ANOs, and in many cases also the NRA, on the migration process and copper switch-off e.g. to provide a detailed copper switch-off plan. Whether NRAs also monitor the migration process and copper switch-off depends on national circumstances, however, in many countries this is the case. The need for monitoring may also arise from the transposition of Art. 81 (2) of the EEC.
- Further rules: In the market analysis procedure, the NRAs typically also impose obligations on the SMPO (i) to publish a reference offer for the alternative wholesale access products (ii) to offer the alternative wholesale access products with key performance indicators (KPIs) and service level guarantees (SLGs) and also (iii) a non-discrimination obligation. Many NRAs did also set specific rules which ensure a smooth migration for the end-users, however, this depends on national circumstances. There was no need to set specific rules with regard to the impact of the copper switch-off on the universal service.
- Permission to close MDFs: The SMPOs have the possibility to close MDFs if the rules set by the NRA are fulfilled and normally they do not need any further explicit formal permission.

7 Abbreviations for countries

Abbreviation	Country
AT	Austria
BE	Belgium
BG	Bulgaria
CH	Switzerland
CY	Cyprus
CZ	Czech Republic
DE	Germany
DK	Denmark
EE	Estonia
ES	Spain
FI	Finland

Abbreviation	Country
FR	France
GR	Greece
HU	Hungary
HR	Croatia
IE	Ireland
IT	Italy
KO	Kosovo
LI	Liechtenstein
LT	Lithuania
LU	Luxembourg
LV	Latvia
ME	Montenegro

Abbreviation	Country
MT	Malta
NO	Norway
NL	Netherlands
PL	Poland
PT	Portugal
RO	Romania
SE	Sweden
SI	Slovenia
SK	Slovakia

8 Further abbreviations

ANO	Alternative Network Operator
BSA	BitStream Access
CPE	Customer Premises Equipment
CPS	Carrier Pre-Selection
CS	Carrier Selection
DPU	Distribution Point Unit
DSLAM	Digital Subscriber Line Access Multiplexer
EECC	European Electronic Communications Code
FTTB	Fibre To The Building
FTTC	Fibre To The Cabinet
FTTEx	Fibre To The Exchange
FTTH	Fibre To The Home
FWA	Fixed Wireless Access
HFC	Hybrid Fibre Coax
ISDN	Integrated Services Digital Network
KPI	Key Performance Indicators
LLU	Local Loop Unbundling

MDF	Main Distribution Frame
MSAN	Multi Service Access Node
NGA	Next Generation Access
NGN	Next Generation Network
NRA	National Regulatory Authority
NTP	Network Termination Point
OLT	Optical Line Termination
PON	Passive Optical Network
POTS	Plain Old Telephone Service
PSTN	Public Switched Telephone Network
SC	Street Cabinet
SLG	Service Level Guarantees
SLU	Sub-Loop Unbundling
SMP	Significant Market Power
SMPO	SMP Operator
ULL	Unbundled Local Loop
VoIP	Voice over IP
VULA	Virtual Unbundled Local Access
WAP	Wholesale Access Product
WLR	Wholesale Line Rental

9 List of Figures

Figure 1: Overview of the SMPOs' copper switch-off.....	7
Figure 2: Overview of SMPOs' copper switch-off plans.....	8
Figure 3: SMPOs' MDF closure plans	9
Figure 4: Notice period.....	14
Figure 5: SMPO's copper-based wholesale access products no longer available after copper-switch-off.....	16
Figure 6: SMPO's alternative wholesale access products	17

10 List of Tables

Table 1: Overview questions (AT, BE, BG, HR, CY, CZ, DK, EE, FI, FR, DE, GR, HU, IE, IT)	37
Table 2: Overview questions (KO, LV, LI, LT, LU, MT)	38
Table 3: Overview questions (ME, NL, NO, PL, RO, SK, SI, ES, SE, CH)	39
Table 4: Status of NGA migration (BE, HR; EE)	40
Table 5: Status of NGA migration (FI, FR, GR)	41
Table 6: Status of NGA migration (HU, IE, IT)	42
Table 7: Status of NGA migration (LI, LU, MT)	43
Table 8: Status of NGA migration (NL, NO, PT)	44
Table 9: Status of NGA migration (SK, SI, ES, SE)	45
Table 10: Basic information on copper switch-off (BE, HR, EE)	46
Table 11: Basic information on copper switch-off (FI, FR, GR)	47
Table 12: Basic information on copper switch-off (HU, IE, IT)	48
Table 13: Basic information on copper switch-off (LI, LU, MT)	49
Table 14: Basic information on copper switch-off (NL, NO, PT)	50
Table 15: Basic information on copper switch-off (SK, SI, ES, SE)	51
Table 16: Current status of copper switch-off (BE, EE, FI)	52
Table 17: Current status of copper switch-off (LI, LU, MT)	53
Table 18: Current status of copper switch-off (NL, NO, PT)	54
Table 19: Current status of copper switch-off (SI, ES, SE)	55
Table 20: Future copper switch-off (BE, EE, FI)	56
Table 21: Future copper switch-off (FR, GR, HU)	57
Table 22: Future copper switch-off (LU, IE)	58
Table 23: Future copper switch-off (IT, LI)	59
Table 24: Future copper switch-off (MT, NL, NO)	60
Table 25: Future copper switch-off (PL, PT, SK)	61
Table 26: Future copper switch-off (SI, ES, SE)	62
Table 27: Rules set by the NRA for the migration process and copper switch-off – type of procedure, level and scope of the rules (BE,HR, CY)	63
Table 28: Rules set by the NRA for the migration process and copper switch-off – type of procedure, level and scope of the rules (CZ, EE, FI)	64
Table 29: Rules set by the NRA for the migration process and copper switch-off – type of procedure, level and scope of the rules (FR, GR, HU)	65
Table 30: Rules set by the NRA for the migration process and copper switch-off – type of procedure, level and scope of the rules (IT, LI, LU)	66
Table 31: Rules set by the NRA for the migration process and copper switch-off – type of procedure, level and scope of the rules (NO, PL)	67
Table 32: Rules set by the NRA for the migration process and copper switch-off – type of procedure, level and scope of the rules (PT, SI)	68
Table 33: Rules set by the NRA for the migration process and copper switch-off – type of procedure, level and scope of the rules (EE, SE)	69

Table 34: Rules set by the NRA for the migration process and copper switch-off – stakeholder involvement (BE, HR, CY).....	70
Table 35: Rules set by the NRA for the migration process and copper switch-off – stakeholder involvement (CZ, EE, FI).....	71
Table 36: Rules set by the NRA for the migration process and copper switch-off – stakeholder involvement (FR, GR, HU)	72
Table 37: Rules set by the NRA for the migration process and copper switch-off – stakeholder involvement (IT, LI, LU).....	73
Table 38: Rules set by the NRA for the migration process and copper switch-off – stakeholder involvement (NO, PL, PT, SI).....	74
Table 39: Rules set by the NRA for the migration process and copper switch-off – stakeholder involvement (ES, SE).....	75
Table 40: Rules set by the NRA for the migration process and copper switch-off – NGA rollout and notice period (BE, HR, CY)	76
Table 41: Rules set by the NRA for the migration process and copper switch-off – NGA rollout and notice period (CZ, EE, FI).....	77
Table 42: Rules set by the NRA for the migration process and copper switch-off – NGA rollout and notice period (FR, GR, HU)	78
Table 43: Rules set by the NRA for the migration process and copper switch-off – NGA rollout and notice period (IT, LI, LU).....	79
Table 44: Rules set by the NRA for the migration process and copper switch-off – NGA rollout and notice period (NO, PL).....	80
Table 45: Rules set by the NRA for the migration process and copper switch-off – NGA rollout and notice period (PT, SI)	81
Table 46: Rules set by the NRA for the migration process and copper switch-off – NGA rollout and notice period (ES, SE).....	82
Table 47: Rules set by the NRA for the migration process and copper switch-off – legacy wholesale access products (BE, HR, CY)	83
Table 48: Rules set by the NRA for the migration process and copper switch-off – legacy wholesale access products (CZ, EE, FI).....	84
Table 49: Rules set by the NRA for the migration process and copper switch-off – legacy wholesale access products (FR, GR, HU)	85
Table 50: Rules set by the NRA for the migration process and copper switch-off – legacy wholesale access products (IT, LI, LU).....	86
Table 51: Rules set by the NRA for the migration process and copper switch-off – legacy wholesale access products (NO, PL, PT).....	87
Table 52: Rules set by the NRA for the migration process and copper switch-off – legacy wholesale access products (SI, ES, SE)	88
Table 53: Rules set by the NRA for the migration process and copper switch-off – alternative wholesale access products – part 1 (BE, HR, CY)	89
Table 54: Rules set by the NRA for the migration process and copper switch-off – alternative wholesale access products – part 1 (CZ, EE, FI).....	90
Table 55: Rules set by the NRA for the migration process and copper switch-off – alternative wholesale access products – part 1 (FR, GR, HU).....	91

Table 56: Rules set by the NRA for the migration process and copper switch-off – alternative wholesale access products – part 1 (IT, LI, LU).....	92
Table 57: Rules set by the NRA for the migration process and copper switch-off – alternative wholesale access products – part 1 (NO, PL, PT)	93
Table 58: Rules set by the NRA for the migration process and copper switch-off – alternative wholesale access products – part 1 (SI, ES, SE)	94
Table 59: Rules set by the NRA for the migration process and copper switch-off – alternative wholesale access products – part 2 (BE, HR, CY)	95
Table 60: Rules set by the NRA for the migration process and copper switch-off – alternative wholesale access products – part 2 (CZ, EE, FI).....	95
Table 61: Rules set by the NRA for the migration process and copper switch-off – alternative wholesale access products – part 2 (FR, GR, HU)	96
Table 62: Rules set by the NRA for the migration process and copper switch-off – alternative wholesale access products – part 2 (IT, LI, LU).....	96
Table 63: Rules set by the NRA for the migration process and copper switch-off – alternative wholesale access products – part 2 (NO, PL, PT)	97
Table 64: Rules set by the NRA for the migration process and copper switch-off – alternative wholesale access products – part 2 (SI, ES, SE)	97
Table 65: Rules set by the NRA for the migration process and copper switch-off – migration costs (BE, HR, CY)	98
Table 66: Rules set by the NRA for the migration process and copper switch-off – migration costs (CZ, EE, FI)	99
Table 67: Rules set by the NRA for the migration process and copper switch-off – migration costs (FR, GR, HU).....	100
Table 68: Rules set by the NRA for the migration process and copper switch-off – migration costs (IT, LI, LU)	101
Table 69: Rules set by the NRA for the migration process and copper switch-off – migration costs (NO, PL, PT).....	102
Table 70: Rules set by the NRA for the migration process and copper switch-off – migration costs (SI, ES, SE)	103
Table 71: Rules set by the NRA for the migration process and copper switch-off – information of the SMPO and monitoring 1 (BE, HR, CY)	104
Table 72: Rules set by the NRA for the migration process and copper switch-off – information of the SMPO and monitoring (CZ, EE, FR).....	105
Table 73: Rules set by the NRA for the migration process and copper switch-off – information of the SMPO and monitoring (FI, GR, HU)	106
Table 74: Rules set by the NRA for the migration process and copper switch-off – information of the SMPO and monitoring (IT, LI).....	107
Table 75: Rules set by the NRA for the migration process and copper switch-off – information of the SMPO and monitoring (LU, NO, PL).....	108
Table 76: Rules set by the NRA for the migration process and copper switch-off – information of the SMPO and monitoring (PT, SI).....	109
Table 77: Rules set by the NRA for the migration process and copper switch-off – information of the SMPO and monitoring (ES, SE)	110

Table 78: Rules set by the NRA for the migration process and copper switch-off – further rules (BE, HR, CY).....	111
Table 79: Rules set by the NRA for the migration process and copper switch-off – further rules (CZ, EE, FR)	112
Table 80: Rules set by the NRA for the migration process and copper switch-off – further rules (FI, GR, HU).....	113
Table 81: Rules set by the NRA for the migration process and copper switch-off – further rules (IT, LI, LU).....	114
Table 82: Rules set by the NRA for the migration process and copper switch-off – further rules (NO, PL, PT)	115
Table 83: Rules set by the NRA for the migration process and copper switch-off – further rules (SI, ES, SE)	116
Table 84: Rules set by the NRA for the migration process and copper switch-off – permission to close MDFs (BE, HR, CY).....	117
Table 85: Rules set by the NRA for the migration process and copper switch-off – permission to close MDFs (CZ, EE, FR).....	118
Table 86: Rules set by the NRA for the migration process and copper switch-off – permission to close MDFs (FI, GR, HU)	119
Table 87: Rules set by the NRA for the migration process and copper switch-off – permission to close MDFs (IT, LI, LU)	120
Table 88: Rules set by the NRA for the migration process and copper switch-off – permission to close MDFs (NO, PL, PT).....	121
Table 89: Rules set by the NRA for the migration process and copper switch-off – permission to close MDFs (SI, ES, SE).....	122
Table 90: SMPO's framework for migration and copper switch-off (HU, IT, LI)	123
Table 91: SMPO's framework for migration and copper switch-off (PT, SI, SE).....	124
Table 92: Incentives for end-users and migration issues (BE, NO, PT)	125
Table 93: Incentives for end-users and migration issues (SI, SE).....	126

Annex Basic data of the report (as of June 2021)

Annex 1: Basic data used in section 2

Table 1: Overview questions (AT, BE, BG, HR, CY, CZ, DK, EE, FI, FR, DE, GR, HU, IE, IT)

Country	Did the SMP operator already announce/inform that it plans to switch-off its legacy copper access network e.g. close MDFs?	Did the SMP operator already close (phase out, no longer use) copper-based network elements (e.g. MDFs)?	Did the NRA already set rules (e.g. in market analysis procedure) for the migration process and copper switch-off (e.g. closure of MDFs)?
Austria	No	No	No
Belgium	Yes	Yes	Yes
Bulgaria	No	No	No
Croatia	Yes ⁴³	No ⁴⁴	Yes
Cyprus	No	No	Yes
Czech Republic	No	No	Yes
Denmark	No	No	No
Estonia	Yes	Yes	Yes
Finland	Yes	Yes	No ⁴⁵
France	Yes ⁴⁶	No ⁴⁷	Yes ⁴⁸
Germany	No	No	No
Greece	Yes	No	Yes
Hungary	Yes	No	Yes
Ireland	Yes	No	No
Italy	Yes	No ⁴⁹	Yes

Source: BEREC

⁴³ SMPO does not yet plan to close MDFs (or SCs) and information when it will close how many MDFs is not available.

⁴⁴ SMPO closed only one MDF in a pilot project announced in 2013.

⁴⁵ No, however some rules in national law that guides the NRA

⁴⁶ At the end of 2019, Orange, the SMPO expressed its wish to switch-off its legacy copper access network

⁴⁷ Orange, has already proceeded to the commercial closure of some copper offers, but has not yet proceeded to any technical closure.

⁴⁸ Arcep set rules in its market analysis (see decisions n° 2020-1446, n° 2020-1447 and n° 2020-1448)

⁴⁹ No. Currently only 62 MDFs have been announced by TIM and approved to be closed in 24 months (2023). 6.000 LEXs planned to be closed in 2023 (but not still announced and approved).

Table 2: Overview questions (KO, LV, LI, LT, LU, MT)

Country	Did the SMP operator already announce/inform that it plans to switch-off its legacy copper access network e.g. close MDFs?	Did the SMP operator already close (phase out, no longer use) copper-based network elements (e.g. MDFs)?	Did the NRA already set rules (e.g. in market analysis procedure) for the migration process and copper switch-off (e.g. closure of MDFs)?
Kosovo	No	No	No
Latvia	No	No	No
Liechtenstein	Yes ⁵⁰	Yes ⁵¹	Yes ⁵²
Lithuania	No	No ⁵³	No ⁵⁴
Luxembourg	Yes	Yes	Yes
Malta	Yes	Yes ⁵⁵	No

Source: BEREC

⁵⁰ In Liechtenstein, the passive network infrastructure (ducts, backhaul glass fibre, access copper/glassfibre, HFC-coax, collocations...) is vertically separated from the service provision. The national utility (Liechtensteinische Kraftwerke, LKW) builds and offers the passive network infrastructure. LKW has no other activities in the telecom wholesale or retail markets. Each service provider, including the incumbent, rents infrastructure from LKW at regulated conditions).

⁵¹ The phase out is done on a local base, i.e. on access lines level. Basically 12 months after installation of the FTTH building entry point, the old copper and coax lines of the building are disconnected/removed. This removal might be done in an aggregated manner by street / by group of several buildings. The FTTH network has a P2P design, i.e. individual glass fibres from the optical distribution to the units of usage (apartment or business premises).

⁵²Partly. The NRA took note of the FTTH-project of LKW, and informally approved the provisional offer for glass fibre access lines of the network provider LKW, regarding transparency, non-discrimination and some pricing aspects of setup services. The NRA approved the amendment of the standard offer for copper access lines, whereby LKW can terminate and decommission existing individual copper lines on an area-by-area basis no earlier than 12 months after the FTTH lines have been installed. The formal authorisation of a standard offer with cost-oriented price regulation (as part of the market analysis procedure) will follow when the FTTH network is completed and the entire cost information is available.

⁵³ The SMPO does not plan to switch-off its legacy copper access network. In areas where there is no fiber access, usually copper (ADSL or VDSL) is used. There is also a hybrid access ADSL+ 4G because our SMPO is also a mobile service provider. The migration took place a few years ago and is not happening at the moment. The SMPO only performs individual project connections for customers, not migration.

⁵⁴ No special rules have been set by the NRA. However, these processes are regulated by The Rules for Delivery and Provision of Access, including Interconnection of Networks. According to the Paragraph 48 of The Rules, "The provider must notify the user on the end of the time periods of operation of each network element, to which the Access is provided and its composite parts in writing not later than 36 months before the date of expiry of the corresponding time period of operation. In case the provider is able to offer the user Access, analogical in terms of the price and technical characteristics in the same geographical location, in which the Access, the provision of which is planned to be terminated, is provided to the user, the provider must notify the user on the issue in writing not later than 12 months before the date of expiry of the corresponding term of operation."

⁵⁵ A small number of Street Cabinets

Table 3: Overview questions (ME, NL, NO, PL, RO, SK, SI, ES, SE, CH)

Country	Did the SMP operator already announce/inform that it plans to switch-off its legacy copper access network e.g. close MDFs?	Did the SMP operator already close (phase out, no longer use) copper-based network elements (e.g. MDFs)?	Did the NRA already set rules (e.g. in market analysis procedure) for the migration process and copper switch-off (e.g. closure of MDFs)?
Montenegro	Yes ⁵⁶	No	No
Netherlands	N/A ⁵⁷	N/A ⁵⁸	N/A ⁵⁹
Norway	Yes	Yes	Yes ⁶⁰
Poland	Yes	Yes	Yes ⁶¹
Portugal	Yes	Yes	Yes
Romania	N/A ⁶²	N/A ⁶²	N/A ⁶²
Slovakia	Yes, partially	No	No
Slovenia	Yes	Yes	Yes
Spain	Yes	Yes	Yes
Sweden	Yes ⁶³	Yes ⁶⁴	Yes ⁶⁵
Switzerland	Yes ⁶⁶	Yes ⁶⁷	No ⁶⁸

Source: BEREC

⁵⁶ SMPO has planned to start the copper switch-off last month. The aim is removing of copper cables and street cabinets that have no active users, in Podgorica firstly, and in other municipalities after.

⁵⁷ In 2020, the Dutch court annulled ACM's analysis of markets 3a/2014 and 3b/2014. Since then, there is no SMP operator on the Dutch market. KPN (the former SMP operator) has closed 6 MDF as part of a pilot. KPN plans to switch-off of copper in all areas where FttH has been deployed in 2023. The details for these plans are yet to be confirmed.

⁵⁸ See footnote 57. KPN (the former SMPO) has closed 6 MDF locations as part of a pilot.

⁵⁹ See footnote 57. Currently there is no regulation on market 1 (3a/2014) in the Netherlands.

⁶⁰ NRA have laid down rules on a general level on this.

⁶¹ Only general rules within access obligations imposed on markets 3a&3b/2014

⁶² Actually, there is no SMP in Romania since the 3a/2014 and 3b/2014 markets were deregulated.

⁶³ SMPO have informed of the MDFs being closed at SMPOs specific homepage. The process was initiated at 2009, and it's planned to be finalised in 2026.

⁶⁴ The SMPO have initiated the dismantling of the copper-based network and associated network elements at some sites or MDFs. The process for dismantling the copper-based network has during the years been optimised to minimise environmental impact and improve in effectiveness.

⁶⁵ In SMP-obligation information of time frame of information to ANOs etc is stated.

⁶⁶ The SMP has already begun with the copper switch-off several years ago and has already made progress. However, the NRA does not monitor the switch-off in detail. An increase in customer complaints has not yet been observed in this area.

⁶⁷ The NRA is aware of closures. However, it does not monitor this development in detail either.

⁶⁸ The legislature has not issued any rules for the copper switch-off. There are also no plans to introduce new rules in this regard.

