

Report on practices and challenges of the phasing out of 2G and 3G

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Executive Summary

The topic of 2G/3G phaseout involves many stakeholders from many different domains; users (including vulnerable users and roamers), networks operators (including virtual operators), vendors, device and other manufacturers, competent national or European authorities, and standardization bodies.

This report sets out a high-level analysis of some of the main issues faced by different stakeholders or groups of stakeholders, with a main focus on the potential impacts on end-users and an overall stakeholder analysis.

The report is divided into 5 five chapters:

- **Chapter 1** sets out some background information and gives an overview of challenges and opportunities arising from 2G/3G phaseout, and examples of related practices in several countries.
- **Chapter 2** briefly highlights impacts and provides some insights into what some NRAs consider to be the main impacts from 2G/3G phaseout.
- **Chapter 3** is a high-level stakeholder analysis that emphasizes different stakeholder engagement attributes and aims to help in advancing the conversation about 2G/3G phaseout. It concludes asking the following main consultation questions:

Which other potential challenges/impacts would you identify?

How urgently do you think the different challenges/impacts need to be addressed (time, priority)?

What challenges/impacts have already been solved or can be considered minor?

What stakeholders should initiate (more) efforts to meet the challenges/impacts?

What stakeholders should be involved in efforts to meet the challenges/impacts?

How should they contribute?

- **Chapter 4** is BEREC's preliminary view setting out the importance of stakeholder engagement.
- **Annex A** sets out the results of a questionnaire issued to BEREC Members and summarizes some of the material gathered by the Radio Spectrum Policy Group (RSPG) when it considered the topic.

Figure 1 is a high-level illustration or guide to 2G/3G phaseout, which is constructed from across the report in terms of the main Goals, Means, Challenges, Examples, Impacts and Practices¹.

¹ Questions relating to the environmental impact of 2G/3G phase-out have not been included or studied in this report. In addition to the issues in the chart, the question of the environmental impact of 2G/3G phase-out can be considered by future Berec work on sustainability.