Table 4: Status of NGA migration (BE, HR; EE)

Country	Belgium	Croatia	Estonia
What percentage of the SMP operator's (SMPO's) active subscriber access lines (retail and wholesale) are based on			
• FTTH (no copper)?	[0-5]%	12.84%	Confidential
• FTTC/B/street/distribution point (part of the copper loop is used)?	[70-75]%	5.05%	Confidential
• FTTEEx (full copper loop is used)?	[5-10]%	82.11%	Confidential
• Cable/HFC?	[0]% (only the incumbent SMP is considered)	0%	0%
• Other type of access (which?)?	[15-20]% (These are voice-only services)	0%	0%
What percentage of the subscriber access lines of the active (in use) SMPO's wholesale access lines (WAPs) are based on:			
• FTTH (no copper)?	[0-5]%	20.8%	SMPO wholesale access lines number is very low
• FTTC/B/street/distribution point (part of the copper loop is used)?	[85-90]%	5.0%	-
• FTTEEx (full copper loop is used)?	[5-10]%	74.2%	-
• Other type of access (which?)?	[0-5]%	0	-
What was the trend in the migration to NGA (e.g. FTTC/B/H) in the past years?	VDSL2 is readily widely available, migration towards FTTH will follow as copper in residential cases will be outphased.	In the past years migration to FTTC/B occurred in limited urban and suburban areas in case of loops longer than the average. In urban and suburban areas SMPO focused more on FTTH deployments. Rural areas, are mostly subject to state aid where FTTH solution is preferred.	Mainly increase in FTTH
Other relevant information regarding the status of NGA migration?	No	No	-

Source: BEREC

Table 5: Status of NGA migration (FI, FR, GR)

Country	Finland	France	Greece
What percentage of the SMP operator's (SMPO's) active subscriber access lines (retail and wholesale) are based on			
• FTTH (no copper)?	8%	38%	0.56%
• FTTC/B/street/distribution point (part of the copper loop is used)?	43%	0%	38.06%
• FTTEEx (full copper loop is used)?	0%	62%	61.4%
• Cable/HFC?	24%	0%	0%
• Other type of access (which?)?	25% (copper: ADSL and PSTN)	0%	0%
What percentage of the subscriber access lines of the active (in use) SMPO's wholesale access lines (WAPs) are based on:			
• FTTH (no copper)?	Not available, data will be collected later this year	43%	0.16%
• FTTC/B/street/distribution point (part of the copper loop is used)?	Not available, data will be collected later this year	11%	28.49%
• FTTEEx (full copper loop is used)?	Not available, data will be collected later this year	45%	71.10%
• Other type of access (which?)?	Not available, data will be collected later this year	0%	0%
What was the trend in the migration to NGA (e.g. FTTC/B/H) in the past years?	Only a minority of copper networks are migrated to fibre networks	There is a migration from FTTC/B and from FTTEEx to FTTH this year that follow the increase of FTTH availability. The number of active subscriber access lines of FTTC/B and FTTEEx have fallen from 23,7 million on the 31st of December 2018 to 19,6 million on the 31st of December 2021.	The SMPO migrates its subscribers to NGA, in all areas it deploys NGA network. Very limited migration from the OLOs.
Other relevant information regarding the status of NGA migration?	NGA migration is taking place in major cities, elsewhere 4G/5G is the main substitute	No	-

Source: BEREC

Table 6: Status of NGA migration (HU, IE, IT)

Country	Hungary	Ireland ⁶⁹	Italy
What percentage of the SMP operator's (SMPO's) active subscriber access lines (retail and wholesale) are based on			
• FTTH (no copper)?	24.6%	17%	2%
• FTTC/B/street/distribution point (part of the copper loop is used)?	9.4%	66%	55%
• FTTEEx (full copper loop is used)?	36.9%	0%	43%
• Cable/HFC?	28.9%	0%	0%
• Other type of access (which?)?	0.24%	17% ⁷⁰	1% (FWA)
What percentage of the subscriber access lines of the active (in use) SMPO's wholesale access lines (WAPs) are based on:			
• FTTH (no copper)?	67.1%	13.5%	0.2%
• FTTC/B/street/distribution point (part of the copper loop is used)?	0.2%	70%	65.2%
• FTTEEx (full copper loop is used)?	6.7%	0%	34.6%
• Other type of access (which?)?	26.0% (Cable/HFC)	16.5% ⁷¹	-
What was the trend in the migration to NGA (e.g. FTTC/B/H) in the past years?	FTTH, HFC	Slight rise in FTTC growth year on year. Sharp growth in FTTH deployment from a low base.	A relevant path of migration from copper-based service toward NGA (FTTC, FTTH, FWA services) has been registered in the recent years. Between 2019 and 2020, copper services decreased by 10.7%, whereas FTTC +6.6%, FTTH +3.0% and FWA +1.1% increased
Other relevant information regarding the status of NGA migration?	-	-	-

Source: BEREC

⁶⁹ at End Dec 2020⁷⁰ ADSL⁷¹ ADSL

Table 7: Status of NGA migration (LI, LU, MT)

Country	Liechtenstein ⁷²	Luxembourg	Malta
What percentage of the SMPO's active subscriber access lines (retail and wholesale) are based on			
• FTTH (no copper)?	N/A ⁷²	56% of Internet Access Lines over Fibre	34.2%
• FTTC/B/street/distribution point (part of the copper loop is used)?	N/A ⁷²	44% of Internet Access Lines over DSL (street cabinet or central office)	3.8% (both broadband and voice connected to outside cabinets)
• FTTEEx (full copper loop is used)?	N/A ⁷²	See above	27.9%
• Cable/HFC?	N/A ⁷²	0%	-
• Other type of access (which?)?	N/A ⁷²	0%	Hybrid ⁷³ 29.8%, Mobile – 4.3%
What percentage of the subscriber access lines of the active (in use) SMPO's wholesale access lines (WAPs) are based on:			
• FTTH (no copper)?	50% ⁷⁴	No information	100%
• FTTC/B/street/distribution point (part of the copper loop is used)?	0% ⁷⁴	No information	-
• FTTEEx (full copper loop is used)?	30% ⁷⁴	No information	-
• Other type of access (which?)?	20% ⁷⁴	No information	-
What was the trend in the migration to NGA (e.g. FTTC/B/H) in the past years?	The glass fibre roll-out was initiated in 2018 and will reach national coverage by the end of 2022.	-	During the past three years the following number of connections were provisioned on fibre : 2019 – 12,296; 2020 – 11,143; 2021 – 11,789
Other relevant information regarding the status of NGA migration?	By the end of 2020, 70% of the utilization units (apartments and commercially used spaces) were connected to the FTTH network, take rate of 59% ⁷⁵	-	-

Source: BEREC

⁷² In Liechtenstein, the passive network infrastructure (ducts, backhaul glass fibre, access copper/glassfibre, HFC-coax, collocations...) is vertically separated from the service provision. The national utility (Liechtensteinische Kraftwerke, LKW) builds and offers the passive network infrastructure. LKW, as network provider, has no other activities in the telecom wholesale or retail markets. Each service provider, including the incumbent, rents infrastructure from LKW at regulated conditions. There are no other network infrastructures of national coverage. Questions are answered for the national network provider LKW.

⁷³ Mainly lines with voice connected to an Exchange and broadband to connected to outdoor DSLAM

⁷⁴ The percentage refers to LKW's wholesale access lines (passive infrastructure only) currently used by service providers.

⁷⁵ Take Rate: Ratio of units utilizing glass fibre vs. units connected to glass fibre.

Table 8: Status of NGA migration (NL, NO, PT)

Country	Netherlands ⁷⁶	Norway	Portugal
What percentage of the SMP operator's (SMPO's) active subscriber access lines (retail and wholesale) are based on			
• FTTH (no copper)?	29%	Q42020: 39%, Q12021:41%	Confidential
• FTTC/B/street/distribution point (part of the copper loop is used)?	32%	N/A	No
• FTTEEx (full copper loop is used)?	39%	Q42020: 27%, Q12021:24% (note: includes SMPOs own copper access, and whosale xDSL and LLU)	No
• Cable/HFC?	-	Q42020: 26%, Q12021: 27%	0%
• Other type of access (which?)?	-	Q42020: FWA 8%, Q1 2021: FWA 9%	Confidential
What percentage of the subscriber access lines of the active (in use) SMPO's wholesale access lines (WAPs) are based on:			
• FTTH (no copper)?	24%	15%	N/A
• FTTC/B/street/distribution point (part of the copper loop is used)?	76%	NA	N/A
• FTTEEx (full copper loop is used)?	-	85%	N/A
• Other type of access (which?)?	-		All SMPO's wholesale access lines are based on copper. However, these wholesale access lines (supported on LLU and wholesale bitstream offers) represent less than 2% of all retail broadband access lines.
What was the trend in the migration to NGA (e.g. FTTC/B/H) in the past years?	-	Copper to FTTH	Migration to fibre has been supporting none stand-alone offers in particular by the main operators that also own mobile networks.
Other relevant information regarding the status of NGA migration?	-	-	Migration in Portugal has been gradual and is happening on a voluntary basis

Source: BEREC

⁷⁶ Data for KPN (the former SMPO)

Table 9: Status of NGA migration (SK, SI, ES, SE)

Country	Slovakia	Slovenia	Spain	Sweden
What percentage of the SMP operator's (SMPO's) active subscriber access lines (retail and wholesale) are based on				
• FTTH (no copper)?	38%	49 %	70% (all data as of April 2021)	Q4 2020: 24 %
• FTTC/B/street/distribution point (part of the copper loop is used)?	-	0%	2%	N/A
• FTTEEx (full copper loop is used)?	61% - ADSL/VDSL	50 %	26%	Q42020: 19%
• Cable/HFC?	1% - coaxial	1%	0%	N/A
• Other type of access (which)?	-	-	2%, radio FWA	Mobile/FWA
What percentage of the subscriber access lines of the active (in use) SMPO's wholesale access lines (WAPs) are based on:				
• FTTH (no copper)?	13,012	50 %	78%	2%
• FTTC/B/street/distribution point (part of the copper loop is used)?	12,262	0 %	N/A. A small fraction of the 22% (next item) are from FTTN.	N/A
• FTTEEx (full copper loop is used)?	83,155	50 %	22%	25%
• Other type of access (which)?	-	-	0%	
What was the trend in the migration to NGA (e.g. FTTC/B/H) in the past years?	+ 20k /year	The trend in the migration to NGA was mostly FTTH	There is a clear trend towards FTTH. Fixed broadband lines based on copper have fallen in the last 5 years from 53.7% to 11.5%, whereas based on FTTH have increased from 26.6% to 73.2%.	Copper to FTTH
Other relevant information regarding the status of NGA migration?	Stop to prolong to xDSL in areas with FTTH overlap	-	<ul style="list-style-type: none"> • Other NGA networks, like HFC, do not experience increase. • There is no FTTC/FTTN/FTTB based NGA. • Several operators deploy their own FTTH networks. 	-

Source: BEREC

Table 10: Basic information on copper switch-off (BE, HR, EE)

Country	Belgium	Croatia	Estonia
What are the main reasons of the SMPO for the copper switch-off?	Reduction of costs, transition to high-speed fiber services	Only 1 MDF closed so far. Reason was reconfiguration of copper access network (shortening loops).	Infrastructure competition.
Which type of copper switch-off does the SMPO pursue:			
<ul style="list-style-type: none"> Switch-off of the full copper loop (e.g. migration to FTTH)? 	Yes, full switch-off when Fiber Zone is complete, but process still under discussion with BIPT	N/A (only 1 MDF closed, no information on when SMPO will close further MDFs)	We do not have information on SMPO strategies
<ul style="list-style-type: none"> Switch-off of part of the copper loop (e.g. migration to FTTC/B)? 	Yes, full LLU is already partly switched-off given that VDSL also uses ADSL-frequencies.	N/A (only 1 MDF closed, no information on when SMPO will close further MDFs)	We do not have information on SMPO strategies
To which alternative access network (FTTH, FTTB, FTTC, cable/HFC, FWA, mobile, other (which?)) the end-users are migrated to			
<ul style="list-style-type: none"> Primarily? 	VDSL2 & FTTH (where deployed)	N/A	We do not have information on SMPO strategies
<ul style="list-style-type: none"> Also to some extent? 	---	N/A	We do not have information on SMPO strategies

Source: BEREC

Table 11: Basic information on copper switch-off (FI, FR, GR)

Country	Finland	France	Greece
What are the main reasons of the SMPO for the copper switch-off?	Decommissioning of the copper network and using mobile networks instead. Both shift in technology to 4-5G and cutting costs.	Orange, the SMPO wants to close its copper network. Stakeholders agreed that maintaining two networks in parallel was not efficient.	Reasons for the planned copper switch-off are that it is not economically viable to keep both the legacy and the next generation access networks.
Which type of copper switch-off does the SMPO pursue:			
• Switch-off of the full copper loop (e.g. migration to FTTH)?	⁷⁷	Yes	In some MDFs, based on the footprint of the SMPO's FTTH network
• Switch-off of part of the copper loop (e.g. migration to FTTC/B)?	mainly FTTB ⁷⁷	No	In more cases
To which alternative access network (FTTH, FTTB, FTTC, cable/HFC, FWA, mobile, other (which?)) the end-users are migrated to			
• Primarily?	Switch to mobile technology ⁷⁷	FTTH	N/A (the migration has not started)
• Also to some extent?	Switch to fibre FTTB & FTTH ⁷⁷	-	-

Source: BEREC

⁷⁷ In Finland several operators have SMP and the type of copper switch-off pursued by the SMPOs differ. The three major SMPOs migrate to FTTB and cable in the larger cities and to mobile (4G, 5G and 5G FWA) in suburban areas and sparsely populated areas. Small local SMPOs migrate to FTTB/FTTH

Table 12: Basic information on copper switch-off (HU, IE, IT)

Country	Hungary	Ireland ⁷⁸	Italy
What are the main reasons of the SMPO for the copper switch-off?	Cost saving and utilization of unused real estates.	Rollout of their FTTH Network which overlap with their FTTC network. Also, National Broadband Project, funded by the state, will provide FTTH to rural premises over 0.5M the next 7 years	Main reasons are efficiency gain and opex reduction.
Which type of copper switch-off does the SMPO pursue:			
• Switch-off of the full copper loop (e.g. migration to FTTH)?	Yes, this is the current trend of migration.	Yes (Planned)	-
• Switch-off of part of the copper loop (e.g. migration to FTTC/B)?	Migration to FTTC was previously more significant.	-	YES, migration mainly to FTTC (FWA in residual cases)
To which alternative access network (FTTH, FTTB, FTTC, cable/HFC, FWA, mobile, other (which?)) the end-users are migrated to			
• Primarily?	FTTH	FTTH	FTTC
• Also to some extent?	cable/HFC	-	FWA

Source: BEREC

⁷⁸ at End Dec 2020

Table 13: Basic information on copper switch-off (LI, LU, MT)

Country	Liechtenstein ⁷⁹	Luxembourg	Malta
What are the main reasons of the SMPO for the copper switch-off?	Operational efficiency: Avoidance of maintenance cost of old copper network in addition to maintenance cost of new glass fibre access network.	No information	FTTH roll-out
Which type of copper switch-off does the SMPO pursue:			
• Switch-off of the full copper loop (e.g. migration to FTTH)?	Yes	Yes	Yes
• Switch-off of part of the copper loop (e.g. migration to FTTC/B)?	No	-	Only when necessary
To which alternative access network (FTTH, FTTB, FTTC, cable/HFC, FWA, mobile, other (which?)) the end-users are migrated to			
• Primarily?	FTTH	FTTH	FTTH (current)
• Also to some extent?	Rarely FTTB + in-building coax	-	FTTC (past years)

Source: BEREC

⁷⁹ In Liechtenstein, the passive network infrastructure (ducts, backhaul glass fibre, access copper/glassfibre, HFC-coax, collocations...) is vertically separated from the service provision. The national utility (Liechtensteinische Kraftwerke, LKW) builds and offers the passive network infrastructure. LKW, as network provider, has no other activities in the telecom wholesale or retail markets. Each service provider, including the incumbent, rents infrastructure from LKW at regulated conditions. There are no other network infrastructures of national coverage. Questions are answered for the national network provider LKW.

Table 14: Basic information on copper switch-off (NL, NO, PT)

Country	Netherlands ⁸⁰	Norway	Portugal
What are the main reasons of the SMPO for the copper switch-off?	Switch to FTTH. High maintenance costs	Modernization of the network Customers churning away from DSL based services	<ul style="list-style-type: none"> • Migration is a natural evolution due to developments that led to the obsolescence of the copper network; • Strong cost reductions are expected at several levels; • Potential profitability due to sale of assets (copper cables and central sites buildings); • Natural disasters, such as forest fires, can also act as a catalyst for migration (e.g. the 2017 tragic fires led to replacement of copper by optical fibre cables).
Which type of copper switch-off does the SMPO pursue:			
<ul style="list-style-type: none"> • Switch-off of the full copper loop (e.g. migration to FTTH)? 	Yes	Full switch-off	Yes
<ul style="list-style-type: none"> • Switch-off of part of the copper loop (e.g. migration to FTTC/B)? 	-	-	No
To which alternative access network (FTTH, FTTB, FTTC, cable/HFC, FWA, mobile, other (which?)) the end-users are migrated to			
<ul style="list-style-type: none"> • Primarily? 	FTTH	FTTH and FWA	FTTH
<ul style="list-style-type: none"> • Also to some extent? 	-	Mobile	Mobile (in the case of end-users that are customers of the SMPO) and Cable/HFC (in the case of end-users of ANO supported on copper wholesale offer).

Source: BEREC

⁸⁰ Data for KPN (the former SMPO)

Table 15: Basic information on copper switch-off (SK, SI, ES, SE)

Country	Slovakia	Slovenia	Spain	Sweden
What are the main reasons of the SMPO for the copper switch-off?	Churn prevention + Cost saving	High maintenance costs, age of cooper network, number of failures, end-users high speed demands, national NGN strategy etc.	The main reason is cost reduction. The copper network is obsolete, with expensive maintenance, and has progressively fewer active customers.	To ensure network quality, and to modernize the network to meet capacity demands, and of course economical reasons.
Which type of copper switch-off does the SMPO pursue:				
• Switch-off of the full copper loop (e.g. migration to FTTH)?	Yes	Yes	Yes.	Full switch-off
• Switch-off of part of the copper loop (e.g. migration to FTTC/B)?	No	No	No. There is no FTTC/FTTN/FTTB based NGA.	-
To which alternative access network (FTTH, FTTB, FTTC, cable/HFC, FWA, mobile, other (which?)) the end-users are migrated to				
• Primarily?	FTTH	FTTH	FTTH (SMPO network or from alternative operator)	FTTH and FWA
• Also to some extent?	FWA	Very few cases to mobile LTE network.	HFC (alternative operator), FWA	Mobile

Source: BEREC

Table 16: Current status of copper switch-off (BE, EE, FI)

Country	Belgium	Estonia	Finland
Did the SMPO already close (phase out, no longer use)			
• MDFs (Yes/No)?	Yes	Yes	Yes
• Street cabinets (SCs) (Yes/No)?	No (not massively at least, it may however be the case in the future as FTTH will be further rolled out and copper will be phased out)	Yes	Yes
• Other copper-based network elements (Yes(which?)/No)?	No	-	Yes (copper wire telephone lines)
In case the SMPO already closed MDFs:			
• How many MDFs did the SMPO have before the closing of any MDF?	590	No data	No information
• How many MDFs in total did the SMPO already close?	34	No data	No information
• Did the SMPO close not only MDFs but also MDF locations (Yes/No)?	Yes	No data	Yes
• If this is the case, what is the percentage of the MDFs the SMPO already closed in total, where it also closed the MDF location (%)?	Around 90%-95%, only the locations used for interconnection are remaining open	No data	No information
• When did the SMPO begin with closing MDFs?	2012	No data	Telia in 2008, others from 2015
Did the SMPO close so far (MDF size seen from the national/SMPO perspective)			
• Primarily its small or medium or large MDFs?	All sizes	No data	Primarily small and medium
• To some degree also MDFs of other sizes?	Potentially all sizes may be in scope, on a case-by-base basis.	No data	Yes, also large MDFs
In case the SMPO already closed SCs, approximately how many SCs did the SMPO close?	N/A	No data	No information ⁸¹
How many other copper-based network elements did the SMPO close?	N/A	No data	No information

Source: BEREC

⁸¹ In Finland there is only 281.000 ADSL subscriptions and 221.000 PSTN (31.12.2020) subscriptions left. Finland has had almost 3 million fixed copper lines in the beginning of the 1990's

Table 17: Current status of copper switch-off (LI, LU, MT)

Country	Liechtenstein	Luxembourg	Malta
Did the SMPO already close			
• MDFs (Yes/No)?	No (all 35 MDF are still in use)	No (but planning for phase-out announced)	No
• Street cabinets (SCs) (Yes/No)?	N/A. LKW does not use FTTC.	Yes	Yes
• Other copper-based network elements (Yes(which?)/No)?	Copper switch-off is done per building, group of buildings or street.	Yes, individual Copper Network Termination Points, poles and overhead networks, aging copper cables etc.	No
In case the SMPO already closed MDFs:			
• How many MDFs did the SMPO have before the closing of any MDF?	N/A	N/A	21
• How many MDFs in total did the SMPO already close?	N/A	N/A	0
• Did the SMPO close not only MDFs but also MDF locations (Yes/No)?	N/A	N/A	Relocations, but MDFs weren't switched-off: Sliema, Marsa, St. Paul's, Zebbug, San Gorg
• If this is the case, what is the percentage of the MDFs the SMPO already closed in total, where it also closed the MDF location (%)?	N/A	N/A	0
• When did the SMPO begin with closing MDFs?	N/A	N/A	2017 (relocation only)
Did the SMPO close so far (MDF size seen from the national/SMPO perspective)			
• Primarily its small or medium or large MDFs?	N/A	N/A	N/A
• To some degree also MDFs of other sizes?	N/A	N/A	Sliema/Marsa/San Gorg relocated from large MDFs to small MDFs
In case the SMPO already closed SCs, approximately how many SCs did the SMPO close?	N/A. LKW does not use FTTC	No information	A small number of SCs in Santa Lucija and in Zebbug Gozo
In case the SMPO already closed other copper-based network elements, approximately how many did the SMPO close?	LKW already switched off copper and coax access in some buildings: totally 4'600 copper and 2'400 coax.	No information	N/A

Source: BEREC

Table 18: Current status of copper switch-off (NL, NO, PT)

Country	Netherlands ⁸²	Norway	Portugal
Did the SMPO already close (phase out, no longer use)			
• MDFs (Yes/No)?	Yes	Yes	Yes
• Street cabinets (SCs) (Yes/No)?	No	Yes	Information not available.
• Other copper-based network elements (Yes(which?)/No)?	No	Yes	N/A
In case the SMPO already closed MDFs:			
• How many MDFs did the SMPO have before the closing of any MDF?	1361	4500	Higher than 1500 and lower than 2000.
• How many MDFs in total did the SMPO already close?	6	292	7
• Did the SMPO close not only MDFs but also MDF locations (Yes/No)?	No	Yes	Information not available.
• If this is the case, what is the percentage of the MDFs the SMPO already closed in total, where it also closed the MDF location (%)?	N/A	100%	Information not available.
• When did the SMPO begin with closing MDFs?	April '21	2016	June 2019
Did the SMPO close so far (MDF size seen from the national/SMPO perspective)			
• Primarily its small or medium or large MDFs?	Small. Up until now it's a pilot with only 6 relatively small MDFs.	Small	Information not available,
• To some degree also MDFs of other sizes?	-	Medium	Information not available.
In case the SMPO already closed SCs, approximately how many SCs did the SMPO close?	N/A	105	N/A
In case the SMPO already closed other copper-based network elements, approximately how many did the SMPO close?	N/A	17023 poles, 1066 km copper cable, 1022 standalone distribution boxes, 1907 equipment, 28 masts, 3 reflectors	N/A

Source: BEREC

⁸² Data for KPN (the former SMPO)

Table 19: Current status of copper switch-off (SI, ES, SE)

Country	Slovenia	Spain	Sweden
Did the SMPO already close (phase out, no longer use)			
• MDFs (Yes/No)?	Yes	Yes	Yes
• Street cabinets (SCs) (Yes/No)?	Yes	Yes	Yes
• Other copper-based network elements?	No	Yes. In exceptional and justified situations ⁸³	Poles and other physical infrastructure related to the copper-network.
In case the SMPO already closed MDFs:			
• How many MDFs did the SMPO have before the closing of any MDF?	Approximately 1070	There were 8867 exchange areas ⁸⁴	Approx. 8124 (value from year 2007)
• How many MDFs in total did the SMPO already close?	Approximately 30	759 exchange areas	Q1 2021 60% closed (Planned Q2 2022 73%)
• Did the SMPO close not only MDFs but also MDF locations (Yes/No)?	Yes	Yes	Yes
• If this is the case, what is the percentage of the MDFs the SMPO already closed in total, where it also closed the MDF location (%)?	On all locations where it closed MDF it also closed functional location	60%	100%
• When did the SMPO begin with closing MDFs?	In 2016	Notification in 2014 and closure in 2015	2009
Did the SMPO close so far (MDF size seen from the national/SMPO perspective)			
• Primarily its small or medium or large MDFs?	Small locations	Primarily small	Small/medium
• To some degree also MDFs of other sizes?	None	Also some medium ⁸⁵	-
In case the SMPO already closed SCs, approximately how many SCs did the SMPO close?	Approximately 10	No information	No information
In case the SMPO already closed other copper-based network elements, approximately how many did the SMPO close?	N/A	No information	No information

Source: BEREC

⁸³ Specific copper lines (sharing a common copper terminal box) have been switched-off (known as partial switch-off).⁸⁴ The relevant unit in copper switch-off is the exchange area. It consists of an MDF and possibly several associated street cabinets, or it may only consist of street cabinets (in some new creation areas, where there is no central exchange building).⁸⁵ The first 13 large ULL exchanges close during the second half of 2021.

Table 20: Future copper switch-off (BE, EE, FI)

Country	Belgium	Estonia	Finland
Does the SMPO plan to close (further)			
• MDFs (Yes/No)?	Yes	Yes	Yes
• SCs (Yes/No)?	Yes, in case when Fiber Zone is complete, but process still under discussion with BIPT	Yes	Yes
• Other copper-based network elements (Yes(which?)/No)?	No	No data	Yes, poles
• When will the SMPO close how many MDFs?	2021-2024: 27	No data	We have several SMPOs and they have different plans. Three small local operators have already switched fully to fibre.
• Will the SMPO close primarily its small or medium or large MDFs (MDF size seen from national/SMPO perspective)?	Smaller to medium sizes	No data	Generally first small and medium sized MDF's, but all will be closed eventually, most likely within 5 years.
• Which MDFs (its small, medium or large) will it close first which later?	No clear distinction made	No data	Large ones usually a bit later, but it may vary between operators
• Did the SMPO already announce when it will close all MDFs (Yes(when?)/No)?	No, only MDF eligible to closure are announced, no general closure is foreseen.	No data	From the beginning of 2021 they have an obligation to inform the NRA
• Does the SMPO plan to close not only MDFs but also MDF locations (Yes/No)?	Yes	No data	Yes
• If this is the case, what is the percentage of the MDFs the SMPO plans to close, where it will also close the MDF location (%)?	100%	No data	Not available
In case the SMPO plans to close (further) SCs, when will the SMPO close approximately how many?	2022-2024:40 (process still under discussion with BIPT)	No data	Not available
In case the SMPO plans to close (further) other copper-based network elements, when will the SMPO close which and approximately how many?	-	No data	Not available
Further information on the steps and timeline of the SMPO with regard to copper switch-off?	-	No data	Some operators have already closed down the copper network, some are doing within two years and some will do it a bit later.
			Within the first five months Traficom has received over 300 notifications from SMPOs to close down parts of networks covering 13.000 subscriptions.

Source: BEREC

Table 21: Future copper switch-off (FR, GR, HU)

Country	France	Greece	Hungary
Does the SMPO plan to close (further)			
• MDFs (Yes/No)?	Yes	Yes	Yes
• SCs (Yes/No)?	Yes	Yes	Yes
• Other copper-based network elements (Yes(which?)/No)?	-	-	No information
• When will the SMPO close how many MDFs?	See last question of the table.	19 MDFs in 2024 (5-year in advance notice in 2019)	6 MDFs in 2021, 490 MDFs in 2022, 2 MDFs in 2023 (according to a rolling forecast which may change over time)
• Will the SMPO close primarily its small or medium or large MDFs?	⁸⁶	Medium to large (average 30,000 subscribers per MDF)	No information
• Which MDFs (its small, medium or large) will it close first which later?	⁸⁶	The SMPO has not announced a detailed time plan.	No information
• Did the SMPO already announce when it will close all MDFs (Yes(when?)/No)?	Orange announced its wish to close all copper network by 2030	No	Yes, by 2025
• Does the SMPO plan to close not only MDFs but also MDF locations (Yes/No)?	No	The SMPO has not clarified whether it will keep the MDFs as PoPs.	No information
• If this is the case, what is the percentage of the MDFs the SMPO plans to close, where it will also close the MDF location (%)?	-	N/A	No information
In case the SMPO plans to close (further) SCs, when will the SMPO close approx..how many?	See last question of the table.	⁸⁷	8 SCs in 2021, 329 SCs in 2022
In case the SMPO plans to close (further) other copper-based network elements, when will the SMPO close which and approximately how many?	See last question of the table.	The SMPO has not made any announcements.	No information
Further information on the steps and timeline of the SMPO with regard to copper switch-off?	See last question of the table.	-	-
Other relevant information on the copper switch-off?	⁸⁸	⁸⁹	-

Source: BEREC

⁸⁶ Arcep set a closure trajectory in its market analysis which considers some criteria that ensure non-discriminatory principle between areas, see last question of the table⁸⁷ The SMPO has announced its intention to close a limited number of SCs due to technical reasons, not as a part of migration from the legacy network.⁸⁸ Orange has to set out a closure program with modalities and procedures for technical closure before any technical closure.⁸⁹ The copper switch-off procedure shall be examined in detail in the context of the forthcoming market analysis. EETT has already conducted a public consultation regarding this issue.

Table 22: Future copper switch-off (LU, IE)

Country	Luxembourg	Ireland
Does the SMPO plan to close (further)		
• MDFs (Yes/No)?	Yes	Yes
• SCs (Yes/No)?	Yes	Yes
• Other copper-based network elements (Yes(which?)/No)?	Yes, individual Copper NTP (Network Termination Points), poles and overhead networks, aging copper cables, ...	-
• When will the SMPO close how many MDFs?	5 until end of 2024, 4 more until end of 2025 (of total 49)	Unknown at this stage
• Will the SMPO close primarily its small or medium or large MDFs (MDF size seen from national/SMPO perspective)?	-	Unknown at this stage
• Which MDFs (its small, medium or large) will it close first which later?	-	Unknown at this stage
• Did the SMPO already announce when it will close all MDFs (Yes(when?)/No)?	No	No
• Does the SMPO plan to close not only MDFs but also MDF locations (Yes/No)?	Yes	Unknown at this stage
• If this is the case, what is the percentage of the MDFs the SMPO plans to close, where it will also close the MDF location (%)?	No information	N/A
In case the SMPO plans to close (further) SCs, when will the SMPO close approximately how many?	63 SC until end 2021, 50 SC more until end 2022. In total 325 SC have been announced to be closed before end of 2025.	Unknown at this stage
In case the SMPO plans to close (further) other copper-based network elements, when will the SMPO close which and approximately how many?	No information	-
Further information on the steps and timeline of the SMPO with regard to copper switch-off?	-	SMPO plan target migration completion in next 5 – 7 years ⁹⁰

Source: BEREC

⁹⁰ https://www.openeir.ie/wp-content/uploads/2021/03/White-paper_Leaving-a-Legacy.pdf

Table 23: Future copper switch-off (IT, LI)

Country	Italy	Liechtenstein
Does the SMPO plan to close (further)		
• MDFs (Yes/No)?	Yes	Yes
• SCs (Yes/No)?	No	N/A. LKW does not use FTTC
• Other copper-based network elements (Yes(which?)/No)?	Yes, when a LEX is switched off, also the copper cables from the LEX to the cabinet are switched off.	Yes. Copper switch-off is done per building, group of buildings or street, on access line level.
• When will the SMPO close how many MDFs?	TIM's plan published in 2018 considers about 6600 LEXs to be switched-off before the end of 2023.	The first closing will happen in 2021. By the beginning of 2024 all copper MDF will be closed.
• Will the SMPO close primarily its small or medium or large MDFs?	Primary small LEXs, a few medium LEXs	MDFs will be closed after copper has been switched off in all buildings connected to the MDF
• Which MDFs (its small, medium or large) will it close first which later?	No specific information provided by TIM on this point.	This depends on the FTTB roll out done municipality by municipality.
• Did the SMPO already announce when it will close all MDFs (Yes(when?)/No)?	Only a general plan has been published, see answer above.	Yes, by the beginning of 2024.
• Does the SMPO plan to close not only MDFs but also MDF locations (Yes/No)?	Yes	Yes
• If this is the case, what is the percentage of the MDFs the SMPO plans to close, where it will also close the MDF location (%)?	100%	in case of 19 of the 35 MDFs (54%) also the MDF location will be closed
When will the SMPO close approx how many SCs?	N/A	N/A. LKW does not use FTTC
In case the SMPO plans to close (further) other copper-based network elements, when will the SMPO close which and approximately how many?	When a LEX is switched off, also the copper cables from the LEX to the cabinet are switched off, in the same moment.	By the beginning of 2024 copper access lines of all buildings will be switched off.
Further information on the steps and timeline of the SMPO with regard to copper switch-off?	In the majority of LEXs under switch-off, OAOs use non-infrastructure services (bitstream) ⁹¹	Finalisation of FTTH roll-out by the end of 2022.

Source: BEREC

⁹¹ The total number of LEXs is 6.678; in 510 LEXs LLU services are used by ANOs, whereas in the remaining 6.168 LEXs traditional copper bitstream and WLR services are used.

Table 24: Future copper switch-off (MT, NL, NO)

Country	Malta	Netherlands ⁹²	Norway
Does the SMPO plan to close (further)			
• MDFs (Yes/No)?	Yes	Yes	Yes
• SCs (Yes/No)?	Yes	-	Yes
• Other copper-based network elements (Yes(which?)/No)?	Yes	-	Yes, poles, copper cables, distribution boxes, building, equipment, mast, reflectors
• When will the SMPO close how many MDFs?	Date not yet established	⁹³	170 by end 2022, and 4000 by 2026-2028 ⁹⁴
• Will the SMPO close primarily its small or medium or large MDFs?	All	No information	Small
• Which MDFs (its small, medium or large) will it close first which later?	Priority is not based on the size of the MDF.	No information	Small to large
• Did the SMPO already announce when it will close all MDFs?	No	No information	Yes by end of 2022
• Does the SMPO plan to close not only MDFs but also MDF locations (Yes/No)?	Yes	No information	Yes
• In how many cases (%) the SMPO will not only close MDFs but also MDF locations?	2% of total MDFs capacity	No information	67%
When will the SMPO close approximately how many SCs?	Date not yet established	-	31 by end 2022, and 850 by 2026-2028
When will the SMPO close (further) other copper-based network elements and approximately how many?	Date not yet established	-	⁹⁵
Further information on the steps and timeline?	⁹⁶	-	⁹⁷

Source: BEREC

⁹² Data for KPN (the former SMPO)⁹³ In 2023, all MDFs in areas where FTTH has been deployed. Details are yet to be confirmed.⁹⁴ The NRA imposed on Telenor the obligation to maintain the access to copper-based access networks to 2 September 2025. If Telenor works out a migration plan that can be approved by the NRA, Telenor can switch-off copper/close MDFs sooner than 2025 (and nearer to Telenor's own plan to switch off the copper network by end of 2022). Update Sept. 2021: Telenor submitted a draft plan for migration on 27 August 2021. Based on Nkom's assessment and inputs from access buyers, Nkom has concluded that there is not sufficient basis for further work on the plan. This means that Telenor must maintain the access to copper-based access networks to 2 September 2025.⁹⁵ By end 2022: 15900 poles, 975 km copper cable, 5000 standalone distribution boxes, 130 buildings, 1500 equipment, 50 masts, 25 reflectors

By 2026-2028: 265000 poles, 20600 km copper cable, 250000 standalone distribution boxes, 1700 buildings, 500 masts, 150 reflectors

⁹⁶ Long-term target is to switch-off copper completely but no fixed timelines have been established yet⁹⁷ The period between January 1st 2023 to after September 2025 there will be minor volumes switched off and dismantled due to regulation Telenor is instructed, by a decision by Nkom of September 2 2020, to keep the copper based infrastructure open for wholesale access in 5 years (until September 2 2025).

Table 25: Future copper switch-off (PL, PT, SK)

Country	Poland	Portugal	Slovakia
Does the SMPO plan to close (further)			
• MDFs (Yes/No)?	Yes	Yes	Yes
• SCs (Yes/No)?	Yes	N/A	Yes (MSANs)
• Other copper-based network elements (Yes(which?)/No)?	Yes (cables)	N/A	Yes
• When will the SMPO close how many MDFs?	No data available yet	⁹⁸	N/A
• Will the SMPO close primarily its small or medium or large MDFs?	No data available yet	Information not available.	Primary small
• Which MDFs (its small, medium or large) will it close first which later?	No data available yet	List of MDFs that will be closed up to 2026 is available in Annex 2 of the unbundling reference offer ⁹⁹	Small first
• Did the SMPO already announce when it will close all MDFs (Yes(when?)/No)?	No	Yes. Up to 2030	No
• Does the SMPO plan to close not only MDFs but also MDF locations (Yes/No)?	Yes	Yes (in the majority of cases)	Yes
• In how many cases (%) the SMPO will not only close MDFs but also MDF locations?	No data available yet	Information not available.	Approx. 70-80% of all
When will the SMPO close approximately how many SCs?	No data available yet	N/A	10 MSANs in 2021, 40 in 2022,
When will the SMPO close (further) other copper-based network elements and approximately how many?	No data available yet	N/A	Na
Further information on the steps and timeline?	Process shall start in 2021/2022	MEO announced a set of 360 central office to disconnect up to 2026.	Hard Migration Pilot in 2021. Rollout since 2022 – till 2040

Source: BEREC

⁹⁸ Until now MEO has already announced publicly and identified specifically the 360 central offices that is going to close around up to 2026. Additionally, MEO has already announced that it will close all central offices until 2030.

⁹⁹ <https://ptwholesale.pt/en/servicos-nacionais/capacidade/Pages/orall.aspx>

Table 26: Future copper switch-off (SI, ES, SE)

Country	Slovenia	Spain	Sweden
Does the SMPO plan to close (further)			
• MDFs (Yes/No)?	Yes	Yes	Yes
• SCs (Yes/No)?	Yes	Yes	Yes
• Other copper-based network elements (Yes(which?)/No)?	Yes (MSAN, EWSD, SI2000m, aerial cable)	Yes (copper terminal boxes)	Yes, most of the equipment which is used for the copper network.
• When will the SMPO close how many MDFs?	Approximately 200 MDFs to 2026	¹⁰⁰	No information
• Will the SMPO close primarily its small or medium or large MDFs?	Primarily small and medium MDFs	All	Small and medium
• Which MDFs (its small, medium or large) will it close first which later?	First small, then medium and later on large MDFs	Due to the longer notice periods (as they have ULL), large MDFs will close later. Small ones will close first.	Small to large
• Did the SMPO already announce when it will close all MDFs (Yes(when?)/No)?	No	The expectation is to fully deploy an alternative network to copper (FTTH+radio) by 2025.	Yes, planned to 2026
• Does the SMPO plan to close not only MDFs but also MDF locations (Yes/No)?	Yes	Yes	Yes
• If this is the case, what is the percentage of the MDFs the SMPO plans to close, where it will also close the MDF location (%)?	100 %. SMPO plans to close all MDFs where also MDF location will be closed.	The plan is to close all locations that are not MPoP (OLT locations) or core network locations.	No information
In case the SMPO plans to close (further) SCs, when will the SMPO close approximately how many?	Approximately 60 in 5 years	SCs contained in exchange areas will be close when the exchange closes. No explicit information for other SCs.	No information
In case the SMPO plans to close (further) other copper-based network elements, when will the SMPO close which and approximately how many?	Approximately 40 per year (SI2000, EWSD, MSAN, aerial cable)	Not available. Closure of these elements is not a planned process, but the result of specific circumstances and has to be approved by the NRA.	No information
Further information on the steps and timeline of the SMPO with regard to copper switch-off?	-	-	SMPO Telia closes approximately 40' lines per year.

Source: BEREC

¹⁰⁰ The currently notified schedule is (Year/total number of closed MDFs): 2015/2, 2016/16, 2017/48, 2018/191, 2019/402, 2020/476, 2021/1010, 2022/2252, 2023/2329, 2024/2909, 2025/3042, 2026/3044

Annex 2: Basic data used in section 3

Table 27: Rules set by the NRA for the migration process and copper switch-off – type of procedure, level and scope of the rules (BE,HR, CY)

Country	Belgium	Croatia	Cyprus
Which type of procedure did the NRA use for setting the rules:			
• Market analysis procedure (Yes(which market?)/No)?	Yes, market 3a/2014, 3b/2014 and 4/2014	Yes (market 3a/2014 and market M3b/2014)	Yes, market 3a/2014 and 3b/2014
• Other (Yes(which?)/No)?			
When did the NRA set the rules?	Most recently in the MA of 29/06/2018 (M3a and M3b) and in the MA of 13/12/2019 (M4)	The copper switch-off and migration rules were set in June 2019 as a part of SMPO regulatory obligations imposed by market analysis decisions.	Last market analysis decision Feb 2017
Did the NRA set the rules for the copper switch-off at the level (granularity) of the			
• MDF (MDF closure)(Yes/No)?	Yes	Yes ¹⁰¹	Yes
• SC (SC closure)(Yes/No)?	No	No	Yes
• Other (Yes(which?)/No)?	-	-	-
In which area did the NRA set rules for the copper switch-off:			
• Where the incumbent has SMP and access remedies are imposed on the incumbent (Yes/No)?	Yes	Yes	Yes
• Only in some parts of this area (Yes/No)?	N/A, no geographic distinction applies wrt. access remedies	No	-
• Also in other areas (Yes/No)?	N/A, no geographic distinction applies wrt. access remedies	No	-

Source: BEREC

¹⁰¹ Switching off and migration rules are set in general for all MDF's. So, if MDF's satisfy one or more conditions set of migration rules are applicable to all these MDF's. Besides full switch off rules, the NRA also set migration rules for reconfiguration of copper access network (i.e. closing old MDF and opening a new node with shorter copper loops) or opening a new FTTC node which is still connected with old MDF(which is not closed).

Table 28: Rules set by the NRA for the migration process and copper switch-off – type of procedure, level and scope of the rules (CZ, EE, FI)

Country	Czech Republic	Estonia	Finland
Which type of procedure did the NRA use for setting the rules:			
• Market analysis procedure (Yes(which market?)/No)?	Yes. 3a/2014 market remedies.	Yes, in market 3a/2014	No. A market analysis will however be carried out later, probably 2022
• Other (Yes(which?)/No)?	No	No	In the updated law, article 81 c, there are rules on the notification of copper switch-off and the powers of the NRAs for imposing obligations on SMPOs
When did the NRA set the rules?	05/2018	2017	Rules set by the government and the parliament.
Did the NRA set the rules for the copper switch-off at the level (granularity) of the			
• MDF (MDF closure)(Yes/No)?	No ¹⁰²	Overall switch-off rules, no special refer to MDF.	No
• SC (SC closure)(Yes/No)?	No ¹⁰²	Overall switch-off rules, no special refer to SC.	No
• Other (Yes(which?)No)?	No ¹⁰²	-	No
In which area did the NRA set rules for the copper switch-off:			
• Where the incumbent has SMP and access remedies are imposed on the incumbent (Yes/No)?	Yes.	Yes	To be decided. So far no separate decision on a SMP operator.
• Only in some parts of this area (Yes/No)?	No	No	A possible decision will cover the area the operator has notified that switch-off will take place
• Also in other areas (Yes/No)?	No	No	-

Source: BEREC

¹⁰² Copper switch-off rules apply to the entire copper access network and do not refer to a certain level as e.g. MDF or street cabinet.

Table 29: Rules set by the NRA for the migration process and copper switch-off – type of procedure, level and scope of the rules (FR, GR, HU)

Country	France	Greece	Hungary
Which type of procedure did the NRA use for setting the rules:			
• Market analysis procedure (Yes(which market?)/No)?	Yes ¹⁰³	Yes, market 3a/2014.	Yes, market 3a/2014
• Other (Yes(which?)/No)?	No	-	-
When did the NRA set the rules?	2020	22.12.2016	2017
Did the NRA set the rules for the copper switch-off at the level (granularity) of the			
• MDF (MDF closure)(Yes/No)?	Yes	Yes	Yes
• SC (SC closure)(Yes/No)?	Yes	Yes	Yes
• Other (Yes(which?)No)?	Shared access point	No	No
In which area did the NRA set rules for the copper switch-off:			
• Where the incumbent has SMP and access remedies are imposed on the incumbent (Yes/No)?	Yes, so at the national level.	Yes	Yes
• Only in some parts of this area (Yes/No)?	No	No	No
• Also in other areas (Yes/No)?	No	No	No

Source: BEREC

¹⁰³ (i) market of wholesale local access provided at a fixed location (market 3a/2014) (ii) market of wholesale central access provided at a fixed location for mass-market products (market 3b/2014).(iii) market of wholesale high-quality access provided at a fixed location (market 4/2014)

Table 30: Rules set by the NRA for the migration process and copper switch-off – type of procedure, level and scope of the rules (IT, LI, LU)

Country	Italy	Liechtenstein	Luxembourg
Which type of procedure did the NRA use for setting the rules:			
• Market analysis procedure (Yes(which market?)/No)?	Yes	No	Yes (market 3a/2014, 3b/2014)
• Other (Yes(which?)/No)?	Technical forum with stakeholders held by AGCOM before the market analysis.	¹⁰⁴	No
When did the NRA set the rules?	In 2019 in the framework of market analysis	December 2018	03 2019
Did the NRA set the rules for the copper switch-off at the level (granularity) of the			
• MDF (MDF closure)(Yes/No)?	Yes	-	Yes
• SC (SC closure)(Yes/No)?	No	-	Yes
• Other (Yes(which?)No)?	No	Copper access lines	Yes (for individual NTP/addresses)
In which area did the NRA set rules for the copper switch-off:			
• Where the incumbent has SMP and access remedies are imposed on the incumbent (Yes/No)?	Yes	Yes	Yes
• Only in some parts of this area (Yes/No)?	No	No	No (no area differentiation is made)
• Also in other areas (Yes/No)?	No	No	No

Source: BEREC

¹⁰⁴ The NRA approved the amendment of the standard offer for copper access lines, whereby LKW can terminate and decommission existing individual copper lines on an area-by-area basis no earlier than 12 months after the FTTH lines have been installed. Approval upon request of LKW.