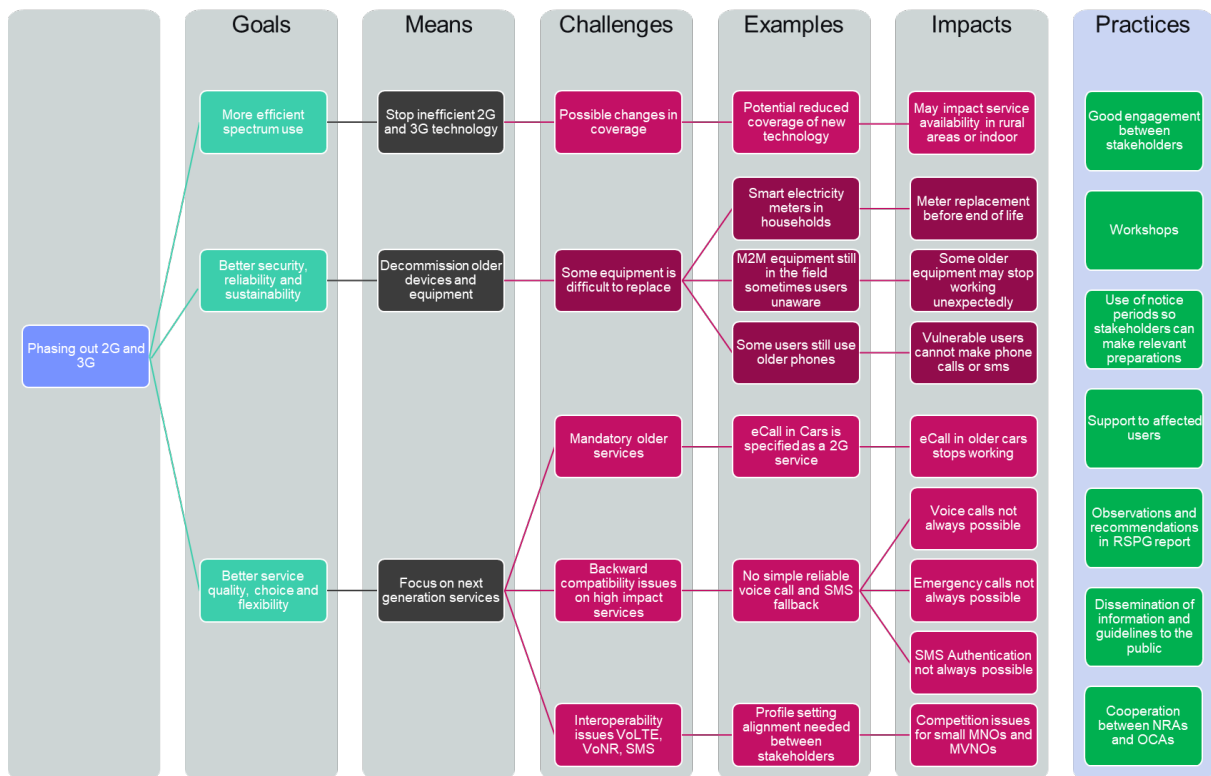


Figure 1: Overview of potential challenges with 2G and 3G phaseout, with examples, impacts and identified practices

1 Introduction and background

Newer generations of mobile communications brought improvements of existing and new services. In 4G, Voice over LTE (VoLTE) was introduced. In 5G, services such as 5G voice (Voice over New Radio, or VoNR), Ultra Reliable and Low Latency Communications (URLLC), Massive Machine-Type Communications (mMTC) and network slicing are introduced. Additionally, eSIM technology has been specified over the last 10 years and started to be deployed since then on top end smart phones as well as IoT devices.

The newer services and newer variants of the older services can be used if end user devices, home networks and visited networks support this type of service. In many cases, when a (newer) service is not fully supported and a setup of such a service is not possible, standards and settings provide for backwards compatibility. This way devices and networks 'step back' to older variants of a service to complete the end-to-end setup of an older variant of such a service that can be supported by all network elements involved.

However, in case of 2G and 3G phase out in many cases no fallback is possible anymore. This means that a number of older devices and services that do not support 4G and beyond will not be supported anymore. Such examples are legacy mobile phones and even some early smart phones, older M2M devices such as smart electricity meters, and eCall functionality built in in cars.

There are also cases where devices and networks support 4G and beyond, but not in a way where interoperability of all services is guaranteed. For some services, there is such a variety of options in the standards that it is possible to comply with standards while not being able to set up a connection. When fallback to older variants is still possible that a consumer hardly notices this problem, but with 2G and 3G phaseout this type of problems will likely surface, for instance when people are not able to call 112 (or 911) in a visiting country².

According to the GSMA Mobile Economy Europe 2021 report³, some operators in Europe still had significant shares of subscribers linked to 2G and 3G technologies. However, due to time passing and recent phase out of 3G in many countries, BEREC does not quote specific totals (of shares of subscribers) here as these totals may change during and after completion of this report.

In addition, according to data provided to WIK for a study conducted for BEREC (the "WIK Study"⁴), consumer MVNOs have a higher proportion of their customers focus on in-store purchase and/or have handsets which do not support 4G or 5G, than is the case for traditional

² <https://eena.org/knowledge-hub/press-releases/many-europeans-cannot-call-911-when-traveling-to-the-us/>

³ GSMA Intelligence https://www.gsma.com/mobileeconomy/wp-content/uploads/2021/09/GSMA_ME_Europe_2021_R_Web_Singles.pdf. BEREC acknowledges that quoting totals is only relevant at a particular snapshot in time, and based on desk research it does not have more recent totals to reference and values/totals are subject to timely modifications.

⁴ <https://www.berec.europa.eu/en/document-categories/berec/reports/study-on-wholesale-mobile-connectivity-trends-and-issues-for-emerging-mobile-technologies-and-deployments>

MNOs. MVNOs also reported to WIK that legacy handsets are more prevalent in certain countries, such as the UK and Ireland, than in others, such as the Czech Republic.

Also in the WIK Study, IoT MVNOs reported that a non-negligible proportion of their devices are based on older technologies such as 2G and 3G. For example, applications such as telecare alarms or payment terminals run on 2G connectivity – sometimes retailed by an intermediary so MNOs or MVNOs do not have precise numbers of active devices in operation.