(NRA decision: https://www.llv.li/files/ak/20181211-lkw_genehmigung-tal-kupfer-15.pdf)

Table 31: Rules set by the NRA for the migration process and copper switch-off – type of procedure, level and scope of the rules (NO, PL)

Country	Norway	Poland
Which type of procedure did the NRA use for setting the rules:		
• Market analysis procedure?		Yes (market 3a&3b/2014)
• Other (Yes(which?)/No)?	Yes ¹⁰⁵	No
When did the NRA set the rules?	2 September 2020	2019
Did the NRA set the rules for the copper switch-off at the level (granularity) of the		
• MDF (MDF closure)(Yes/No)?	¹⁰⁶	No
• SC (SC closure)(Yes/No)?		No
• Other (Yes(which?)/No)?		No
In which area did the NRA set rules for the copper switch-off:		
• Where the incumbent has SMP and access remedies are imposed on the incumbent?	Yes (at a national level)	Yes
• Only in some parts of this area (Yes/No)?	-	No
• Also in other areas (Yes/No)?	-	No

Source: BEREC

¹⁰⁵ Decision to amend the decisions in Markets 3a and 3b – Obligation to maintain access to copper-based access networks. The most important elements of the decisions, are the following: Obligation on Telenor to maintain the access to copper-based access networks to 2 September 2025.

Prior to this date, Telenor may decommission copper-based accesses if Telenor offers relevant replacement products to the access buyers, in line with a migration plan approved by Nkom. Telenor is responsible for preparing a draft plan for migration. Access buyers should have the opportunity to provide both verbal and written input to the plan. The plan should, as a minimum, show how Telenor will ensure that: (i) all relevant information concerning the process for the decommissioning of copper in various different geographical areas can be communicated at the same time, and with the same content and level of detail, to all copper customers in the relevant area, while also ensuring that it is the access buyers, and not Telenor, who inform their existing copper customers in this respect; (ii) access buyers have the same opportunities as Telenor's retail activity to continue their customer relationships with existing copper customers, irrespective of which access solution Telenor chooses to offer as a replacement for copper access in various different geographical areas; and (iii) access buyers have the opportunity to sell and deliver replacement products to their copper customers, based on a new access solution adopted by Telenor for a given area, as from the same dates as Telenor's retail activity. Update Sept. 2021: Telenor submitted a draft plan for migration on 27 August 2021. Based on Nkom's assessment and inputs from access buyers, Nkom has concluded that there is not sufficient basis for further work on the plan. This means that Telenor must maintain the access to copper-based access networks to 2 September 2025.

¹⁰⁶ The rules for the copper switch-off applies for the entire copper access network, irrespective of MDF- or SC-level

Table 32: Rules set by the NRA for the migration process and copper switch-off – type of procedure, level and scope of the rules (PT, SI)

Country	Portugal	Slovenia
Which type of procedure did the NRA use for setting the rules:		
• Market analysis procedure?	Yes	Market 1/2020
• Other (Yes(which?)/No)?	No	No
When did the NRA set the rules?	March 2017, in the context of the analysis of market 3a/2014	2011, updated 2017. New update is planned in new analysis, decision expected in 2021.
Did the NRA set the rules for the copper switch-off at the level (granularity) of the		
• MDF (MDF closure)(Yes/No)?	Yes. ¹⁰⁷	Yes
• SC (SC closure)(Yes/No)?	No	Yes
• Other (Yes(which?)No)?		Copper line when used by ANO
In which area did the NRA set rules for the copper switch-off:		
• Where the incumbent has SMP and access remedies are imposed on the incumbent?	Yes.	Yes
• Only in some parts of this area (Yes/No)?	N/A	No
• Also in other areas (Yes/No)?	N/A	No

Source: BEREC

¹⁰⁷ ANACOM has set out notice periods for the closure of copper exchanges and wholesale access conditions that must be met as a pre-condition for the closure of exchanges.

Table 33: Rules set by the NRA for the migration process and copper switch-off – type of procedure, level and scope of the rules (EE, SE)

Country	Spain	Sweden
Which type of procedure did the NRA use:		
• Market analysis procedure ?	Yes (former markets 4/2007 and 3a/2014, current market 1/2020)	-
• Other?	No	¹⁰⁸
When did the NRA set the rules?	Rules were set 2009. They were modified 2016 and 2021.	2020-06-08 (SMP dnr15-7200)
Did the NRA set the rules for the copper switch-off at the level (granularity) of the		
• MDF (MDF closure)(Yes/No)?	Yes. Rules are defined for an exchange area (an MDF and all copper elements, like SCs, within its coverage area). Some exchange areas consist only of SCs (no MDF)	The rules for the copper switch-off are set for the copper network at national level.
• SC (SC closure)?	Single SCs can also be switched off	-
• Other?	¹⁰⁹	-
In which area did the NRA set rules:		
• Where the incumbent has SMP and access remedies are imposed on the incumbent?	Yes	Yes
• Only in some parts of this area?	No	No
• Also in other areas (Yes/No)?	No	No

Source: BEREC

¹⁰⁸ Yes: No obligation in Sweden for SMPO to offer alternative access to network (i.e. fibre, FWA, etc) due to court of law decision in 2007 (dnr.05-1072/23). Rules set by SMP-regulation in market 3a/2014. SMPO Telia have to inform ANOs in advance for future copper dismantling plans. This information timespan was previous set to 5 years (SMP-regulation dnr. 11-9306), supervisory case in 2016 concluded this time period too long, as this will not affect the competition and market situation in such an extent that it will justify this time period. This set the time period to 18 months, which now is set in SMP-obligation (dnr. 15-7200). Furthermore, the information should be clear and precise, and should at least inform of year and month of the planned dismantling time and MDFs. SMPO inform their customers / end users at least within one year before the copper switch-off. Plan for copper-switch-off is published at "Framtidens Nät" at SMPOs website. SMPO perform analysis of prerequisites for each site and local conditions as alternative networks, mobile coverage etc. Urge for ANO to be proactive and in those cases there's no internal solution at SMPO for specific MDF or customers, SMPO urge for contacting operator-neutral customer service which is set up for the copper switch-off, and should look at possible solution at local level. SMPO estimate approximately 0.1 % (in 2020) of the customers affected by the copper switch-off can't have a successful alternative solution in SMPOs networks. In those cases where no successful alternative solution in SMPOs networks can be found there are other network provider which in some cases can offer alternatives. This can be local or municipal networks, mobile operators, satellite-based services etc. If no solution can be found NRA PTS have the universal service regulation which gives consumers right to connection to a public communication network for voice and data at 10 Mbps. The NRA and SMPO have meetings each quarter to monitor the progress and outcome of the copper switch-off process.

¹⁰⁹ Copper terminal boxes (typically servicing a building or group of buildings) can be switched off under explicit request (known as partial switch-off).

Table 34: Rules set by the NRA for the migration process and copper switch-off – stakeholder involvement (BE, HR, CY)

Country	Belgium	Croatia	Cyprus
Did the NRA involved stakeholders when it set the rules?	Yes	Yes ¹¹⁰	No ¹¹¹
If this is the case, which stakeholders (apart from involving all stakeholders in a public consultation):			
• SMPO?	No, mostly during the public consultation of the market analysis	Yes	See above
• ANOs?		Yes	See above
• Associations of network operators?		Yes	See above
• Consumer organisations?		Yes	See above
• Other (Yes(which?)/(No)?	-		See above
How did the NRA involve the stakeholders:			
• Party in the procedure?	No		No
• Public consultation?	Yes	Yes	Yes
• Workshops?	No		No
• Technical forum?	No		No
• Other (Yes(which?)/(No)?	-		-
Which concerns (if any) did the stakeholders express about the forced instead of a voluntary switch-off:			
• ANOs?	No significant remarks, mainly concerning the notification period (reduced from 5yrs to 2 yrs)	No concerns expressed	They proposed specific timeframes for MDF and SC switch off
• Consumer organisations?	No	No concerns expressed	No
• Others (which?)?	No	No concerns expressed	No
What other view/position did the stakeholders express			
• SMPO?	N/A	¹¹²	N/A
• ANOs?	N/A	No other view	N/A
• Consumer organisations?	N/A	-	N/A
• Others (which?)?	N/A		N/A

Source: BEREC

¹¹⁰ The rules set by market analysis decision were subject to public consultations so all stakeholders were able to participate¹¹¹ The rules were set only in Public Consultation where stakeholders had the chance to provide comments¹¹² SMPO wanted more flexibility in the process of switching off of the copper network. For a notice period of six months instead of five years, for switching off of the parts of copper access networks with very long loops and few active end users.

Table 35: Rules set by the NRA for the migration process and copper switch-off – stakeholder involvement (CZ, EE, FI)

Country	Czech Republic	Estonia	Finland
Did the NRA involved stakeholders (SMPO, ANOs, others) when it set the rules?	Yes.	Yes, through market 3a national consultation.	¹¹³
If this is the case, which stakeholders (apart from involving all stakeholders in a public consultation):			
• SMPO?	Yes.	Yes	-
• ANOs?	Yes.	Yes	-
• Associations of network operators?	Yes.	Yes	-
• Consumer organisations?	Yes.	No	-
• Other (Yes(which?))/(No)?	No.	No	-
How did the NRA involve the stakeholders:			
• Party in the procedure?	No	-	-
• Public consultation?	Yes	Yes	-
• Workshops?	No	-	-
• Technical forum?	No	-	-
• Other (Yes(which?))/(No)?	No	-	-
Which concerns (if any) did the stakeholders express about the forced instead of a voluntary switch-off:			
• ANOs?	No	No concerns	-
• Consumer organisations?	No	No concerns	-
• Others (which?)?	No	No concerns	-
What other view/position did the stakeholders express			
• SMPO?	SMPO proposed clarification of the definition of cases to which the notification period applies. SMPO proposed to apply notification period to FTTH/B, not to FTTC topology.	No other views	
• ANOs?	One ANO proposed to prolong notification period up to 5 years.	No other views	
• Consumer organisations?	No.	No other views	
• Others (which?)?	No.		

Source: BEREC

¹¹³ Traficom has discussed the implementation of the law with SMPO and ANOs, but no more rules have been set by Traficom. Traficom may make decisions based on the law.

Table 36: Rules set by the NRA for the migration process and copper switch-off – stakeholder involvement (FR, GR, HU)

Country	France	Greece	Hungary
Did the NRA involved stakeholders (SMPO, ANOs, others) when it set the rules?	Yes, all stakeholders by public consultations	¹¹⁴	Yes.
How did the NRA involve the stakeholders:			
• Party in the procedure?	-	-	-
• Public consultation?	Yes	Yes	Yes.
• Workshops?	-	-	-
• Technical forum?	-	-	-
• Other (Yes(which?)/(No)?	-	-	-
Which concerns (if any) did the stakeholders express about the forced instead of a voluntary switch-off:			
• ANOs?	¹¹⁵	¹¹⁶	-
• Consumer organisations?	-	-	-
• Others (which)?	-	-	-
What other view/position did the stakeholders express			
• SMPO?	Orange wanted a straightforward procedure.	¹¹⁷	¹¹⁸
• ANOs?	Others operators wanted a strong control over the fulfilment of the criteria.		-
• Consumer organisations?	-		-

Source: BEREC

¹¹⁴ Yes, in the context of the public consultation for market 3a/2014. As part of the preparation of the next round, EETT conducted a new public consultation in May 2021.

¹¹⁵ Stakeholders agreed that maintaining two networks in parallel was not efficient

¹¹⁶ The following were expressed during EETT's public consultation in 2021. These shall be taken into account in the forthcoming analysis of market 1/2020: (i) High costs of the migration on the ANOs. The SMPO to take some of the costs, such as the one-off migration fee for the subscribers moving from the legacy network to the NGA network. (ii) The NRA to coordinate the procedure (iii) Transparency: Details about the SMPO strategy in the issue. Detailed information about the status of the network and the procedure. (iv) Availability of the appropriate wholesale products. (v) KPIs for monitoring the procedure. (vi) Copper switch-off to take place also in areas that ANOs deploy NGA networks.

¹¹⁷ The stakeholders will have the opportunity to express their views during the public consultation in the new round of market analysis.

¹¹⁸ To inform NRA in advance 12 months is too long (if colocation occurs), not proportionate it should be reduced to 6 months.

Table 37: Rules set by the NRA for the migration process and copper switch-off – stakeholder involvement (IT, LI, LU)

Country	Italy	Liechtenstein	Luxembourg
Did the NRA involved stakeholders when it set the rules?	Yes	Yes: SMPO (LKW requesting amendment of the standard offer for copper access lines)	Yes (during public consultation)
If this is the case, which stakeholders (apart from involving all stakeholders in a public consultation):			
• SMPO?	Yes	Yes	-
• ANOs?	Yes		-
• Associations of network operators?	Yes		-
• Consumer organisations?	No ¹¹⁹ .		-
• Other (Yes(which?)/(No)?	No		Competition Authority
How did the NRA involve the stakeholders:			
• Party in the procedure?	No	Yes	-
• Public consultation?	Yes		Yes
• Workshops?	No		-
• Technical forum?	Yes		-
• Other (Yes(which?)/(No)?	No		-
Which concerns (if any) did the stakeholders express about the forced instead of a voluntary switch-off:			
• ANOs?	¹²⁰	Time pressure of switching customers in a pre-defined period.	-
• Consumer organisations?	NA		-
• Others (which?)?	NA		-
What other view did the stakeholders express			
• SMPO?	¹²¹		-
• ANOs?	¹²²	¹²³	-
• Consumer organisations?	N/A		-

¹¹⁹ Public consultation was opened to all potential participants, but no consumer organisation provided contributions

¹²⁰ ANOs stressed that a switch-off process is a strategic choice by the SMP operator, it is not requested by the market, and it may have some negative effects on the level of competition and on customer's experience (due to forced migration toward not requested services). Instead, a natural process is more gradual and avoid the risk of anti-competitive behaviour of the incumbent. Moreover, also effects on the customers are mitigated if only voluntary migration is allowed.

¹²¹ SMPO expressed the request to allow switch-off in a shorter timeframe.

¹²² ANOs requested to delay the switch-off process in order to allow a more gradual migration of customers.

¹²³ Incumbent was unhappy with short 12 months period for switching after installation of FTTH connection to the building. Opted for 36 months, but did not succeed at LKW. Did not request a formal procedure at NRA.

Table 38: Rules set by the NRA for the migration process and copper switch-off – stakeholder involvement (NO, PL, PT, SI)

Country	Norway	Poland	Portugal	Slovenia
Did the NRA involved stakeholders when it set the rules?	Yes ¹²⁴	No	Yes	Yes
If this is the case, which stakeholders (apart from involving all stakeholders in a public consultation):				
• SMPO?	Yes	N/A	No	Yes
• ANOs?	Yes	N/A	No	Yes
• Associations of network operators?	-	N/A	No	No
• Consumer organisations?	Yes	N/A	No	No
• Other (Yes(which?)/(No)?	-	N/A	No	No
How did the NRA involve the stakeholders:				
• Party in the procedure?	-	N/A	Yes (in the context of administrative procedure code)	Yes
• Public consultation?	Yes	N/A	Yes	Yes
• Workshops?	-	N/A	No	No
• Technical forum?	-	N/A	No	No
• Other (Yes(which?)/(No)?	-	N/A	No	Dedicated questionnaire
Which concerns (if any) did the stakeholders express about the forced instead of a voluntary switch-off:				
• ANOs?	¹²⁵	N/A	N/A	No
• Consumer organisations?	¹²⁶	N/A	N/A	No
• Others (which?)?	-	N/A	N/A	No
What other view/position did the stakeholders express				
• SMPO?	-	N/A	Wanted a shorter notification period.	Notice period is too long
• ANOs?	-	N/A	Agreed and/or asked for more information.	¹²⁷
• Consumer organisations?	-	N/A	N/A	No

Source: BEREC

¹²⁴ The SMPO is responsible for making a draft plan for migration from the copper network. The ANOs have the opportunity to provide both verbal and written input to the plan

¹²⁵ Failure to offer replacement products could result in a significant reduction of competition in the retail market for fixed broadband access.

¹²⁶ (i) No alternatives to copper accesses for some end users (ii) Concerns about the quality of the replacement products compared to services provided over the copper network.

¹²⁷ (i) Copper is replaced by P2MP optics which cannot be unbundled; VULA is hardly equivalent product, more like bitstream, which is not on the same market, prices are higher for worse service (ii) required switch to fiber without costs (iii) SMPO should reimburse proportionate part of investments of ANO in co-location

Table 39: Rules set by the NRA for the migration process and copper switch-off – stakeholder involvement (ES, SE)

Country	Spain	Sweden
Did the NRA involved stakeholders?	Yes	Yes, ¹²⁸
If this is the case, which stakeholders (apart from involving all stakeholders in a public consultation):		
• SMPO?		x
• ANOs?		x
• Associations of network operators?		
• Consumer organisations?		x
• Other (Yes(which?)/(No)?	All stakeholders involved in the public consultation of the market analysis	Yes, in some cases county or municipal representatives
How did the NRA involve the stakeholders:		
• Party in the procedure?	Yes	
• Public consultation?	Yes	x
• Workshops?		
• Technical forum?		
• Other (Yes(which?)/(No)?		
Which concerns (if any) did the stakeholders express about the forced instead of a voluntary switch-off:		
• ANOs?	Some operators considered that closure of a exchange should only happen when all users have moved to fibre	Reduced competition and lack of alternative replacement wholesale product.
• Consumer organisations?		¹²⁹
• Others (which?)?		
What other view/position expressed		
• SMPO?	¹³⁰	
• ANOs?	¹³¹	
• Consumer organisations?		

Source: BEREC

¹²⁸ NRA have had continuous dialog with the stakeholders and planned meetings to follow the ongoing process.¹²⁹ Lack of alternative solutions for some customers. Reduces quality and robustness in mobile based alternatives.¹³⁰ (i) The frame makes network migration difficult (ii) 5 years notice period is too long

There should be an automatic extension if the SMPO maintains copper customers at the end of the process in a exchange

¹³¹ (i) Continuity of retail services in the exchange should be ensured (ii) 5 years notice period is too short (iii) Permission for closure should be granted for each MDF one by one (iv) Migration should be free.

Table 40: Rules set by the NRA for the migration process and copper switch-off – NGA rollout and notice period (BE, HR, CY)

Country	Belgium	Croatia	Cyprus
Do the rules set by the NRA permit copper switch-off only in case a certain NGA rollout is reached (Yes/No)?	No, there is no threshold defined. SMP can proceed when an alternative service is provided	No	No. There is no such provision.
If this is the case:			
• Which NGA architecture)?	N/A	-	N/A
• When?	N/A	-	N/A
If this is not the case, why not?	-	¹³²	-
Which notice period did the NRA impose on the SMPO with regard to migration process and copper-switch-off?	See below	¹³³	¹³⁴
What is the notice period if:			
• ANOs (at least one ANO) use copper-based ULL provided by the SMPO?	At least 2 years, unless there is a mutual agreement	5 years (except migration procedure is agreed between SMPO and ANOs)	3 years. The SMP needs to provide though an equivalent wholesale access
• ANOs use only bitstream and/or VULA provided by the SMPO which continue to be available at the same PoH after MDF closure (however, not based on the copper line which will be closed)?	At least 1 year, unless there is a mutual agreement in case of bitstream	5 years (except migration procedure is agreed between SMPO and ANOs)	There is no notice period as existing ANOs are not affected. The SMPO has to provide information on the expansion of the Fibre optic network for a window period of 3 years
• ANOs do not use any copper-based WAP provided by the SMPO?	At least 1 year	6 months	¹³⁵
Does the notice period depend on whether the SMPO provides a fully equivalent WAP (Yes/No)?	No, this is an absolute requirement for the switch-off or MDF closure	-	No it is a general requirement

Source: BEREC

¹³² SMPO had not shown intentions for copper switch off, even in the areas covered with FTTH networks, due to low utilization of newly deployed FTTH networks. SMPOs copper network allows NGA speeds even without significant investments due to relatively short loops. Therefore, copper switch off could be expected only in limited areas covered with FTTH.

¹³³ Notice period is five years in advance, except in case different agreement with ANOs is reached. There is an exception where notice period can be six months if SMPO switches off loops longer than 2000 m. Also, there is an additional exception, when SMPO is allowed to switch off copper access network with a notice period shorter than five years. This exception refers to the switch off in the isolated areas (islands for instance) with very small number of end users on very long loops

¹³⁴ The SMP should not switch off any copper elements without informing the Commissioner and the ANOs. The notice period will be agreed between the Commissioner, SMP and the ANOs who already have access to copper based wholesale products and the SMP needs to provide an equivalent wholesale access product.

¹³⁵ There is no notice period. The SMP needs to provide though an equivalent wholesale access The SMP operator has to provide also information on the expansion of the Fibre optic network for a window period of three (3) years.

Table 41: Rules set by the NRA for the migration process and copper switch-off – NGA rollout and notice period (CZ, EE, FI)

Country	Czech Republic	Estonia	Finland
Do the rules set by the NRA permit copper switch-off only in case a certain NGA rollout is reached (Yes/No)?	Yes.	No ¹³⁶	No
If this is the case:			
• Which NGA architecture (e.g. FTTC/B/H) needs to be rolled out to what extent (e.g. 80/90/100% homes passed or retail subscriptions)?	FTTx, copper line can be rolled out, when is replaced by optical line, no more details were set.	N/A	N/A
• When (at the at the end of the notice period)?	End of notice period.	N/A	N/A
If this is not the case, why not?	N/A	-	The copper network can be replaced by a mobile network (4G or 5G)
Which notice period did the NRA impose on the SMPO with regard to migration process and copper-switch-off?	One year notice period. Copper line can be switched off after notice period expired and optical line is available.	SMPO is obliged to notify the other communications undertakings using the corresponding copper pair access network at least 6 months in advance.	The SMP operator must notify the NRA 6 months in advance of the switch-off.
What is the notice period if:			
• ANOs (at least one ANO) use copper-based ULL provided by the SMPO?	One year. Line is disconnected. Optical line is available for unbundling.	SMPO is obliged to notify the other communications undertakings using the corresponding copper pair access network at least 6 months in advance.	6 months
• ANOs use only bitstream and/or VULA provided by the SMPO which continue to be available at the same PoH after MDF closure (however, not based on the copper line which will be closed)?	One year. Bitstream service would be then switched and then provided via new optical infrastructure.		
• ANOs do not use any WAP provided by the SMPO based on the copper local loop of the MDF the SMPO will close?	One year.		
Does the notice period depend on whether the SMPO provides a fully equivalent WAP (Yes/No)?	No	No	No

Source: BEREC

¹³⁶ The only rules are: If SMPO replaces the copper paired access network with a fibre cable access network, SMPO is obliged to provide to other telecommunications operators access to new fibre cable or access to the duct to install new fibre cable. SMPO is obliged to notify the other communications undertakings using the corresponding copper pair access network at least 6 months in advance.

Table 42: Rules set by the NRA for the migration process and copper switch-off – NGA rollout and notice period (FR, GR, HU)

Country	France	Greece	Hungary
Do the rules set by the NRA permit copper switch-off only in case a certain NGA rollout is reached (Yes/No)?	Yes	¹³⁷	Yes
If this is the case:			
• Which NGA architecture (e.g. FTTC/B/H) needs to be rolled out to what extent?	FttH (100%)	-	¹³⁸
• When (at the beginning, during or at the end of the notice period)?	¹³⁹	-	12 months before the switch-off. 6 months if wholesale services not used
If this is not the case, why not?	-	-	-
Which notice period did the NRA impose on the SMPO with regard to migration process and copper-switch-off?	36 months in all cases.	-	24 months before the switch-off, or 6 months wholesale services not used.
What is the notice period if:			
• ANOs (at least one ANO) use copper-based ULL provided by the SMPO?	-	-	24 months
• ANOs use only bitstream and/or VULA provided by the SMPO which continue to be available at the same PoH after MDF closure?	-	-	24 months
• ANOs do not use any copper-based WAP provided by the SMPO?	-	-	6 months
Does the notice period depend on whether the SMPO provides a fully equivalent WAP (Yes/No)?	No ¹⁴⁰	-	No ¹⁴¹

Source: BEREC

¹³⁷ According to the current rules, two in advance notice periods have been defined: (i) Five years for MDF closure (ii) Eighteen months for other significant changes (such as SCs closure). Detailed rules shall be considered in the new round of market analysis.

¹³⁸ All types of NGA networks (FTTC/B/H, HFC); There is no percentage determined for homes passed or subscriptions, there is a general rule that the area of the copper switch-off has to be covered by the alternative NGA network.

¹³⁹ At the end of the notice period for commercial closure of the copper offers at the MDF level. At the beginning of the notice period for commercial closure of the copper offers at the shared access point level.

¹⁴⁰ The SMP operator is only allowed to close MDF if a fully equivalent wholesale access product is available on the FTTH network, however, this access product does not need to be provided by the SMPO itself.

¹⁴¹ The SMPO is obliged to provide an alternative WAP before the copper switch off, so notice periods are not differentiated this way.

Table 43: Rules set by the NRA for the migration process and copper switch-off – NGA rollout and notice period (IT, LI, LU)

Country	Italy	Liechtenstein	Luxembourg
Do the rules set by the NRA permit copper switch-off only in case a certain NGA rollout is reached (Yes/No)?	Yes	Yes	Yes
If this is the case:			
• Which NGA architecture to what extent (e.g. 80/90/100% homes passed or retail subscriptions)?	100% of NGA coverage (FTTC, FTTH or FWA in marginal cases)	100% FTTB rollout ¹⁴²	Availability of Fibre LLU or VULA over Fibre
• When (at the beginning, during or at the end of the notice period)?	At the beginning of the notice period	At the beginning of the notice period	-
If this is not the case, why not?	-	-	N/A
Which notice period did the NRA impose on the SMPO with regard to migration process and copper-switch-off?	¹⁴³	At least 12 months, on the level of the building of the end-user ¹⁴⁴	See below
What is the notice period if:			
• ANOs (at least one ANO) use copper-based ULL provided by the SMPO?	See above	At least 12 months, on access line level (see above answer)	5 years
• ANOs use only bitstream and/or VULA provided by the SMPO which are still available after MDF?	See above	n/a (bitstream is not offered by SMPO LKW)	5 years
• ANOs do not use any WAP provided by the SMPO based on the copper local loop of the MDF the closed?	See above	N/A ¹⁴⁵	1 year
Does the notice period depend on whether the SMPO provides a fully equivalent WAP (Yes/No)?	No ¹⁴⁶	No	No

Source: BEREC

¹⁴² However, FTTB only needs to be rolled out to the building(s) in which the SMPO wants to close the copper-based building entry point.

¹⁴³ After the achievement of 100% NGA coverage and the minimum level of NGA take-up (60%), local exchanges can be started to be switched-off after a minimum period of X months: (i) 24 months in the white areas, (ii) 18 months in other areas with LLU/SLU/VULA services, (iii) 12 months in other areas with only bitstream services.

¹⁴⁴ In Liechtenstein the networks of the network operators end at the building of the end-user (do not include the in-building network) and the NRA set the rules on the level of the building of the end-user. The NRA approved the amendment of the reference offer for copper access lines, whereby the SMPO (LKW) can terminate and decommission existing copper lines on an area-by-area basis no earlier than 12 months after the FTTH lines have been installed. (NRA decision: https://www.llv.li/files/ak/20181211-lkw_genehmigung-tal-kupfer-15.pdf)

¹⁴⁵ The SMPO operates the passive network infrastructure (e.g. ducts, fibre) which is vertically separated from the service provision, therefore, the service providers use its infrastructure.

¹⁴⁶ For each wholesale legacy service, a corresponding wholesale NGA service is available (of at least comparable quality). Only for some specific services (with decreasing demand), a substituting service is not available (WLR and CS/CPS services). However, the notice period is not influenced by the availability of substitution services.

Table 44: Rules set by the NRA for the migration process and copper switch-off – NGA rollout and notice period (NO, PL)

Country	Norway	Poland
Do the rules set by the NRA permit copper switch-off only in case a certain NGA rollout is reached (Yes/No)?	No	No
If this is the case:		
• Which NGA architecture to what extent (e.g. 80/90/100% homes passed or retail subscriptions)?	N/A	N/A
• When (at the beginning, during or at the end of the notice period)?	N/A	N/A
If this is not the case, why not?	-	-
Which notice period did the NRA impose on the SMPO with regard to migration process and copper-switch-off?	Notice periods deemed redundant in light of obligation on Telenor to maintain the access to copper-based access networks to 2 September 2025 .	See below
What is the notice period if:		
• ANOs (at least one ANO) use copper-based ULL provided by the SMPO?	-	3 months
• ANOs use only bitstream and/or VULA provided by the SMPO which are still available after MDF closure?	-	2 years
• ANOs do not use any WAP provided by the SMPO based on the copper local loop of the MDF the closed?	-	2 years
Does the notice period depend on whether the SMPO provides a fully equivalent WAP (Yes/No)?	-	No

Source: BEREC

Table 45: Rules set by the NRA for the migration process and copper switch-off – NGA rollout and notice period (PT, SI)

Country	Portugal	Slovenia
Do the rules set by the NRA permit copper switch-off only in case a certain NGA rollout is reached (Yes/No)?	No	No
If this is the case:		
• Which NGA architecture to what extent (e.g. 80/90/100% homes passed or retail subscriptions)?	N/A	N/A
• When (at the beginning, during or at the end of the notice period)?	N/A	N/A
If this is not the case, why not?	¹⁴⁷	¹⁴⁸
Which notice period did the NRA impose on the SMPO with regard to migration process and copper-switch-off?	¹⁴⁹	¹⁵⁰
What is the notice period if:		
• ANOs (at least one ANO) use copper-based ULL provided by the SMPO?	The above mentioned notice periods are applicable to MDF with co-located operators.	2 years for MDF, 6 months for individual copper line
• ANOs use only bitstream and/or VULA provided by the SMPO which are still available after MDF closure?	N/A	6 months
• ANOs do not use any WAP provided by the SMPO based on the copper local loop of the MDF the closed?	N/A	6 months
Does the notice period depend on whether the SMPO provides a fully equivalent WAP (Yes/No)?	Yes ¹⁵¹	No ¹⁵²

Source: BEREC

¹⁴⁷ Migration rules are related with provision of detailed/timely information on SMPO copper access network development, and depends on the impact on the SMPO wholesale customers' (e.g., percentage of copper lines to deactivate).

¹⁴⁸ (i) If ANOs are not present on MDF, SMPO can switch-off copper, however SMPO must provide end users universal service with 10Mb/s DL speed (ii) If ANOs are present on MDF, SMPO can switch-off certain copper line only if there is at least the equivalent service available from SMPO or open network providers

¹⁴⁹ ANACOM set a 5-year notice period for total switch-off of an MDF, with co-located operators. If an equivalent wholesale access is guaranteed, this notice period can be reduced to 3 years.

ANACOM has also set shorter notice periods in case of deactivation of loops (for reasons attributable to MEO) in exchanges with co-located operators (these notice periods depend on the percentage of loops to deactivate comparing to the total number of active accesses on the MDF).

¹⁵⁰ 2 years announcement obligation for closing MDF (6 months for individual copper line) in case the ANOs are present. 6 months for closing MDF if ANOs are not present.

¹⁵¹ In case the SMPO does provide such an alternative WAP notice period may be reduced to 3 years, otherwise the notice period is 5 years.

¹⁵² Fully equivalent WAP is required if ANO is present (SMPO is not allowed to switch off if ANO is present and there is no equivalent WAP)

Table 46: Rules set by the NRA for the migration process and copper switch-off – NGA rollout and notice period (ES, SE)

Country	Spain	Sweden
Do the rules set by the NRA permit copper switch-off only in case a certain NGA rollout is reached (Yes/No)?	No. The first set of rules (2009) included such a condition (25% of customers in the exchange area should not use copper). It was dropped in the 2016 market revision.	No
If this is the case:		
• Which NGA architecture to what extent (e.g. 80/90/100% homes passed or retail subscriptions)?	N/A	N/A
• When (at the beginning, during or at the end of the notice period)?	N/A	N/A
If this is not the case, why not?	¹⁵³	-
Which notice period did the NRA impose on the SMPO with regard to migration process and copper-switch-off?	¹⁵⁴	No obligation for alternative solution. 18 months for information to ANO.
What is the notice period if:		
• ANOs (at least one ANO) use copper-based ULL provided by the SMPO?	2 years (5 years until 2021).	
• ANOs use only bitstream and/or VULA provided by the SMPO which are still available after MDF closure?	1 year	
• ANOs do not use any WAP provided by the SMPO based on the copper local loop of the MDF the closed?	6 months	
Does the notice period depend on whether the SMPO provides a fully equivalent WAP (Yes/No)?	No ¹⁵⁵	

Source: BEREC

¹⁵³ Such a clause was introduced 2009 as a safeguard measure, in order to avoid damage to competition by strategic exchange closures. However, it was removed 2016, as the growth of FTTH was so strong that copper could no longer compete with fibre, and the trend to migration to FTTH was clear. The risk of strategic closures was non-existent.

¹⁵⁴ After an exchange area is announced for copper switch-off, it enters a guarantee period with this notice periods: (i) Exchange with ULL: 5 years. Note: the ongoing market review proposes to reduce it to 2 years. (ii) Exchange with no ULL but bitstream: 1 year (iii) Exchange (or SC) with no wholesale services: 6 months. During the guarantee period, the reference offer (RUO) applies fully. After the guarantee period, if copper is still in use, the exchange area enters a guard period, of 6 months. During this time additional copper customers are not accepted, existing ones must be migrated. At the end of this period, existing copper connections can be terminated and the use of copper must cease.

¹⁵⁵ The broadband market is subject to geographical segmentation. Equivalent (actually, better) alternative WAP, based on fibre, is available on a regulated basis in certain areas only. In competitive areas, no such regulated WAP exists. In non-competitive areas, such a regulated product is available.

Table 47: Rules set by the NRA for the migration process and copper switch-off – legacy wholesale access products (BE, HR, CY)

Country	Belgium	Croatia	Cyprus ¹⁵⁶
Which legacy WAPs of the SMPO will after the copper switch-off (e.g. MDF closure) not any longer be available:			
• Copper-based ULL (Yes/No)?	No longer available	No	-
• Copper-based VULA with local PoH (Yes/No)? If “Yes”, on which access architecture (FTTEx/C/B) is it based on?	No longer available (because the MDF location will be closed). As of today, there is no uptake of VULA.	No	-
• Copper-based VULA with regional/national PoH (Yes/No)? If “Yes”, on which access architecture (FTTEx/C/B) is it based on?	Yes, FTTC remains available	No	-
• Copper-based bitstream with regional/national PoH (Yes/No)? If “Yes”, on which access architecture (FTTEx/C/B) is it based on?	Yes, FTTC remains available	No	-
• Other (Yes(which?)/No)?	-	-	-
Does the SMPO have to offer these legacy WAPs until the copper is switched off (e.g. MDF closure) (Yes/No)?	Yes	Yes	Yes ¹⁵⁷
If this is not the case:			
• How long does the SMPO have to offer these legacy WAPs?	N/A	N/A	N/A
• Why does the SMPO not have to offer these legacy WAPs until the copper is switched off (e.g. MDF closure)?	N/A	N/A	N/A

Source: BEREC

¹⁵⁶ It is not sure yet if MDF sites will fully close since several areas will may be served by DSLAMS at the MDF site.¹⁵⁷ But the SMPO may proceed with the termination of provision of such products within three (3) years from the public availability of the optical network in a specific area

Table 48: Rules set by the NRA for the migration process and copper switch-off – legacy wholesale access products (CZ, EE, FI)

Country	Czech Republic	Estonia	Finland
Which legacy WAPs of the SMPO will after the copper switch-off (e.g. MDF closure) not any longer be available:			
• Copper-based ULL (Yes/No)?	Yes	Yes	Yes
• Copper-based VULA with local PoH (Yes/No)? If “Yes”, on which access architecture (FTTEx/C/B) is it based on?	Yes	SMPO doesn't provide such service as demand doesn't exist	Yes
• Copper-based VULA with regional/national PoH (Yes/No)? If “Yes”, on which access architecture (FTTEx/C/B) is it based on?	Yes	SMPO doesn't provide such service as demand doesn't exist	Yes
• Copper-based bitstream with regional/national PoH (Yes/No)? If “Yes”, on which access architecture (FTTEx/C/B) is it based on?	Yes	Yes	Yes
• Other (Yes(which?)/No)?	No	-	-
Does the SMPO have to offer these legacy WAPs until the copper is switched off (e.g. MDF closure) (Yes/No)?	Yes	Yes	Yes
If this is not the case:			
• How long does the SMPO have to offer these legacy WAPs?	N/A	N/A	N/A
• Why does the SMPO not have to offer these legacy WAPs until the copper is switched off (e.g. MDF closure)?	N/A	N/A	N/A

Source: BEREC

Table 49: Rules set by the NRA for the migration process and copper switch-off – legacy wholesale access products (FR, GR, HU)

Country	France	Greece	Hungary
Which legacy WAPs of the SMPO will after the copper switch-off (e.g. MDF closure) not any longer be available:			
• Copper-based ULL (Yes/No)?	Yes	No	Yes
• Copper-based VULA with local PoH (Yes/No)? If “Yes”, on which access architecture (FTTEx/C/B) is it based on?	-	Yes (FTTC)	Yes FTTC.
• Copper-based VULA with regional/national PoH (Yes/No)? If “Yes”, on which access architecture (FTTEx/C/B) is it based on?	-	Yes (FTTC)	No
• Copper-based bitstream with regional/national PoH (Yes/No)? If “Yes”, on which access architecture (FTTEx/C/B) is it based on?	Yes	Yes (FTTC)	Yes. FTTEx, FTTC
• Other (Yes(which?)/No)?	-	-	-
Does the SMPO have to offer these legacy WAPs until the copper is switched off (e.g. MDF closure) (Yes/No)?	Yes until commercial closure.	Will be examined in the new round of market analysis.	Yes ¹⁵⁸
If this is not the case:			
• How long does the SMPO have to offer these legacy WAPs?	N/A	-	N/A
• Why does the SMPO not have to offer these legacy WAPs until the copper is switched off (e.g. MDF closure)?	N/A	-	N/A

Source: BEREC

¹⁵⁸ The SMPO has to provide the legacy services until the copper switch off, but not obliged to accept new orders from 12 months before the switch-off

Table 50: Rules set by the NRA for the migration process and copper switch-off – legacy wholesale access products (IT, LI, LU)

Country	Italy	Liechtenstein	Luxembourg
Which legacy WAPs of the SMPO will after the copper switch-off (e.g. MDF closure) not any longer be available:			
• Copper-based ULL (Yes/No)?	Yes, copper ULL will not be available after SO.	Yes	No longer available
• Copper-based VULA with local PoH (Yes/No)? If “Yes”, on which access architecture (FTTEx/C/B) is it based on?	No	(product not existing)	Not available at all in Luxembourg
• Copper-based VULA with regional/national PoH (Yes/No)? If “Yes”, on which access architecture (FTTEx/C/B) is it based on?	No	(product not existing)	Not available at all in Luxembourg
• Copper-based bitstream with regional/national PoH (Yes/No)?	Yes, copper bitstream on FTTEx. will not be available after copper switch-off.	(product not existing)	No longer available
• Other (Yes(which?)/No)?	Yes, WLR, CS/CPS and analog leased lines will not be available after copper switch-off.	HFC-coax channels	-
Does the SMPO have to offer these legacy WAPs until the copper is switched off (e.g. MDF closure) (Yes/No)?	Yes	Yes, rule applies on the level of the building of the end-user: 12 months after installation of FTTB, the copper can be removed.	No
If this is not the case:			
• How long does the SMPO have to offer these legacy WAPs?	N/A	N/A	See below
• Why does the SMPO not have to offer these legacy WAPs until the copper is switched off (e.g. MDF closure)?	N/A	N/A	If Fibre LLU is available at a given address, no legacy WAP has to be offered anymore at this address (provided that fibre in-house cabling is available or feasible)

Source: BEREC

Table 51: Rules set by the NRA for the migration process and copper switch-off – legacy wholesale access products (NO, PL, PT)

Country	Norway	Poland	Portugal
Which legacy WAPs of the SMPO will after the copper switch-off (e.g. MDF closure) not any longer be available:			
• Copper-based ULL (Yes/No)?	No	Yes	Yes
• Copper-based VULA with local PoH (Yes/No)? If “Yes”, on which access architecture (FTTEx/C/B) is it based on?	NA	N/A	N/A
• Copper-based VULA with regional/national PoH (Yes/No)? If “Yes”, on which access architecture (FTTEx/C/B) is it based on?	NA	N/A	N/A
• Copper-based bitstream with regional/national PoH (Yes/No)? If “Yes”, on which access architecture (FTTEx/C/B) is it based on?	No	NO	N/A
• Other (Yes(which?)/No)?	-	N/A	N/A
Does the SMPO have to offer these legacy WAPs until the copper is switched off (e.g. MDF closure) (Yes/No)?	Yes	Yes	Yes, as long as these copper access obligations (access obligation to LLU and bitstream) are in force.
If this is not the case:			
• How long does the SMPO have to offer these legacy WAPs?	2025, see answer above	N/A	N/A
• Why does the SMPO not have to offer these legacy WAPs until the copper is switched off (e.g. MDF closure)?	-	N/A	N/A

Source: BEREC

Table 52: Rules set by the NRA for the migration process and copper switch-off – legacy wholesale access products (SI, ES, SE)

Country	Slovenia	Spain	Sweden
Which legacy WAPs of the SMPO will after the copper switch-off (e.g. MDF closure) not any longer be available:			
• Copper-based ULL (Yes/No)?	Yes	Yes, no longer available	No
• Copper-based VULA with local PoH (Yes/No)? If “Yes”, on which access architecture (FTTEx/C/B) is it based on?	Yes FTTEx/C/B	Not existent in Spain	No
• Copper-based VULA with regional/national PoH (Yes/No)? If “Yes”, on which access architecture (FTTEx/C/B) is it based on?	Yes FTTEx/C/B	Not existent in Spain	No
• Copper-based bitstream with regional/national PoH (Yes/No)? If “Yes”, on which access architecture (FTTEx/C/B) is it based on?	Yes FTTEx/C/B	Yes, no longer available	No
• Other (Yes(which?)/No)?	No	Any other service based on copper will not be available, like WLR or 2M leased lines	-
Does the SMPO have to offer these legacy WAPs until the copper is switched off (e.g. MDF closure) (Yes/No)?	Yes	Yes. The reference offers are fully valid until the end of the guarantee period. In the guard period, only migration is possible.	No
If this is not the case:			
• How long does the SMPO have to offer these legacy WAPs?	N/A	N/A	No obligation to offer WAP for SMPO.
• Why does the SMPO not have to offer these legacy WAPs until the copper is switched off (e.g. MDF closure)?	N/A	N/A	At those MDFs affected by copper switch-off copper-based services will no longer be offered at all.