1.1 Challenges and opportunities

Switching off 2G and 3G will affect voice communication such as emergency communications, including eCalls, as well as data communications from legacy systems such as smart meters, security alarms, remote controls, M2M and IoT applications.

Specifically, the possible impact on interoperability and coverage issues of emergency calls, the coverage issues in rural and remote areas supported by 2G as well as understanding which M2M and IoT devices in operation will be affected are important issues to be considered. In addition, the continuity of services for end-users and the challenges of migration of these services to new technologies also need to be considered. The transition to IP based telephony is therefore essential for the success of switching off some of the legacy services. Nevertheless, standardization bodies, MNOs, network equipment vendors and device manufacturers will have to develop, implement and adopt adequate standards for VoLTE and VoNR so service availability of voice calls including emergency calls is preserved, also when roaming or switching service providers with compliant smartphones. Limitations in existing terminal equipment, the replacement cycle and the possibility of an inadequate availability of spare equipment parts by the end of this decade should be taken into account.

Phasing out older technology generations will have positive effects on different aspects, such as an increase in spectrum and energy efficiency and improved communication security. It will therefore provide a reducing security risk. The phasing out will also result in higher data speeds that will enable new use cases. In addition, it will save in network and maintenance complexity, reducing the required knowledge of maintenance employees and the reserves of spare equipment. Finally, the environmental impact of the switch-off needs to be considered, both positive and negative, as the replacement of network and end-user equipment will have its impact. These benefits are in the interest of regulatory authorities and administrations, while being of great value to operators and consumers⁵.

⁵ RSPG22-035 FINAL: Mobile technology evolution – experiences and strategies https://radio-spectrum-policy-group.ec.europa.eu/system/files/2023-03/RSPG23-010final-RSPG_Report_on_Mobile_technology_evolution_%28with%20annexes%29.pdf

1.2 Practices: relevant country case examples

In several countries initiatives have been developed to address the challenges and opportunities described in the previous paragraph. Below some examples of such practices are given.

1.2.1 France

After the announcements of several 2G/3G sunsets across the world for several years, the first one for the metropolitan territory in France has been made on the 1st of March 2022 by Orange. Previously other sunsets were operated overseas, 2G has been switched off in December 2020 in Saint-Martin and Saint-Barthelemy.

Orange has taken this decision unilaterally as MNOs are not required to maintain a technology. Licenses are technology neutral.

On the 1st of March 2022, Orange announced the sunset planning for 2G and 3G. 2G will be the first technology to be switched-off in 2025, and 3G will follow in 2028. The announcement was initially made by press release.

The 2G/3G sunset is presented as an overall modernization of the network. Technology evolution has led the way to 4G and 5G roll outs, which have reached today the same coverage level as 2G/3G. The sunset of 2G and 3G networks is therefore the next step with a purpose to rationalize technologies and to focus on the most recent ones which are more efficient, faster and more secure. 4G and 5G are more adapted to the actual and future data consumption trend.

This operation has been made possible by the 4G coverage efforts that have been made over time: rural or hilly areas shall be as well covered in 4G/5G as in 2G/3G. Today, 2G and 3G operate over frequency resources that could be more efficiently harnessed by 4G or 5G technologies.

Both individual and business customers will be supported. Individual customers will be able to get a compatible phone at an Orange store and could have their old phone recycled or exchanged. Business customers have the option to get their connectivity over LTE-M, more suitable for IoT devices. The announced agenda should leave enough time to both parties to migrate their equipment.

From an operational viewpoint: 2G (then 3G) switch-off is expected to be led at once over the whole territory. One issue remains though: active network sharing between one operator willing to switch-off a technology and another willing to keep this technology operating.

Nine months after this announcement, SFR and Bouygues Telecom released their sunset agenda. SFR will switch off 2G by 2026 and 3G by 2028, while Bouygues Telecom will switch off 2G by 2026 and 3G by 2029.

1.2.2 Hungary

In Hungary more than 95% of the total mobile internet traffic relied on 4G networks and with the implementation of VoLTE the voice traffic rapidly shifted toward 4G and reached 62% at the end of 2021.