Source: BEREC

Table 53: Rules set by the NRA for the migration process and copper switch-off – alternative wholesale access products – part 1 (BE, HR, CY)

Country	Belgium	Croatia	Cyprus
Which alternative WAPs does the SMPO have to provide:			
• Duct access (Yes/No)?	Yes	Yes	Yes
• Copper SLU (Yes/No)?	Yes	No	Yes
• Fibre LLU (Yes/No)?	No	No	No
• VULA with local PoH (Yes/No)?	Yes	No	Yes
• VULA with regional and/or national PoH (Yes/No)?	Yes ¹⁵⁹	Yes ¹⁶⁰	At the present such product is not considered as a VULA product
• Bitstream with regional and/or national PoH (Yes/No)?	Yes	No ¹⁶¹	Yes
• Other (Yes(which?)/No)?	No	-	No
Which of the alternative WAPs (see above) are considered to be fully equivalent or having at least a comparable quality?	We consider VULA and bitstream having the same comparable quality	VULA with regional and/or national PoH	VULA with local PoH
Which of the alternative WAPs are imposed on the SMPO:			
• Independent of the copper switch-off as a “usual” remedy on a regulated market?	All of them	Bitstream with regional and/or national PoH	All
• Only in case of copper switch-off (e.g. closure of MDFs)?	-	VULA (or BSA service equivalent to LLU) with regional and/or national PoH	-

Source: BEREC

¹⁵⁹ VULA and bitstream service are both L2, the only difference is the handover point. VULA has a handover possibility in each LEX while bitstream only has a handover possibility at regional level. Thus, there is not really a VULA at regional level; it considered bitstream

¹⁶⁰ This WAP SMPO has to provide in case when “old” MDF is closed and copper loops longer than 2000 m are migrated to new node with MDF. The rule is that SMPO is obliged to provide bitstream access which is equivalent to LLU

¹⁶¹ There is no explicit obligation, but SMPO is obliged to provide that service as SMPO at market 3b/2014 and ANO's can migrate to that WAP if they want.

Table 54: Rules set by the NRA for the migration process and copper switch-off – alternative wholesale access products – part 1 (CZ, EE, FI)

Country	Czech Republic	Estonia	Finland
Which alternative WAPs does the SMPO have to provide:			
• Duct access (Yes/No)?	No	Yes	No
• Copper SLU (Yes/No)?	No	SMPO doesn't provide such service as demand doesn't exist	No
• Fibre LLU (Yes/No)?	Yes	Yes	Yes, if fibre is available
• VULA with local PoH (Yes/No)?	Yes	SMPO doesn't provide such service as demand doesn't exist	Yes, if fibre LLU is not available and fibre network exist
• VULA with regional and/or national PoH (Yes/No)?	No	SMPO doesn't provide such service as demand doesn't exist	No
• Bitstream with regional and/or national PoH (Yes/No)?	Yes.	Yes	No
• Other (Yes(which?)/No)?	No	-	Mobile bitstream access, if no fibre exist
Which of the alternative WAPs (see above) are considered to be fully equivalent or having at least a comparable quality?	All of them	-	Fibre LLU is fully equivalent, but other are also considered to be at least at comparable quality
Which of the alternative WAPs are imposed on the SMPO:			
• Independent of the copper switch-off as a "usual" remedy on a regulated market?	Yes	All are "usual" remedies	N/A
• Only in case of copper switch-off (e.g. closure of MDFs)?	-	No	N/A

Source: BERECA

Table 55: Rules set by the NRA for the migration process and copper switch-off – alternative wholesale access products – part 1 (FR, GR, HU)

Country	France	Greece	Hungary
Which alternative WAPs does the SMPO have to provide:			
• Duct access (Yes/No)?	Yes	Yes	No
• Copper SLU (Yes/No)?	No	Yes	Yes
• Fibre LLU (Yes/No)?	Yes, fttH	No	Yes
• VULA with local PoH (Yes/No)?	No	Yes	Yes
• VULA with regional and/or national PoH (Yes/No)?	No	Yes	No
• Bitstream with regional and/or national PoH (Yes/No)?	No	Yes	No
• Other (Yes(which?)/No)?	No		Yes. Terminating (coaxial) segment of HFC
Which of the alternative WAPs (see above) are considered to be fully equivalent or having at least a comparable quality?	FttH	VULA with local PoH	All of them are considered as equivalent/comparable WAPs in the migration procedure
Which of the alternative WAPs are imposed on the SMPO:			
• Independent of the copper switch-off as a “usual” remedy on a regulated market?	X	Duct access, Copper LLU, Copper SLU, VULA (local/regional), bitstream (regional)	All of them.
• Only in case of copper switch-off (e.g. closure of MDFs)?	FttH	-	-

Source: BEREC

Table 56: Rules set by the NRA for the migration process and copper switch-off – alternative wholesale access products – part 1 (IT, LI, LU)

Country	Italy	Liechtenstein	Luxembourg
Which alternative WAPs does the SMPO have to provide:			
• Duct access (Yes/No)?	No	Yes	-
• Copper SLU (Yes/No)?	Yes	No	-
• Fibre LLU (Yes/No)?	No	Yes (planned not yet imposed)	Yes
• VULA with local PoH (Yes/No)?	Yes	No	Yes (VULA over Fibre on local POP)
• VULA with regional and/or national PoH (Yes/No)?	No	No	-
• Bitstream with regional and/or national PoH (Yes/No)?	Yes	No	-
• Other (Yes(which?)/No)?	FWA wholesale service (bitstream like), only in marginal cases where fibre not available	-	-
Which of the alternative WAPs (see above) are considered to be fully equivalent or having at least a comparable quality?	All services	Fibre LLU	Fibre LLU, VULA over Fiber
Which of the alternative WAPs are imposed on the SMPO:			
• Independent of the copper switch-off as a “usual” remedy on a regulated market?	All except for FWA	Fibre LLU (price will be regulated in the future), duct access	Fibre LLU, VULA over Fibre, Bitstream
• Only in case of copper switch-off (e.g. closure of MDFs)?	FWA	-	None

Source: BEREC

Table 57: Rules set by the NRA for the migration process and copper switch-off – alternative wholesale access products – part 1 (NO, PL, PT)

Country	Norway	Poland	Portugal
Which alternative WAPs does the SMPO have to provide:			
• Duct access (Yes/No)?	-	No	No.
• Copper SLU (Yes/No)?	-	Yes	No.
• Fibre LLU (Yes/No)?	Yes (potential replacement product)	Yes	No.
• VULA with local PoH (Yes/No)?		No	No.
• VULA with regional and/or national PoH (Yes/No)?	Yes (potential replacement product)	No	No.
• Bitstream with regional and/or national PoH (Yes/No)?	-	Yes	No.
• Other (Yes(which?)/No)?	FWA (potential replacement product)	No	No. There is no obligation to provide an alternative WAP.
Which of the alternative WAPs (see above) are considered to be fully equivalent or having at least a comparable quality?	¹⁶²	Access in FTTx	n.a. It should be assessed on a case-by-case basis.
Which of the alternative WAPs (see above) are imposed on the SMPO:			
• Independent of the copper switch-off as a “usual” remedy on a regulated market?	Fibre LLU, VULA fibre, FWA	No	Duct access (remedy already imposed on market 3a).
• Only in case of copper switch-off (e.g. closure of MDFs)?	None yet, cf. ongoing discussions	Yes	None.

Source: BEREC

¹⁶² Preliminary assessment of FWA: not fully equivalent. No formal assessment of VULA fibre is carried out. However, the ANOs have in meetings expressed that they consider it fully equivalent or having at least a comparable quality to copper accesses. The lack of coverage seems to be the foremost challenge with regards to this WAP

Table 58: Rules set by the NRA for the migration process and copper switch-off – alternative wholesale access products – part 1 (SI, ES, SE)

Country	Slovenia	Spain	Sweden
Which alternative WAPs does the SMPO have to provide:			
• Duct access (Yes/No)?	No	Yes	“Yes” (from directive 2014/61/EU)
• Copper SLU (Yes/No)?	No	No	
• Fibre LLU (Yes/No)?	No	No	Yes (from SMP-regulation)
• VULA with local PoH (Yes/No)?	No	Yes (where access obligation exists)	
• VULA with regional and/or national PoH (Yes/No)?	No	No	
• Bitstream with regional and/or national PoH (Yes/No)? ¹⁶³	No	Yes (where access obligation exists)	
• Other (Yes(which?)/No)?	¹⁶⁴	No	
Which of the alternative WAPs (see above) are considered to be fully equivalent or having at least a comparable quality?	Any equivalent WAP which performance is equal or better to the existing solution (except duct access)	¹⁶⁵	
Which of the alternative WAPs are imposed on the SMPO:			
• Independent of the copper switch-off as a “usual” remedy on a regulated market?	Duct access, Fibre LLU, VULA with local PoH, Bitstream with regional and/or national PoH	VULA, bitstream, duct access	Fibre LLU
• Only in case of copper switch-off (e.g. closure of MDFs)?	None	-	-

Source: BEREC

¹⁶³ The alternative bitstream product depends on the network to which the end-users are migrated to. The alternative bitstream product is based on FTTC/B/H in case of migration to FTTC/B/H, based on FTTB/H in case of migration to FTTB/H and based on FTTH only in case of migration to FTTH.

¹⁶⁴ Any WAP equivalent or better solution (except duct access). However, SMPO doesn't have to provide own solution if technologically at least equivalent open network is available.

¹⁶⁵ VULA is a virtual unbundling of fibre, thus it provides actually a better service than copper unbundling or copper bitstream. Bitstream, based on fibre, provides also a higher valued service. Duct access is a mean for ANOs to deploy their own FTTH network, and thus a means to reach a better service than copper.

Table 59: Rules set by the NRA for the migration process and copper switch-off – alternative wholesale access products – part 2 (BE, HR, CY)

Country	Belgium	Croatia	Cyprus
Are alternative WAPs provided by other operators than the SMPO available (Yes/No)?	No, however cable operators are regulated in Belgium in the context of a separate access market (M3b2)	Yes, but in limited areas.	No
If this is the case,			
• Which?	N/A	BSA, Fiber SLU	N/A
• Based on which access network (e.g. FTTC/B/H)?	N/A	FTTH	N/A
• To what extent e.g. in some/many/all MDFs?	N/A	In some MDFs	N/A
Which of these WAPs are considered to be fully equivalent or having at least a comparable quality?	N/A	BSA, Fiber SLU	N/A

Source: BEREC

Table 60: Rules set by the NRA for the migration process and copper switch-off – alternative wholesale access products – part 2 (CZ, EE, FI)

Country	Czech Republic	Estonia	Finland
Are alternative WAPs provided by other operators than the SMPO available (Yes/No)?	No	No	-
If this is the case,			
• Which?	N/A	-	-
• Based on which access network (e.g. FTTC/B/H)?	N/A	-	-
• To what extent e.g. in some/many/all MDFs?	N/A	-	-
Which of these WAPs are considered to be fully equivalent or having at least a comparable quality?	N/A	-	-

Source: BEREC

Table 61: Rules set by the NRA for the migration process and copper switch-off – alternative wholesale access products – part 2 (FR, GR, HU)

Country	France	Greece	Hungary
Are alternative WAPs provided by other operators than the SMPO available (Yes/No)?	Yes	Yes	No
If this is the case,			
• Which?	Any operator who deploys FttH network	VULA local	-
• Based on which access network (e.g. FTTC/B/H)	FttH	FTTC/H	-
• To what extent e.g. in some/many/all MDFs?	Many	In the SCs that they have deployed NGA networks in the context of the “vectoring procedure” defined and administered by EETT.	-
Which of these WAPs are considered to be fully equivalent or having at least a comparable quality?	¹⁶⁶	VULA local	-

Source: BEREC

Table 62: Rules set by the NRA for the migration process and copper switch-off – alternative wholesale access products – part 2 (IT, LI, LU)

Country	Italy	Liechtenstein	Luxembourg
Are alternative WAPs provided by other operators than the SMPO available (Yes/No)?	Yes	No	No
If this is the case,			
• Which?	VULA, Fibre LLU	N/A	N/A
• Based on which access network (e.g. FTTC/B/H)	FTTH, FWA	N/A	N/A
• To what extent e.g. in some/many/all MDFs?	Some	N/A	N/A
Which of these WAPs are considered to be fully equivalent or having at least a comparable quality?	All	N/A	N/A

Source: BEREC

¹⁶⁶ WAPs that fulfill criteria defined by Arcep for commercial closure (FttH network presence and necessary wholesale services availability, operators presence or respect of sufficient notice periods, non-discrimination obligation between areas).

Table 63: Rules set by the NRA for the migration process and copper switch-off – alternative wholesale access products – part 2 (NO, PL, PT)

Country	Norway	Poland	Portugal
Are alternative WAPs provided by other operators than the SMPO available (Yes/No)?	No	No	No
If this is the case,			
• Which?	N/A	N/A	N/A
• Based on which access network (e.g. FTTC/B/H)?	N/A	N/A	N/A
• To what extent e.g. in some/many/all MDFs?	N/A	N/A	N/A
Which of these WAPs are considered to be fully equivalent or having at least a comparable quality?	N/A	N/A	N/A

Source: BEREC

Table 64: Rules set by the NRA for the migration process and copper switch-off – alternative wholesale access products – part 2 (SI, ES, SE)

Country	Slovenia	Spain	Sweden
Are alternative WAPs provided by other operators than the SMPO available?	Yes	Yes	No
If this is the case,			
• Which?	Open BB Network areas (mostly rural)	VULA, bitstream	N/A
• Based on which access network (e.g. FTTC/B/H)?	FTTH	FTTH	N/A
• To what extent e.g. in some/many/all MDFs?	Some MDFs	Potentially in many. Details depend on the commercial agreement.	N/A
Which of these WAPs are considered to be fully equivalent or having at least a comparable quality?	FTTH LLU, VULA local/regional/central PoH	All. No details are available, but there are a number of commercial agreements, and they are used to successfully provide retail FTTH services to customers comparable to those of the SMPO.	N/A

Source: BEREC

Table 65: Rules set by the NRA for the migration process and copper switch-off – migration costs (BE, HR, CY)

Country	Belgium	Croatia	Cyprus
Did the NRA set any rules with regard to the migration costs (Yes/No)?	Yes	No	Yes
If this is the case, did the NRA set rules with regard to:			
<ul style="list-style-type: none"> Did the NRA set reduced monthly fees for active alternative WAP (e.g. VULA, bitstream) in case ANOs need to migrate from legacy copper LLU to them? 	-	N/A	-
<ul style="list-style-type: none"> Does the SMPO have to offer alternative VULA/bitstream with comparable features (e.g. same bandwidth) and at the same monthly fee as the legacy VULA/bitstream? 	-	N/A	-
<ul style="list-style-type: none"> Who pays the one-off fee for deactivation of old/legacy WAP and activation of new/alternative WAP? 	-	N/A	-
<ul style="list-style-type: none"> Who pays the new modem/CPE of the ANOs in case the legacy modem/CPE needs to be replaced? 	-	N/A	-
<ul style="list-style-type: none"> Who pays not yet recovered investments of ANOs in case of closure of co-location? 	-	N/A	-
<ul style="list-style-type: none"> Who pays the costs for closing co-location? 	-	N/A	-
<ul style="list-style-type: none"> Did the NRA set rules that the SMPO is not allowed to increase the fees of the legacy WAPs before the copper is switched off (e.g. MDF closure)? 	-	N/A	-
<ul style="list-style-type: none"> Other rules? 	¹⁶⁷	N/A	¹⁶⁸
If this is not the case, why did the NRA set no rules with regard to the migration costs?	¹⁶⁹	¹⁷⁰	

Source: BEREC

¹⁶⁷ There is a general rule that says that each operator needs to support its own costs when a building is closed (for example, removing of equipment)

¹⁶⁸ The general rule is that the termination of the physical access: (i) in areas of optical network deployment and (ii) in areas where vectoring is applied, presupposes the free migration of the subscribers of the alternative providers to virtual access products.

¹⁶⁹ The SMPO needs to provide an alternative service when the SMPO wants to stop a copper service. It is the NRA who may decide if the alternative service is sufficient or not and the migration costs will be one of the many factors reviewed in this process. Please note that in previous cases, the SMPO always proposed to execute the migration at zero cost for the alternative operator, but did not propose any reduction in rental fee for the alternative service.

¹⁷⁰ Since the notice period is five years, we are of the opinion that ANO's have enough time to prepare for migration to alternative WAP. Also, we are of the opinion that in the period of five years most of the investment costs related to using existing WAPs are recovered.

Table 66: Rules set by the NRA for the migration process and copper switch-off – migration costs (CZ, EE, FI)

Country	Czech Republic	Estonia	Finland
Did the NRA set any rules with regard to the migration costs (Yes/No)?	No	No	No
If this is the case, did the NRA set rules with regard to:			
<ul style="list-style-type: none"> Did the NRA set reduced monthly fees for active alternative WAP (e.g. VULA, bitstream) in case ANOs need to migrate from legacy copper LLU to them? 	N/A	N/A	N/A
<ul style="list-style-type: none"> Does the SMPO have to offer alternative VULA/bitstream with comparable features (e.g. same bandwidth) and at the same monthly fee as the legacy VULA/bitstream? 	N/A	N/A	N/A
<ul style="list-style-type: none"> Who pays the one-off fee for deactivation of old/legacy WAP and activation of new/alternative WAP? 	N/A	N/A	N/A
<ul style="list-style-type: none"> Who pays the new modem/CPE of the ANOs in case the legacy modem/CPE needs to be replaced? 	N/A	N/A	N/A
<ul style="list-style-type: none"> Who pays not yet recovered investments of ANOs in case of closure of co-location? 	N/A	N/A	N/A
<ul style="list-style-type: none"> Who pays the costs for closing co-location? 	N/A	N/A	N/A
<ul style="list-style-type: none"> Did the NRA set rules that the SMPO is not allowed to increase the fees of the legacy WAPs before the copper is switched off (e.g. MDF closure)? 	N/A	N/A	N/A
<ul style="list-style-type: none"> Other rules? 	N/A	N/A	N/A
If this is not the case, why did the NRA set no rules with regard to the migration costs?	CTU does not assume to regulate it.	As active (in use) WAP amount is very small.	No regulation in the national law

Source: BEREK

Table 67: Rules set by the NRA for the migration process and copper switch-off – migration costs (FR, GR, HU)

Country	France	Greece	Hungary
Did the NRA set any rules with regard to the migration costs (Yes/No)?	¹⁷¹	No. The issue will be examined in the new round of market analysis.	No.
If this is the case, did the NRA set rules with regard to:			
<ul style="list-style-type: none"> Did the NRA set reduced monthly fees for active alternative WAP (e.g. VULA, bitstream) in case ANOs need to migrate from legacy copper LLU to them? If not, why not? 	No	-	N/A
<ul style="list-style-type: none"> Does the SMPO have to offer alternative VULA/bitstream with comparable features (e.g. same bandwidth) and at the same monthly fee as the legacy VULA/bitstream? 	Copper switch-off implies that an alternative offer is provided by at least one operator (SMP or alternative operator) on the FttH network.	-	N/A
<ul style="list-style-type: none"> Who pays the one-off fee for deactivation of old/legacy WAP and activation of new/alternative WAP? 	¹⁷²	-	N/A
<ul style="list-style-type: none"> Who pays the new modem/CPE of the ANOs in case the legacy modem/CPE needs to be replaced? 	-	-	N/A
<ul style="list-style-type: none"> Who pays not yet recovered investments of ANOs in case of closure of co-location? 	-	-	N/A
<ul style="list-style-type: none"> Who pays the costs for closing co-location? 	-	-	N/A
<ul style="list-style-type: none"> Did the NRA set rules that the SMPO is not allowed to increase the fees of the legacy WAPs before the copper is switched off (e.g. MDF closure)? 	The 2021-2023 M3a market analysis decision states that copper LLU is cost oriented and Arcep's decision 2020-1493 imposed a price-cap for the period 2021-2023 on copper LLU.	-	N/A
<ul style="list-style-type: none"> Other rules? 	-	-	N/A
If this is not the case, why did the NRA set no rules with regard to the migration costs?		-	¹⁷³

Source: BEREC

¹⁷¹ Arcep did not set a whole specific set of rules regarding migration costs. However, access to the copper local loop of the SMP is cost oriented (this perimeter includes the switch-off fees paid by ANOs) and some other rules apply.

¹⁷² The deactivation fees for LLU paid by the ANOs are in the perimeter of cost orientation. The activation of new WAP enters in the cost base of the new product and is to be recovered by the new WAP prices.

¹⁷³ Because of infrastructure based competition the take-up of regulated access and colocation is low, so this type of rule wouldn't be proportionate.

Table 68: Rules set by the NRA for the migration process and copper switch-off – migration costs (IT, LI, LU)

Country	Italy	Liechtenstein	Luxembourg
Did the NRA set any rules with regard to the migration costs (Yes/No)?	Yes	No	No
If this is the case, did the NRA set rules with regard to:			
<ul style="list-style-type: none"> Did the NRA set reduced monthly fees for active alternative WAP (e.g. VULA, bitstream) in case ANOs need to migrate from legacy copper LLU to them? 	Yes. Wholesale price of the NGA “substituting” service is equalized, during the migration period, to the wholesale price of the “substituted” copper service until the switch-off of the local exchange is realized.	N/A	No
<ul style="list-style-type: none"> Does the SMPO have to offer alternative VULA/bitstream with comparable features (e.g. same bandwidth) and at the same monthly fee as the legacy VULA/bitstream? 	No. Because the measure above described has been adopted.	N/A	-
<ul style="list-style-type: none"> Who pays the one-off fee for deactivation of old/legacy WAP and activation of new/alternative WAP? 	One-off wholesale costs (activation and de-activation fees) covered by SMPO.	N/A	Operator
<ul style="list-style-type: none"> Who pays the new modem/CPE of the ANOs in case the legacy modem/CPE needs to be replaced? 	ANOs.	N/A	Operator
<ul style="list-style-type: none"> Who pays not yet recovered investments of ANOs in case of closure of co-location? 	SMPO also covers additional cost for decommissioning of co-location OAO’ sites, for co-location in new Local exchange and for interconnection equipment’s to migrate customers.	N/A	As the notification period for copper switch off is 5 years there should be no issues about ROI (return on invest).
<ul style="list-style-type: none"> Who pays the costs for closing co-location? 	SMPO.	N/A	-
<ul style="list-style-type: none"> Did the NRA set rules that the SMPO is not allowed to increase the fees of the legacy WAPs before the copper is switched off (e.g. MDF closure)? 	No, because wholesale prices are already strictly regulated (cost-oriented).	N/A	-
<ul style="list-style-type: none"> Other rules? 	-	N/A	-
If this is not the case, why did the NRA set no rules with regard to the migration costs?	N/A	The SMPO (LKW) and the providers agreed upon the terms. The NRA was not called upon to settle or decide on disputes. Cost oriented pricing will be regulated when the roll-out of the FTTH-network is finished.	-

Source: BEREC

Table 69: Rules set by the NRA for the migration process and copper switch-off – migration costs (NO, PL, PT)

Country	Norway	Poland	Portugal
Did the NRA set any rules with regard to the migration costs (Yes/No)?	No	No	No ¹⁷⁴
If this is the case, did the NRA set rules with regard to:			
<ul style="list-style-type: none"> Did the NRA set reduced monthly fees for active alternative WAP (e.g. VULA, bitstream) in case ANOs need to migrate from legacy copper LLU to them? If not, why not? 	N/A	N/A	N/A
<ul style="list-style-type: none"> Does the SMPO have to offer alternative VULA/bitstream with comparable features (e.g. same bandwidth) and at the same monthly fee as the legacy VULA/bitstream? 	N/A	N/A	N/A
<ul style="list-style-type: none"> Who pays the one-off fee for deactivation of old/legacy WAP and activation of new/alternative WAP? 	N/A	N/A	N/A
<ul style="list-style-type: none"> Who pays the new modem/CPE of the ANOs in case the legacy modem/CPE needs to be replaced? 	N/A	N/A	N/A
<ul style="list-style-type: none"> Who pays not yet recovered investments of ANOs in case of closure of co-location? 	N/A	N/A	N/A
<ul style="list-style-type: none"> Who pays the costs for closing co-location? 	N/A	N/A	N/A
<ul style="list-style-type: none"> Did the NRA set rules that the SMPO is not allowed to increase the fees of the legacy WAPs before the copper is switched off (e.g. MDF closure)? 	N/A	N/A	N/A
<ul style="list-style-type: none"> Other rules? 	N/A	N/A	N/A
If this is not the case, why did the NRA set no rules with regard to the migration costs?	This is likely to be part of the migration plan	-	¹⁷⁵

Source: BEREC

¹⁷⁴ However, ANACOM presented the understanding that it would be necessary to ensure that any costs of change would not be passed indiscriminately and disproportionately to alternative operators, as it could constitute a double penalty for them.