After consultations with stakeholders NMHH concluded that 2G phase out is not feasible until proper solutions are developed to handle the following issues:

- A large proportion of the population would lose mobile service (people use 2G only phones – no fall-back scenario in this case).
- Many M2M services would be discontinued, including critical services such as on-line cash registers communicating with the tax authority servers or security and other measuring services.

In case of the 3G phase out NMHH, along with other stakeholders, set the objective that concerned consumers should not be adversely affected by the switch off. As a result, NMHH launched a programme called „NetreFel” (supported by a website⁶) to raise awareness, inform and educate people to ensure the smooth switch-off of 3G networks. As part of “NetreFel” the Mobile Device Exchange Support Programme was launched in February 2021. The programme offered a one-time subsidy for residential users to replace their old handsets to at least 4G VoLTE capable mobile phones (one user – one subsidy). First, subsidies were issued only to exchange 3G devices, later the replacement option was extended to 2G phones as well. The initial subsidy of HUF 20,000 (appr. EUR 54) was doubled in the second phase of the programme. By 31 March 2023 120,000 phones were replaced for new 4G/5G capable devices while old phones were collected and the recycled in an environment friendly manner. The Programme was funded from the budget of NMHH with subsidies amounting to HUF 4.2 billion (appr. EUR 11.4 million) thus helping consumers to use better, faster and more reliable services with a renewed mobile phone fleet in Hungary.

NetreFel had a significant contribution to the fact that no consumer complaints were issued during the phase out of 3G services by service operators. (Magyar Telekom shut down its 3G services on 30 June 2022, Vodafone did the same on 31 March 2023, and the third MNO, Yettel also switched off the vast majority of its 3G services) Nation-wide switch-off is expected to be completed by no later than 31 December 2023.

1.2.3 Switzerland

In Switzerland, the replacement of 2G with newer mobile technologies is underway in all three mobile networks. One mobile network operator has already completed the switch-off of 2G. A second mobile network operator will switch off 2G in the first half of 2023. A third MNO has not provided a date, but the percentage of 2G base stations on that network is in the low single digits.

⁶ <https://netrefel.hu/>

One mobile operator has announced that it will cease 3G operations by the end of 2025. The other two mobile operators have not yet announced a date for the discontinuation of 3G operations.

Affected customers have been and will be informed by the mobile network operators in good time and on several occasions in writing, by telephone and by text message about the replacement of 2G and 3G technology. Likewise, the affected customers will receive offers from the mobile network operators to help them cope with the changeover.

1.2.4 Sweden

In Sweden, the retirement of the copper network started in 2009 and is planned to finish in 2026. About 90 % of the copper lines are no longer active. The closing of 3G has been going on since 2020 and is associated with the build out of 5G. The planned 2G closing will happen in 2025 in one organised activity.

The Swedish regulator PTS has been given a government assignment to follow up on the phasing out of the 2G and 3G networks and the copper network. The assignment instructs PTS to follow up on what information efforts that are carried out by the MNOs. PTS must also follow what replacement solutions that are offered. If necessary, PTS is obliged to report and propose measures to the government.

To accomplish the assignment, PTS arranges quarterly meetings with four MNOs in Sweden. The meetings address the present closing of 3G, as well as the planned 2G closing in 2025, and discuss the phasing out in relation to other topics.

PTS has a close collaboration with the MNOs, the industry association TechSverige (a member organization for companies of all sizes within the tech sector), and SKR (Swedish Association of Local Authorities and Regions). Together and individually, activities are carried out, such as arranging and participating in webinars, and to keep contact with the media.

Annually, PTS organises and facilitates a public streamed meeting with the operators and other stakeholders. At the meeting phasing out plans are presented and discussed. The meeting is open for the public to ask questions via chat. PTS also addresses important issues, such as making a procurement in time.

PTS uses different ways of communicating information to the public and the stakeholders about the phasing out of the 2G and 3G networks. The website is kept updated with a FAQ, as well as material from previous web meetings. PTS has a hotline for people experiencing problems with communication networks, as the phasing out sometimes is identified as the source of the problem.

PTS is also in contact with other relevant authorities regarding eCalls, e.g. The Swedish Transport Agency, The Swedish Transport Administration and SOS alarm, the publicly owned company operating the PSAPs for the emergency number 112 in Sweden. The Swedish Consumer Agency has also shown interest in making joint efforts with PTS, and the planning is ongoing.

The Swedish MNOs monitor and inform their customers if they need to change their subscription or buy new equipment, and TechSverige works to reach the media, various interest organizations and industry associations to get the word out about the phase out. The Swedish Consumer Agency and the Swedish Association of Local Authorities and Regions are also working to reach out to users with information. PTS is not aware of any MVNOs participating in any activities other than web information. Various media have on several occasions highlighted the phase out and its effects.

MNOs report that the rollout of VoLTE is going well. One problem for MVNOs is though the time-consuming process to verify terminals by manufacturers.

1.2.5 United Kingdom

The UK's mobile network operators have confirmed to not continue to offer 2G and 3G mobile networks beyond 2033 at the latest. Switching-off 3G first and supporting the further roll-out of 4G and 5G mobile networks. This switch-off will impact customers using older mobile devices and services. Ofcom published a document setting out how mobile providers approach this switch-off to ensure consumer continuity⁷.

Ofcom sets out that while it does not have a formal role in the switch-off process itself, it wants to ensure that consumers are treated fairly and can continue to access the services they need. Amongst the key expectations that Ofcom sets out for operators include: minimising coverage impact; contractual information about switch-off of services should be explained; customers should be communicated with and supported by providers as required; and the notice period for certain classes of customers should be taken into account.

Ofcom also sets out that intends to regularly meet with MNOs to get updates on their switch-off progress, continue to gather metrics on the use of 2G and 3G networks, maintain an up-to-date website guide, monitor complaints, and continue to engage with stakeholders.

1.2.6 Additional NRA information about 2G/3G phase out

From the BEREC questionnaire to NRAs and other information some additional practices were observed:

- ECOI (Iceland) performed a public consultation regarding the intentions of the MNO's to switch-off 2G and 3G to co-ordinate the time of phase out. Meetings were held with stakeholders who provided comments during the public consultation. The result was to delay the planned 2G phase out by one year. Both will be switched-off by end of 2025.
- BNetzA (Germany) conducted the 3G switch off reactively, in order to organize this process as customer-friendly as possible. The 3G switch off did not have negative

⁷ Ofcom document «3G and 2G switch-off: Our expectations of mobile providers», available at https://www.ofcom.org.uk/data/assets/pdf_file/0025/252592/3G-and-2G-switch-off.pdf

consequences for customers and was done successfully. BNetzA was contacted by a number of interested customers, but there have not been complaints about the switch off as operators have started to offer alternative offers in time.

- ACM (the Netherlands) together with the Dutch Authority for Digital Infrastructure and the Ministry of Economic Affairs and Climate, in informal contact (round tables) with mobile operators, MVNOs and manufacturers about this matter, especially in the context of reachability of the emergency number (112). This is also mentioned in a letter of the Minister in response to parliamentary questions reflecting concerns about 112 reachability in case of 2G/3G phaseout⁸

1.2.7 RSPG view's on Mobile Technology Evolution

The Radio Spectrum Policy Group (RSPG), the advisory body to the European Commission, adopted a Report on: "Mobile technology evolution – experiences and strategies (February 2023)"⁹ as a contribution from a strategic spectrum management perspective to the process of switching off 2G and 3G, which will affect legacy systems, equipment and services such as eCall, emergency calls and smart meters.

To explore the issue, a questionnaire was issued to RSPG Members and representatives of the EEA countries¹⁰ and a workshop was held, with the purpose:

- to identify the possible impact of an anticipated 2G/3G phasing out
- to gather input from stakeholders on the impact of 2G/3G switch-off and evolution to 4G/5G technologies and
- to understand possible obstacles or delays to technology evolution,

The main benefits and obstacles/barriers (pros and cons) are summarized below.