¹⁷⁵ The number of accesses supported on LLU and wholesale bitstream offers has been increasingly residual. Also, the notice periods that were set already foresee that the beneficiaries of the wholesale offers can recover the installation costs at the exchange. Additionally, it was not imposed on the SMPO an obligation to supply a new wholesale products.

Table 70: Rules set by the NRA for the migration process and copper switch-off – migration costs (SI, ES, SE)

Country	Slovenia	Spain	Sweden
Did the NRA set any rules with regard to the migration costs?	No	¹⁷⁶	No ¹⁷⁷
If this is the case, did the NRA set rules with regard to:			
• Did the NRA set reduced monthly fees for active alternative WAP in case of migration from copper LLU?	N/A	-	-
• Does the SMPO have to offer alternative VULA/bitstream with comparable features (e.g. same bandwidth) and at the same monthly fee as the legacy VULA/bitstream?	N/A	-	-
• Who pays the one-off fee for deactivation of old/legacy WAP and activation of new/alternative WAP?	N/A	-	-
• Who pays the new modem/CPE of the ANOs in case the legacy modem/CPE needs to be replaced?	N/A	-	-
• Who pays not yet recovered investments of ANOs in case of closure of co-location?	N/A	-	-
• Who pays the costs for closing co-location?	N/A	-	-
• Did the NRA set rules that the SMPO is not allowed to increase the fees of the legacy WAPs before the copper is switched off (e.g. MDF closure)?	N/A	-	-
• Other rules?	N/A	-	-
If this is not the case, why did the NRA set no rules with regard to the migration costs?	SMPO already offers free migration in case of copper switch off.	¹⁷⁸	This is likely to be part of the migration plan

Source: BEREC

¹⁷⁶ For the general switch-off, no. However, in the case of closure of smaller units than SC (which need explicit permission), migration is free in areas with access obligations.

¹⁷⁷ Only if SMPO did not inform in advance as stipulated in SMP-decision, i.e. 18 months, then SMPO must reimburse ANO for net book value.

¹⁷⁸ User migration from copper to FTTH is a fact since several years. Copper can no longer compete with FTTH. Several ANOs deploy FTTH. In this context, there are several alternatives after copper is switched-off: regulated offers, commercial offers, own deployment, and thus several possibilities for migration. Specific rules for migration costs to one of the possibilities would unduly influence and bias competition in the market.

Table 71: Rules set by the NRA for the migration process and copper switch-off – information of the SMPO and monitoring 1 (BE, HR, CY)

Country	Belgium	Croatia	Cyprus
What information does the SMPO have to provide to the:			
• NRA?	Timing schedule and proposal for alternative service	¹⁷⁹	Inform in a timely manner and provide a satisfactory alternative product
• ANOs?	Timing schedule and proposal for alternative service	¹⁷⁹	Inform in a timely manner and provide a satisfactory alternative product
• SMPO's end-users?	None	There are general contractual obligations to inform end users on any change related to change of the provided service.	N/A
• Other entities (which entities?)?	None	-	N/A
What further information does the SMPO provide voluntarily to the:			
• NRA?	Nothing additional	NRA is usually informed by SMPO about any planned change in the network before the change is introduced.	¹⁸⁰
• ANOs?	Nothing additional	-	¹⁸⁰
• SMPO's end-users?	None	-	
• Other entities (which entities?)?	None	-	
Does the NRA monitor the migration process?	Reactively	-	Yes
If this is the case, what does the NRA monitor?	None	-	In terms of illustration of information on a periodic basis
If this is not the case, why does the NRA not monitor the migration process?	The NRA can always intervene in case of issues related to migration.	-	-

Source: BEREC

¹⁷⁹ 5 years in advance SMPO must provide detailed plan of switch off. In case of migration to a new node, information and detailed plan of migration should be provided at least 6 months in advance. Announcement on migration to a new node should contain: (i) Total number of lines and number of non-occupied lines hosted at a new node (ii) ID of each single end user connected to a new node (iii) Information on ducts availability between “old” access and a “new” access node (iv) Map of coverage area of a new access node (v) List of addresses migrated from an “old” to a “new” access node (vi) Time plan of migration

¹⁸⁰ Information on network deployment in different stages. The procedure initially states that SMP must provide information on the deployment of Fiber Optic Network for a window period of 3 years. Information flow continues on a quarterly basis and then on monthly basis.

Table 72: Rules set by the NRA for the migration process and copper switch-off – information of the SMPO and monitoring (CZ, EE, FR)

Country	Czech Republic	Estonia	France
What information does the SMPO have to provide at which stage of the migration process to the:			
• NRA?	None	No rules	¹⁸¹
• ANOs?	Announcement of copper switch off, which starts one year notice period.	No rules	¹⁸¹
• SMPO's end-users?	No, SMPO is wholesale only.	No rules	¹⁸¹
• Other entities (which entities?)?	None.	No rules	¹⁸¹
What further information does the SMPO provide voluntarily at which stage of the migration process to the:			
• NRA?	None	No data	Unknown at this stage
• ANOs?	None	No data	Unknown at this stage
• SMPO's end-users?	None.	No data	Unknown at this stage
• Other entities (which entities?)?	None.	No data	Unknown at this stage
Does the NRA monitor the migration process?	No	No	Yes
If this is the case, what does the NRA monitor?	N/A	N/A	NRA will monitor the future closure program (including modalities and procedures for closure) that Orange has to present before any technical closure.
If this is not the case, why does the NRA not monitor the migration process?	CTU does not plan to monitor it in near future. Copper switch off is not still widespread.	As active (in use) WAP amount is very small.	N/A

Source: BEREC

¹⁸¹ (public) Information about closure trajectory and criteria defined by NRA for commercial closure.

Table 73: Rules set by the NRA for the migration process and copper switch-off – information of the SMPO and monitoring (FI, GR, HU)

Country	Finland	Greece ¹⁸²	Hungary
What information does the SMPO have to provide to the:			
• NRA?	Yes, information on the switch-off date, area, ANOs, end users and alternative network and quality	-	¹⁸³
• ANOs?	Yes, information on the switch-off date, area and alternative network and quality	-	The same information and timing as above.
• SMPO's end-users?	One month in advance the switch-off date.	-	¹⁸⁴
• Other entities (which entities?)?	-	-	No.
What further information does the SMPO provide voluntarily to the:			
• NRA?	-	-	No
• ANOs?	-	-	No
• SMPO's end-users?	Alternative products	-	No.
• Other entities (which entities?)?	-	-	No.
Does the NRA monitor the migration process?	Yes	-	Yes
If this is the case, what does the NRA monitor?	Monitoring is partly dependent on complaints from ANO's and end-users.	-	¹⁸⁵
If this is not the case, why does the NRA not monitor the migration process?	N/A	-	N/A

Source: BEREC

¹⁸² According to the current regulation, the SMPO has to provide information only for the parts of its network that will be switched-off (5 years in advance for MDFs and 18 months for SCs). More detailed rules will be examined in the forthcoming analysis of market 1/2020

¹⁸³ The SMPO has to provide the NRA the following information 24 months before the planned switch off (or 6 months, if there is no actual wholesale usage at the given access point): (i) the copper-based WAPs which will be withdrawn (ii) the geographical area affected by the switch off (iii) the wholesale access point (iii) timing of the migration and (iv) the available alternative WAPs

¹⁸⁴ If a substantial feature of the retail service changes the SMPO shall inform the end-users 60 days in advance.

¹⁸⁵ The NRA monitors the process through information provided by the SMPO. Also may investigate it in a market surveillance procedure.

Table 74: Rules set by the NRA for the migration process and copper switch-off – information of the SMPO and monitoring (IT, LI)

Country	Italy	Liechtenstein
What information does the SMPO have to provide to the:		
• NRA?	¹⁸⁶	¹⁸⁷
• ANOs?	¹⁸⁶	
• SMPO's end-users?	No obligations	
• Other entities (which entities?)?	-	¹⁸⁸
What further information does the SMPO provide voluntarily to the:		
• NRA?	No other specific information	¹⁸⁹
• ANOs?	No other specific information ¹⁹⁰ .	¹⁹¹
• SMPO's end-users?	No other specific information	
• Other entities (which entities?)?	No other specific information	¹⁹²
Does the NRA monitor the migration process?	Yes ¹⁹³	Yes, informally, and by the annual statistical data collection
If this is the case, what does the NRA monitor?	NGA coverage and take-up ¹⁹³ .	¹⁹⁴
If this is not the case, why does the NRA not monitor the migration process?	N/A	

Source: BEREC

¹⁸⁶ Plan of decommissioning have been provided to NRA and ANOs; it includes all the local exchanges to be switched off in the next years, but only with a generic indication of timing (formerly, the objective was to close all the LEXs in the Plan before by the end of 2023).

¹⁸⁷ 1) annual information in the framework of the statistical data collection (legal, general obligation of the communications act, not FTTH/migration specific) 2) cost model in the process of price regulation

¹⁸⁸ To owners of buildings: pre-information on planned FTTH construction activities and replacement of old access lines, including information on in-building cabling, information on date of introducing FTTH in building, information on FTTH completion and availability for telecoms services.

¹⁸⁹ Additional information on progress of FTTH project (e.g. key indicators of number of utilisation units connected, take rate)

¹⁹⁰ But a specific procedure for manage migration at wholesale level has been proposed by SMPO (under approval). In this framework, more information may be provided

¹⁹¹ Regular updates of data base for planned and finished FTTH connections, semi-annual meetings for information and coordination purposes.

¹⁹² To the public: general and regular information about the FTTH project, (publications in newspapers, public information events)

¹⁹³ Publication of local exchanges to be switched-off (which is also the moment of starting of the notice period) is subject to the formal approval of NRA (verification of the conditions on NGA coverage and take-up).

¹⁹⁴ 1) development of indicators of the statistical data collection (e.g. development of copper LLU, HFC-coax and fibre LLU. 2) attending the semi-annual meetings for information and coordination purposes of LKW and providers

Table 75: Rules set by the NRA for the migration process and copper switch-off – information of the SMPO and monitoring (LU, NO, PL)

Country	Luxembourg	Norway	Poland
What information does the SMPO have to provide to the:			
• NRA?	¹⁹⁵	¹⁹⁶	No
• ANOs?	¹⁹⁵	¹⁹⁶	Information about planned migration not less than 2 years before
• SMPO's end-users?	-	-	No
• Other entities (which entities?)?	-	-	No
What further information does the SMPO provide to the:			
• NRA?	-	-	No
• ANOs?	-	-	Locations, migration conditions, alternatives etc
• SMPO's end-users?	-	-	No
• Other entities (which entities?)?	-	-	No
Does the NRA monitor the migration process?	Yes	-	No
If this is the case, what does the NRA monitor?	¹⁹⁷	-	N/A
If this is not the case, why not?	N/A	-	No legal basis and decision/obligations

Source: BEREC

¹⁹⁵ At the start of the migration process, the SMPO has to provide the identification and address of the CU Sites concerned with identification of the NTP and addresses connected.

¹⁹⁶ From Nkom's decision 2 September 2020: "The plan should, as a minimum, show how Telenor will ensure that: (i) all relevant information concerning the process for the decommissioning of copper in various different geographical areas can be communicated at the same time, and with the same content and level of detail, to all copper customers in the relevant area, while also ensuring that it is the access buyers, and not Telenor, who inform their existing copper customers in this respect; (ii) access buyers have the same opportunities as Telenor's retail activity to continue their customer relationships with existing copper customers, irrespective of which access solution Telenor chooses to offer as a replacement for copper access in various different geographical areas; and (iii) access buyers have the opportunity to sell and deliver replacement products to their copper customers, based on a new access solution adopted by Telenor for a given area, as from the same dates as Telenor's retail activity." More detailed rules can be part of the migration plan.

¹⁹⁷ The NRA monitors the evolution of the copper switch-off, controls the respect of the deadlines.

Table 76: Rules set by the NRA for the migration process and copper switch-off – information of the SMPO and monitoring (PT, SI)

Country	Portugal	Slovenia
What information does the SMPO have to provide to the:		
• NRA?	-	198
• ANOs?	199	198
• SMPO's end-users?	N/A	None
• Other entities (which entities?)?	N/A	-
What further information does the SMPO provide voluntarily to the:		
• NRA?	200	None (if not specifically asked)
• ANOs?	N/A	None
• SMPO's end-users?	N/A	Encouraging end users to switch to the new optical network /offer discounted contract
• Other entities (which entities?)?	N/A	-
Does the NRA monitor the migration process?	Not actively.	Yes
If this is the case, what does the NRA monitor?	N/A	Announcements about switch-off lines and MDFs
If this is not the case, why does the NRA not monitor the migration process?	201	N/A

Source: BEREC

¹⁹⁸ Information about disconnecting of copper loop where ANO is present (6 months in advance), closing of MDF where ANOs are not present (6 months in advance), closing of MDF where ANOs are present (24 months in advance)

¹⁹⁹ In case of relocation of loops for reasons attributable to SMPO, and for the PA where there are co-deployed operators, SMPO shall give notice with at least: (i) 12 months in advance, for a number of active loops to be relocated lower than 1/3 of the total of active loops in the referred PA; (ii) 36 months in advance, for a number of active loops to be relocated higher than 1/3 and lower than 2/3 of the total active loops in the referred PA; (iii) 60 months in advance, for a number of active loops to be relocated higher than 2/3 of the total number of active loops in the referred PA (including the switch-off of the PA). This period may be reduced to 36 months in case an equivalent active access is ensured". Under these circumstances, PA is equivalent to a local MDF/exchange. Note: A PA (=Attendance Point) is a designation used to identify a technical node/MDF in MEO's copper network, covering a certain area and whose creation is based on network optimization criteria.

²⁰⁰ The SMPO has been providing periodical status of the migration process, namely regarding its interaction with clients and other providers.

²⁰¹ The process of "internal migration" is being handled by operators, without the need of ANACOM's intervention. Additionally, it should be mentioned that in Portugal the number of accesses supported on local loop unbundling offer and bitstream access offer is residual comparing to the number of accesses of ANOs that use their own solutions, namely based on fibre, and supported on regulated access to ducts and poles.

Table 77: Rules set by the NRA for the migration process and copper switch-off – information of the SMPO and monitoring (ES, SE)

Country	Spain	Sweden
What information does the SMPO have to provide at which stage of the migration process to the:		
• NRA?	Like ANOs, and additionally detailed information about each copper exchange area covered by FTTH (number of passed homes, associated MPoP). It includes current state and planned state in the next 3 months.	Information, at least 18 months in advance, of which sites/MDFs affected by the copper switch-off
• ANOs?	There is a general obligation to provide information about the FTTH network, including the MPoPs (OLT location) and their area of coverage. It includes current state and planned state in the next 3 months. This information must be kept up to date. Additionally, for each MDF to be switched-off, information about the planned coverage of the alternative networks to copper.	Information, at least 18 months in advance, of which sites/MDFs affected by the copper switch-off
• SMPO's end-users?	-	-
• Other entities (which entities?)?	-	-
What further information does the SMPO provide voluntarily to the:		
• NRA?	-	-
• ANOs?	-	-
• SMPO's end-users?	Customers are sent information about the planned closure date, the last such communication is done by official means and about 45 days in advance.	Not specifically regulated, SMPO process stipulate information to end-users 1 year in advance.
• Other entities (which entities?)?	-	Counties and municipalities are often informed when the ANOs are informed.
Does the NRA monitor the migration process?	Yes	Yes, several meetings with NRA and SMPO per year, and SMPO present progress and other relevant information.
If this is the case, what does the NRA monitor?	All received closure notifications, their characteristics and evolution. The next major step will be monitoring of the closure of ULL exchanges, which implies the need to remove ANO's equipment. CNMC also publishes a list of exchanges in the switch-off process in its web site, for general public information.	Which sites/MDFs who are affected by the switch-off. General progress and information of feedback from stakeholders.
If this is not the case, why does the NRA not monitor the migration process?	N/A	N/A

Source: BEREC

Table 78: Rules set by the NRA for the migration process and copper switch-off – further rules (BE, HR, CY)

Country	Belgium	Croatia	Cyprus
Did the NRA set the following rules			
• The SMPO has to publish a reference offer for these WAPs?	Yes	Yes	Yes
• The SMPO has to offer these WAPs with KPIs and SLGs?	Yes	Yes	Yes
• The SMPO has a non-discrimination obligation?	Yes	Yes	Yes
Did the NRA set any specific rules which foster/ensure a smooth migration for the end-users?	No	No	Yes
• If this is the case, which rules?	N/A	N/A	See table on migration costs and table for flow of information for ANOs.
• If this is not the case, why did the NRA not set such rules?	²⁰²	²⁰³	
Did the NRA allow the SMPO a copper switch-off to some extent for test purposes?	Not relevant	No	There was no such request
• If this is the case, what are the rules for this test?	N/A	N/A	N/A
Did the NRA set any specific rules:			
• with regard to the impact of the copper switch-off on the universal service?	²⁰⁴	No. Universal service shall be provided on technology neutral way.	No. Since equivalent access does not affect the service offered.
• with regard to emergency situations?	No ²⁰⁵	No ²⁰⁶	No. Access is not affected.
• on other aspects of copper switch-off?	No	No	No

Source: BEREC

²⁰² Currently, there has always been an agreement with the alternative operators and the SMPO on the migration process. In future cases, it is possible no agreement will be reached and then the NRA will intervene

²⁰³ HAKOM considered 5 years noticed period before switch off as an appropriate period which should ensure smooth migration.

²⁰⁴ At the moment, there is no designated universal service provider for the geographical component of the universal service, since this component is provided on a commercial basis by the market.

²⁰⁵ It is considered that the legal disposition in art 107, § 1/1, of the Belgian Electronic Communications Act of 13 June 2005 is technology neutral and applies both to legacy (copper) networks as fiber. It mandates electronic communications voice service providers to take, if necessary in collaboration with the operators of the underlying electronic communication networks, all necessary, even preventive, measures to ensure uninterrupted accessibility of emergency services. Secondary legislation can be enacted to mandate that operators inform their subscribers of any modification regarding the accessibility of emergency services; to date, no such secondary legislation has been enacted.

²⁰⁶ Croatian SMPO has already faced with the problem of the availability of the end user service in emergency situations since old PSTN network has been replaced by all IP (IMS) network and the majority of end users have already been affected by potential problem of availability of the service in case of an emergency situations.