Benefits in general that have been highlighted in the report include:

- Improvement of spectrum and energy efficiency
- Improvement of communication security
- Achievement of savings in network and maintenance complexity
- Reduction of reserves of spare equipment parts deployed on the network
- Upgrade incentives for customers, as some customers also actively seek the latest technology
- Uphold the principle of technology and service neutrality
- Migrating from 4G to 5G is more flexible compared to migration from previous generations because of dynamic spectrum sharing (DSS); DSS allows supporting both 4G and 5G in same band based on real-time demand

⁸ <https://open.overheid.nl/documenten/ronl-2b65567de8771e35c7288d5844a64dadc19d34e9/pdf>

⁹ Available in https://rspg-spectrum.eu/wp-content/uploads/2021/06/RSPG21-033final-RSPG_Opinion_on_RSPP.pdf.

¹⁰ See Annex A

Obstacles / Main barrier:

- Current emergency call and eCall are still mainly routed through **circuit-switched** mobile technologies (2G/3G) and not packet switched 4G/5G networks, thus phaseout would endanger access to emergency services for both EU citizens (including when roaming within the EU) and inbound roamers from third countries.

RSPG concludes that:

- From a spectrum regulatory perspective, no need has been identified for regulatory intervention to extend the lifespan of 2G/3G.
- A switch-off of both 2G and 3G networks will disable the use of eCall under the current regulation. Any update of eCall framework should assess impacts on current licenses in force
- Operators will switch off 3G before 2G, mainly due to lower volume of 3G traffic registered in their networks.
- RSPG observes that prior to phasing out of 2G/3G, MNOs tend to repurpose high frequency bands first: 2.1 GHz band from 3G to 4G/5G and 1800 MHz band from 2G to 4G/5G. Repurpose 2G and/or 3G spectrum for more efficient 4G and 5G technologies, in terms of energy, and capacity MNOs tend to prefer retaining 2G and/or 3G in the 900 MHz band during the coming years, but the situation differs among countries.

RSPG also highlights that the transition from circuit switched telephony over 2G and 3G networks to IP based (packet switched) telephony over 4G (VoLTE) and future generations (5G, 6G) is an essential condition for successful 2G/3G phasing out.

1.3 Summary of key practices in countries

In Europe the phaseout of 2G and 3G networks is still in full progress with completion dates still in the future or even unknown. Nevertheless, useful practices that seem to emerge from the country examples are:

- Good engagement between stakeholders

Cooperation between involved stakeholders is a useful tool to ensure that the phase-out will be concluded uneventfully. In some cases, NRAs, Other Competent Authorities (OCAs) or Consumer Agencies have cooperated with MNOs, in a form of a public consultation or regular meetings in order to ensure service continuity for consumers during and after the phaseout and that adequate information is disseminated to affected stakeholders timely.

- Workshops

Some involved organisations organised workshops related to the issue of 2G/3G phase-out impacts for consumers in order to inform the stakeholders accordingly and raise public awareness. Such workshops promote the visibility of the issue and strengthen the need for finding a solution.

- Use of notice periods so that stakeholders can make relevant preparations

The announcement of clear notice periods is a practice used by most MNOs and it is obviously very important so as to allow the relevant stakeholders to timely prepare for a controlled, well managed phaseout.

- Support to affected users

In some cases, the service operators supported the affected consumers by providing assistance with the replacement of old legacy mobile devices with other mobile devices that can operate with the new technologies. This action when coupled with recycling of withdrawn devices, is also environmentally beneficial. These practices need to be considered against the stakeholder analysis and the identified potential challenges / impacts next.

- Dissemination of information and guidelines to the public

In some countries websites of NRAs or MNOs have published information and guidance notes on their websites regarding the phase out. In some countries media coverage has been given to the phasing out of 2G and/or 3G.

- Observations and recommendations in RSPG report

Several observations and recommendations were given in a recently published RSPG report (see the previous paragraph)

- Cooperation between NRAs and OCAs

In some countries National Regulatory Authorities are in contact with Ministries and Other Competent Authorities to share observations or to jointly contact market players. As a result, other useful recommendations include:

- Coverage matching what was previously offered¹¹ (a recommended MNOs' best practices)
- Stakeholders/suppliers/service providers not introducing devices and solutions, which are based solely on legacy technologies (awareness raising practices).

¹¹ See also the United Kingdom practices re: monitoring use of 2G and 3G networks and reporting on same in the Connected Nations reports. In addition, a national observatory focusing on the evolution of mobile phone sites is also available in France [here](#).