Table 79: Rules set by the NRA for the migration process and copper switch-off – further rules (CZ, EE, FR)

Country	Czech Republic	Estonia	France
Did the NRA set the following rules with regard to the alternative WAPs			
• The SMPO has to publish a reference offer for these WAPs?	Yes.	No	No
• The SMPO has to offer these WAPs with KPIs and SLGs)?	Yes.	No	No
• The SMPO has a non-discrimination obligation?	Yes.	No	No
Did the NRA set any specific rules which foster /ensure a smooth migration for the end-users?	No.	No	Yes
• If this is the case, which rules?	N/A	N/A	Orange has to consider the switched telephone network closure calendar by setting the copper network closure calendar
• If this is not the case, why did the NRA not set such rules?	CTU does not see any negative impact of the process to end users.	As active (in use) WAP amount is very small.	N/A
Did the NRA allow the SMPO a copper switch-off to some extent for test purposes?	-	-	Yes
• If this is the case, what are the rules for this test and the main results of this test?	-	-	Arcep allows shorter notice period for test. Orange will launch its second test soon. Tests allow to rise any concerns about migration (technical difficulties or difficulties linked to communication)
Did the NRA set any specific rules:			
• with regard to the impact of the copper switch-off on the universal service?	No. Universal service is not connected with type of network.	No universal service.	-
• with regard to the availability of the end-user services in emergency situations?	No. Universal service is not connected with type of network.	No	No
• on other aspects of the migration process and copper switch-off?	No. Universal service is not connected with type of network.	No	-

Source: BEREC

Table 80: Rules set by the NRA for the migration process and copper switch-off – further rules (FI, GR, HU)

Country	Finland	Greece	Hungary
Did the NRA set the following rules with regard to the alternative WAPs			
• The SMPO has to publish a reference offer for these WAPs?	No (no obligation in existing SMP decision)	Yes	Yes
• The SMPO has to offer these WAPs with KPIs and SLGs)?	No (no obligation in existing SMP decision)	Yes	Yes
• The SMPO has a non-discrimination obligation?	Yes	Yes	Yes
Did the NRA set any specific rules which foster /ensure a smooth migration for the end-users?	No	No	No
• If this is the case, which rules?	N/A	N/A	N/A
• If this is not the case, why did the NRA not set such rules?	Switch-off have taken place for many years	Will be considered in the new round.	The general obligation of non-discrimination between SMPO's retail and wholesale end-users is applied.
Did the NRA allow the SMPO a copper switch-off to some extent for test purposes?	-	No	No
• If this is the case, what are the rules for this test and the main results of this test?	-	N/A	N/A
Did the NRA set any specific rules:			
• with regard to the impact of the copper switch-off on the universal service?	No. According to law and decisions on universal service, some SMP operators must ensure universal service. This can be done also by mobile communications.	No. The issue will be considered in the new market analysis.	No
• with regard to the availability of the end-user services in emergency situations?	NO, it is included in the law and decisions on universal service.	No. The issue will be considered in the new market analysis.	No
• on other aspects of the migration process and copper switch-off?	No	No. The issue will be considered in the new market analysis.	No

Source: BEREC

Table 81: Rules set by the NRA for the migration process and copper switch-off – further rules (IT, LI, LU)

Country	Italy	Liechtenstein	Luxembourg
Did the NRA set the following rules with regard to the alternative WAPs			
• The SMPO has to publish a reference offer for these WAPs?	Yes	no	-
• The SMPO has to offer these WAPs with KPIs and SLGs)?	Yes	no	-
• The SMPO has a non-discrimination obligation?	Yes	no	-
Did the NRA set any specific rules which foster /ensure a smooth migration for the end-users?	Yes	Yes.	No
• If this is the case, which rules?	²⁰⁷	²⁰⁸	-
• If this is not the case, why did the NRA not set such rules?			-
Did the NRA allow the SMPO a copper switch-off to some extent for test purposes?	Yes ²⁰⁹	²¹⁰	-
• If this is the case, what are the rules for this test and the main results of this test?	See answer above. No specific problems have been reported to NRA after the conclusion of the trial.	N/A	-
Did the NRA set any specific rules:			
• with regard to the impact of the copper switch-off on the universal service?	No, but USO still to be respected after the switch-off.	No	-
• with regard to the availability of the end-user services in emergency situations?	Not currently.	No ²¹¹	-
• on other aspects of the migration process and copper switch-off?	No.	No	-

Source: BEREC

²⁰⁷ Notice period and formal approval procedure by Agcom for the publication of a LEX to be switched off guarantee a smooth migration for the end-users, because operators have enough time to inform final customers and migrate gradually.

²⁰⁸ In the approved amendment to the copper standard offer, a period of at least 12 months after installation of the FTTH connection must be granted for migration.

²⁰⁹ After the technical forum with stakeholders, held by AGcom, a trial among operators has been approved (wholesale&retail level) for a duration of 6 months. The trial dealt with: i) migration procedure of a single lines from the decommissioned LEX to the NGA LEX, ii) migration procedure of multiple lines from the decommissioned LEX to the NGA LEX, iii) wholesale services substitution matrix effects on the final customers in terms of user experience.

²¹⁰ The SMPO did not do switch-offs for test purposes. There was only a pilot project regarding FTTH-roll-out.

²¹¹ No necessity, VoIP-telephony over glass fibre are considered as sufficient substitute for PSTN/ISDN telephony.

Table 82: Rules set by the NRA for the migration process and copper switch-off – further rules (NO, PL, PT)

Country	Norway	Poland	Portugal
Did the NRA set the following rules with regard to the alternative WAPs			
• The SMPO has to publish a reference offer for these WAPs?	Yes (with regards to VULA fibre and FWA)	Yes	N/A There is no obligation to provide an alternative WAP.
• The SMPO has to offer these WAPs with KPIs and SLGs)?	Yes	Yes	N/A
• The SMPO has a non-discrimination obligation?	Yes	Yes	N/A
Did the NRA set any specific rules which foster /ensure a smooth migration for the end-users?	No, will be part of the migration plan	Information about migration should be at least 2 years in advance (the longest end-user contract is of 2 years)	No
• If this is the case, which rules?	N/A	N/A	N/A
• If this is not the case, why did the NRA not set such rules?	-	N/A	So far there were no situations that demanded the intervention of the NRA.
Did the NRA allow the SMPO a copper switch-off to some extent for test purposes?	No	No	It was SMPO initiative to carry out a pilot to assess the behaviour of its customers in light of the need to change infrastructure.
• If this is the case, what are the rules for this test and the main results of this test?	N/A	N/A	There were no specific rules for this pilot (as this was an SMPO initiative).
Did the NRA set any specific rules:			
• with regard to the impact of the copper switch-off on the universal service?	-	N/A	No. Currently, there are no companies designated to provide the US in Portugal. The last US provider was not the SMPO, but an ANO.
• with regard to the availability of the end-user services in emergency situations?	-	N/A	No. By principle, the SMPO undertakes to provide an alternative for its customer, either via fiber or mobile.
• on other aspects of the migration process and copper switch-off?	-	N/A	N/A

Source: BEREC

Table 83: Rules set by the NRA for the migration process and copper switch-off – further rules (SI, ES, SE)

Country	Slovenia	Spain	Sweden
Did the NRA set the following rules			
• The SMPO has to publish a reference offer for these WAPs?	Yes	Yes ²¹²	No, there's no obligation for SMPO to offer access, i.e. no WAP offering.
• The SMPO has to offer these WAPs with KPIs and SLGs)?	Yes	Yes	No
• The SMPO has a non-discrimination obligation?	Yes	Yes	N/a
Did the NRA set any specific rules which foster /ensure a smooth migration for the end-users?	Yes	-	No, specific rules set.
• If this is the case, which rules?	²¹³	²¹⁴	N/A
• If this is not the case, why did the NRA not set such rules?	-	-	²¹⁵
Did the NRA allow the SMPO a copper switch-off to some extent for test purposes?	No	No	No
• If this is the case, what are the rules for this test?	N/A	N/A	N/A
Did the NRA set any specific rules:			
• with regard to the impact of the copper switch-off on the universal service?	No. Universal service is technologically neutral.	No ²¹⁶	No ²¹⁷
• with regard to emergency situations?	No ²¹⁸	No ²¹⁹	Set by universal service regulation.
• on other aspects of the migration process and copper switch-off?	No	Yes ²²⁰	-

Source: BEREC

²¹² The WAPs are imposed in the market analysis. They are not specific for copper switch-off.

²¹³ SMPO will have to provide undisturbed transfer to adequate or better technological solution

²¹⁴ As a general obligation, the SMPO must facilitate migration to available alternative wholesale offers. The guard period (6 months) is designed to smooth migration, in case copper is still in use after the guarantee period.

²¹⁵ As a result of there's no obligation for SMPO to offer access. There's though an ongoing dialog where NRA and SMPO meet and discuss specific issues as feedback from end users.

²¹⁶ The applicable law regarding SU is technologically neutral, so that SU can be provided over other means than copper (like FTTH or radio).

²¹⁷ Not specifically to the copper switch-off, but universal service regulation gives end users right to connection to a public communication network for voice and data of 10 Mbps. There's no specially designated service provider to provide any of these services.

²¹⁸ In emergency situation there are 3 competing mobile networks with coverage of over 99% of population (each)

²¹⁹ Applicable rules (like 112 number) also apply for non copper accesses.

²²⁰ It is explicitly stated that copper switch-off does not change the availability of any wholesale PoH. Exceptional circumstances, like the SMPO still having copper customers after the guard period, are considered in the framework. In the case of 2M leased lines on copper, they must be migrated to fibre.

Table 84: Rules set by the NRA for the migration process and copper switch-off – permission to close MDFs (BE, HR, CY)

Country	Belgium	Croatia	Cyprus
Which permission does the SMPO need in order to be allowed to close MDFs? Does the SMPO:			
• Need for each MDF an explicit permission to close it (Yes/No)?	No	No	No. Rules described in previous tables
• Has the possibility to receive a general authorisation to close MDFs subject to certain conditions (Yes/No)?	Yes, implicitly via the market analysis as long as conditions set herein are respected	No	No
• Need a different type of permission (Yes(which?)/No)?	No	No	No
If the SMPO needs an explicit permission for each MDF:			
• Why is this necessary and a general authorisation not possible?	N/A	N/A	N/A
• Which conditions must it fulfil in order to receive this permit?	N/A	N/A	N/A
If the SMPO has the possibility to receive a general authorisation to close MDFs:			
• Which conditions must it fulfil in order to be allowed to close an MDF?	Notification period of 2 years or less if agreement reached with all operators and an alternative service needs to be provided.	N/A	N/A
• Why does the SMPO not need for each MDF an explicit permission to close it?	There have never been instances where an agreement was not reached	N/A	N/A

Source: BEREC

Table 85: Rules set by the NRA for the migration process and copper switch-off – permission to close MDFs (CZ, EE, FR)

Country	Czech Republic	Estonia	France
Which permission does the SMPO need in order to be allowed to close MDFs? Does the SMPO:			
• Need for each MDF an explicit permission to close it (Yes/No)?	No.	No	No
• Has the possibility to receive a general authorisation to close MDFs subject to certain conditions (Yes/No)?	No.	No	Yes
• Need a different type of permission (Yes(which?)/No)?	No.	No	No
If the SMPO needs an explicit permission for each MDF:			
• Why is this necessary and a general authorisation not possible?	N/A	N/A	N/A
• Which conditions must it fulfil in order to receive this permit?	N/A	N/A	N/A
If the SMPO has the possibility to receive a general authorisation to close MDFs:			
• Which conditions must it fulfil in order to be allowed to close an MDF?	N/A	N/A	<ul style="list-style-type: none"> • FTTH network presence and necessary wholesale services availability; • Operators presence or respect of sufficient notice periods; • Non-discrimination obligation between areas.
• Why does the SMPO not need for each MDF an explicit permission to close it?	N/A	As active (in use) WAP amount is very small.	Too long, not effective.

Source: BEREC

Table 86: Rules set by the NRA for the migration process and copper switch-off – permission to close MDFs (FI, GR, HU)

Country	Finland	Greece	Hungary
Which permission does the SMPO need in order to be allowed to close MDFs? Does the SMPO:			
• Need for each MDF an explicit permission to close it (Yes/No)?	No, but Traficom can intervene if no alternative products are available	No	No.
• Has the possibility to receive a general authorisation to close MDFs subject to certain conditions (Yes/No)?	No	No	Yes.
• Need a different type of permission (Yes(which?)/No)?	No	No	No.
If the SMPO needs an explicit permission for each MDF:			
• Why is this necessary and a general authorisation not possible?	N/A	N/A	N/A
• Which conditions must it fulfil in order to receive this permit?	N/A	N/A	N/A
If the SMPO has the possibility to receive a general authorisation to close MDFs:			
• Which conditions must it fulfil in order to be allowed to close an MDF?	N/A	N/A	²²¹
• Why does the SMPO not need for each MDF an explicit permission to close it?	N/A	N/A	Not proportionate.

Source: BEREC

²²¹ (i) No collocation: inform the NRA 6 months in advance and alternative WAP must be available when the closing is planned. (ii) There is collocation: inform the NRA 2 years in advance and alternative WAP must be available 12 months before the closing is planned. (iii) Or shorter (but not less than 6 months) if the alternative operators concerned all agreed with and alternative WAP must be available at least 6 months before the closing is planned.

Table 87: Rules set by the NRA for the migration process and copper switch-off – permission to close MDFs (IT, LI, LU)

Country	Italy	Liechtenstein	Luxembourg
Which permission does the SMPO need in order to be allowed to close MDFs? Does the SMPO:		no permissions needed	
• Need for each MDF an explicit permission to close it (Yes/No)?	Yes, formal verification of conditions (as above explained) is “per LEX”.	No permissions needed	No
• Has the possibility to receive a general authorisation to close MDFs subject to certain conditions (Yes/No)?	No	No permissions needed	Yes
• Need a different type of permission (Yes(which?)/No)?	No	No permissions needed	No
If the SMPO needs an explicit permission for each MDF:			
• Why is this necessary and a general authorisation not possible?	See answer above.	N/A	N/A
• Which conditions must it fulfil in order to receive this permit?	See answer above.	N/A	N/A
If the SMPO has the possibility to receive a general authorisation to close MDFs:			
• Which conditions must it fulfil in order to be allowed to close an MDF?	N/A	N/A	Availability of fibre LLU/Fibre VULA on the concerned addresses
• Why does the SMPO not need for each MDF an explicit permission to close it?	N/A	N/A	-

Source: BEREC

Table 88: Rules set by the NRA for the migration process and copper switch-off – permission to close MDFs (NO, PL, PT)

Country	Norway	Poland	Portugal
Which permission does the SMPO need in order to be allowed to close MDFs? Does the SMPO:			
• Need for each MDF an explicit permission to close it (Yes/No)?	No	No	No
• Has the possibility to receive a general authorisation to close MDFs subject to certain conditions (Yes/No)?	Yes, they can close MDFs sooner than 2025 according to an approved migration plan. Update Sept. 2021: Telenor submitted a draft plan for migration on 27 August 2021. Based on Nkom's assessment and inputs from access buyers, Nkom has concluded that there is not sufficient basis for further work on the plan. This means that Telenor must maintain the access to copper-based access networks to 2 September 2025.	No	No
• Need a different type of permission (Yes(which?)/No)?	No	No	No
If the SMPO needs an explicit permission for each MDF:			
• Why is this necessary and a general authorisation not possible?	N/A	N/A	N/A
• Which conditions must it fulfil in order to receive this permit?	N/A	N/A	N/A
If the SMPO has the possibility to receive a general authorisation to close MDFs:			
• Which conditions must it fulfil in order to be allowed to close an MDF?	Not decided yet.	N/A	N/A
• Why does the SMPO not need for each MDF an explicit permission to close it?	-	N/A	N/A

Source: BEREC

Table 89: Rules set by the NRA for the migration process and copper switch-off – permission to close MDFs (SI, ES, SE)

Country	Slovenia	Spain	Sweden
Which permission does the SMPO need in order to be allowed to close MDFs? Does the SMPO:			
<ul style="list-style-type: none"> Need for each MDF an explicit permission to close it (Yes/No)? 	No	No. A general authorisation is granted for MDFs and SCs, subject to the defined rules. Any other copper switch-off (partial switch-off) requires explicit permission.	No
<ul style="list-style-type: none"> Has the possibility to receive a general authorisation to close MDFs subject to certain conditions (Yes/No)? 	No	Yes	Yes, in certain cases timespan of 18 months can be shorter as in cases of force majeure that entails that closure must be carried out at short notice.
<ul style="list-style-type: none"> Need a different type of permission (Yes(which?)/No)? 	No	No	No
If the SMPO needs an explicit permission for each MDF:			
<ul style="list-style-type: none"> Why is this necessary and a general authorisation not possible? 	N/A	N/A	N/A
<ul style="list-style-type: none"> Which conditions must it fulfil in order to receive this permit? 	N/A	N/A	N/A
If the SMPO has the possibility to receive a general authorisation to close MDFs:			
<ul style="list-style-type: none"> Which conditions must it fulfil in order to be allowed to close an MDF? 	N/A	It is subject to the general rules for copper switch-off. There are no prerequisites (they were dropped in the 2016 market revision).	-
<ul style="list-style-type: none"> Why does the SMPO not need for each MDF an explicit permission to close it? 	<ul style="list-style-type: none"> SMPO can't close MDF if any AO's end users are still connected SMPO has to provide adequate service to ANOs in case it closes any copper loop 	The defined switch-off rules are considered an adequate balance between the legacy copper obligations and the right to modernize the access network of the SMPO. It must also be taken into account that there would be potentially thousands of such requests.	As a result of there's no obligation for SMPO to offer access.

Source: BEREC

Annex 3: Basic data used in section 4

Table 90: SMPO's framework for migration and copper switch-off (HU, IT, LI)

Country	Hungary	Italy	Liechtenstein
Did the SMPO establish a framework for migration and copper switch-off?	Yes.	Yes	Yes
If this is the case:			
• Is this framework consistent with the rules set by the NRA?	Yes.	Yes ²²²	Yes
• Did the SMPO involve stakeholders (e.g. ANOs, end-users) when it established the framework?	No	Not directly, SMPO collaborated during technical forum managed by Agcom and public consultations.	Yes
• If this is the case:			
◦ Which stakeholders?	N/A	ANOs.	All providers renting passive infrastructure (fibre LLU, copper LLU, collocation etc.) from LKW)
◦ How did the SMPO involve these stakeholders?	N/A	See answer above	By semi-annual meetings with all providers renting passive infrastructure from LKW
• Did the SMPO reach an agreement on the following with the ANOs and, therefore, there was no need for the NRA to impose them:		-	Yes
◦ Notice period?	N/A	No	Yes
◦ Alternative WAPs?	N/A	No	yes (no alternative WAP, forced migration to FTTH)
◦ Migration costs?	N/A	No	Yes (The NRA didn't have to resolve disputes).
• If this is the case, please describe the agreement the SMPO reached with the ANOs	N/A	N/A	The LKW issued a standard offer for FTTH access lines, which was informally checked by the NRA but is not formally approved. see: https://www.lkw.li/userdata/PDF/fact-sheet-fttb-v1.1.pdf
• Which further (major) rules and/or conditions does the SMPO's framework include which were not set by the NRA?	-	N/A	LKW regularly forwards an updated address-based database, regarding planning and progress of FTTH roll-out, to the providers and the NRA.

Source: BEREC

²²² SMPO just published a general Plan for decommissioning, all the other rules coming from the regulation. In addition, SMPO published a general procedure to migrate customers (including massive migration), which is currently under approval process by NRA (after public consultation).

Table 91: SMPO's framework for migration and copper switch-off (PT, SI, SE)

Country	Portugal	Slovenia	Sweden
Did the SMPO establish a framework for migration and copper switch-off?	Yes. MEO foresees a copper switch-off process that will take place in several phases until 2030.	Yes	Yes, there has been a framework set by SMPO as a result of previous experiences from the past years.
If this is the case:			
• Is this framework consistent with the rules set by the NRA?	Yes. It is consistent with the notice periods set out by ANACOM for the closure of copper exchanges.	Yes ²²³	Yes
• Did the SMPO involve stakeholders (e.g. ANOs, end-users) when it established the framework?	Information not available.	Telekom Slovenije informed the ANOs during the preparation phase of the migration process.	Yes, NRA also involved in this work.
• If this is the case:			
◦ Which stakeholders?	N/A	ANOs	Consumer representative organisations, county or municipal organisations, ANOs etc
◦ How did the SMPO involve these stakeholders?	N/A	Workshops	Industry forum
• Did the SMPO reach an agreement on the following with the ANOs:	-	No	There's no obligation for SMPO to offer access.
◦ Notice period?	N/A The NRA imposed a notice period.	Yes, but notice period was defined by NRA.	Yes
◦ Alternative WAPs?	Information not available. Those agreements will be on a case-by-case basis.	Yes. All services on copper network are also available on the optical network	N/a
◦ Migration costs?	N/A	No ²²⁴	-
• If this is the case, please describe the agreement the SMPO reached with the ANOs	Information not available. Those agreements will be on a case-by-case basis.	-	-
• Which further (major) rules and/or conditions does the SMPO's framework include which were not set by the NRA?	N/A	-	-

Source: BEREC

²²³ Telekom Slovenije meets all regulatory requirements of the NRA in migration phase. Most important is Copper switch-off announcement which must be published at least 6 months before implementation.

²²⁴ Telekom Slovenije does not charge additional costs for the construction of the optical network. The only difference is price between the wholesale copper access and optical fibre access which is regulated by NRA.

Table 92: Incentives for end-users and migration issues (BE, NO, PT)

Country	Belgium	Norway	Portugal
Did the SMPO or ANOs set incentives for their end-users after the SMPO announced the copper switch-off (e.g. to close certain MDFs) in order that their end-users migrate voluntarily and to avoid a forced migration?	Yes	Yes	SMPO operator has been addressing their end-users through campaigns in targeted areas. ANOs are also increasing their NGA coverage and migrating the customers from the copper-based products to fiber-based products. In this context, no issues are expected to arise.
If this is the case which incentives?	SMPO: no migration costs for ANOs and free CPE when necessary	Various introduction offers (eg. reduced price on end user equipment)	Potential benefits of the new networks, at the same price.
Did issues occur (e.g. service interruptions) during the migration process (Yes/No)?	Not that the BIPT is aware of	-	No (according to available information).
If this is the case which:			
• Service interruptions?		-	N/A
• Dissatisfaction of end-users with the end-user product after migration?		-	N/A
• Insufficient (or even incorrect) and/or no timely information for end-users?		-	N/A
• Insufficient (or even incorrect) and/or no timely information for ANOs?		-	N/A
• Other (which?)?		-	N/A
How did the SMPO solve these issues?		Improving information to end users	N/A
How did the ANOs solve these issues?		-	N/A
How did the NRA respond to these issues and how did the NRA contribute to solve them?		-	N/A

Source: BEREC

Table 93: Incentives for end-users and migration issues (SI, SE)

Country	Slovenia	Sweden
Did the SMPO or ANOs set incentives for their end-users after the SMPO announced the copper switch-off (e.g. to close certain MDFs) in order that their end-users migrate voluntarily and to avoid a forced migration?	²²⁵	Yes
If this is the case which incentives?	Migrating end-user is offered the same discount as new user.	In some cases there has been some sort of introduction offers.
Did issues occur (e.g. service interruptions) during the migration process (Yes/No)?	No	-
If this is the case which:		
• Service interruptions?	No	-
• Dissatisfaction of end-users with the end-user product after migration?	No	-
• Insufficient (or even incorrect) and/or no timely information for end-users?	No	-
• Insufficient (or even incorrect) and/or no timely information for ANOs?	No	-
• Other (which)?	End-users did not see the need for migration	-
How did the SMPO solve these issues?	Communication and clarification to end-users they will get better quality services	²²⁶
How did the ANOs solve these issues?	Communication and clarification to end-users they will get better quality services	N/a, there's no obligation for SMPO to offer access.
How did the NRA respond to these issues and how did the NRA contribute to solve them?	There was no response to these issues and no contribution of NRA to solve these problems.	NRA have had ongoing dialog white involved stakeholders.

Source: BEREK

²²⁵ Some ANOs encouraged their end users to move rapidly to the optical network, others not. On the other hand SMPO encourages all users to switch to optics, but many obstacles may appear (disinterest, building new internal house installation, ...)

²²⁶ Most of those issues mentioned above were more common in the past years. SMPO has improved on the work process, but of course there can still be issues in some cases.