2 Examples of impacts

2.1 High level list of impacts

Based on some of the challenges identified in Chapter 1, BEREC sets out a high-level list of impacts, as follows:

Service availability/coverage

Service availability in rural areas might be an issue if there would be no complementary coverage available. Service availability can be addressed by i) having similar coverage levels of 4G prior to 2G/3G switch-off and ii) recognising that frequencies used for 2G/3G can be used for other technologies (the frequency is not being retired only the carrier technology is), thereby there would be continuity in coverage.

For example, in France, 4G coverage efforts have been made over time so that rural or hilly areas can be as well covered as in 2G/3G. Arcep (France) also makes the point that today, 2G and 3G operate over frequency resources that could be more efficiently harnessed by 4G or 5G technologies.

Services are consumed outdoors, indoors (homes/offices/shopping malls, etc, inside of a window or deep inside buildings) or on the move (cars/trains/trams/underground).

RSPG sets out that the 900 MHz band is the lowest spectrum for 2G/3G and, thus, can provide for large coverage areas and deep indoor coverage.

BEREC recognises that indoor coverage depends on the type of building material used and that other connectivity solutions may be available to consumers indoors (e.g. native Wi-Fi calling or mobile repeaters, or both). For example, frequencies used for 2G and 3G generally tend to penetrate deeper into buildings, these frequencies may be reused for newer technologies (4G, 5G and beyond). In which respect this may replicate the current service availability.

However, if the current service availability of 2G and 3G services is not matched in the new situation (or in a temporary situation) there could potentially be an impact.

M2M device replacement before end of life

Many older M2M devices such as meters do not support 4G and later mobile technologies and are still dependent in many geographies on 2G/3G technologies. Depending on the connectivity solutions installed in these devices, to address this issue may involve installing whole new units before the originally expected end of life, because the radio device is in many cases an integral part and cannot be replaced separately.

Some older equipment may stop working unexpectedly

In some markets 2G/3G phaseout will affect data communications from legacy systems such as smart meters, security alarms, remote controls, M2M and IoT applications.

An interruption to service continuity could negatively impact these businesses. The phaseout should not result in service unavailability of emergency alarm devices. Therefore, early engagement between all stakeholders can help minimise disruption.

Vulnerable users cannot make phone calls or SMS

Generally, consumers expect their phone and all basic services (voice calling, SMS, IP connectivity) to continue working as they are used to. In particular, vulnerable users may be more dependent on their devices as a communication means and may be more affected by change.

BEREC considers that every effort should be made by operators to minimize stress and worry for vulnerable users (the elderly or disabled and users who may rely on older feature phones that are based on 2G and 3G mobile technologies).

eCall in existing cars fitted with 2G modules stops working

eCall is a built-in feature in cars, that automatically contacts emergency services in case of a serious accident¹². Many existing eCall modules in cars are 2G only. It is often accompanied by an option to make a phone call to a service centre of the car manufacturer in case a driver needs non-urgent assistance. Current eCall regulation is mandatory (according to Regulation (EU) 2018/858) and allows circuit-switched mobile technologies (2G/3G).

In short, 2G/3G switch-off will render eCall service impossible. Retrofit of cars may not be a suitable solution, owners may have to contact the vehicle manufacturer or authorised dealership and retrofit devices require VoLTE to work, which may not be the case. The process applied by national authorities to certify that a model of a vehicle meets all EU safety, environmental and conformity of production requirements before allowing it to be placed on the EU market may not cover retrofitting solutions. In addition, aftermarket solutions may not be reliable and are costly for the customer.

From discussions at the workshop held by RSPG, stakeholders set out that it is urgent that the European Commission amend the EU Type Approval Regulation. In addition, in the transition period it is up to automotive industry to quickly integrate 4G modules and find adaptive solutions for the existing fleet.

BEREC is aware that the European Commission is working on addressing next generation eCall but notes that this may not address the legacy issues associated with existing cars¹³.

¹² [eCall is defined: https://europa.eu/youreurope/citizens/travel/security-and-emergencies/emergency-assistance-vehicles-ecall/index_en.htm#shortcut-0](https://europa.eu/youreurope/citizens/travel/security-and-emergencies/emergency-assistance-vehicles-ecall/index_en.htm#shortcut-0)

¹³ BEREC is aware that the EC is advancing its thinking about two aspects on the eCall issue, see also footnote 27. However the published proposals do in its current form not yet solve the service continuity issue of eCall equipment built in existing cars.

Voice calls not always possible (a service continuity issue)

When next generation voice (VoLTE, VoNR) is used to make an emergency call, but the call cannot be completed due to interoperability issues between handsets and (visited) networks, normally an automatic fallback to 3G or 2G voice is initiated. But this fallback will not be available anymore in case of 2G/3G phaseout, resulting that call setup is not completed.

In Figure 2 a high-level technical illustration is given of an interoperability issue that is currently experienced in some situations. Not all devices that are supporting 4G or 5G voice calls support the same settings because there is some freedom in the allowed settings in the standards. Also, not all networks support all settings.

So, consumers may use a device which they think supports 4G and/or 5G voice calls, but for instance when roaming abroad or when using a SIM-only subscription in networks where 2G or 3G fallback is not possible anymore, they may find that although the device has coverage and an IP connection is present, the device does not always support initiating or receiving voice calls.

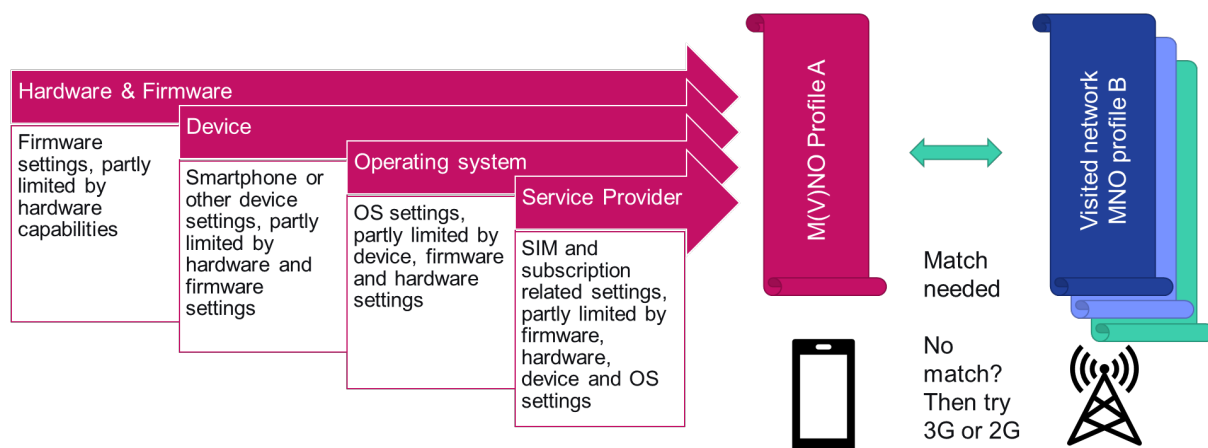


Figure 2: Interoperability issue of VoLTE and VoNR explained (simplified)

The figure tries to convey – at very high level – different observations from different sources and conversations with experts. The main observation is that many different stakeholders are involved in aligning the settings that are necessary to make a voice call over 4G or 5G networks work properly. BEREC welcomes any input to improve this picture, bearing in mind it is intended to be a high-level illustration.

A handset by itself may have some limitations on which standards can be used, due to manufacturer choices of the hardware and firmware. A handset must also be configured and tested with the specific implementation of the VoLTE standard in the home network. If sold by the MNO/MVNO this process can precede the taking into use of the equipment. When equipment, not sold by the MNO/MVNOs, is used on their networks, the testing process may be complex and burdensome, and the network operators are dependent on the handset manufacturers for the present network profiles in their software to be compatible with their

respective networks. A possibility to update the equipment configuration is part of the solution, but because this requires user acceptance and installation, and also some technical knowledge, end-users may have varying abilities to satisfactorily complete such a process.

VoLTE in roaming situations is a specific problem where incompatibility issues are likely. It requires an appropriate configuration of the network and the handset with regard to the roaming parameters defined in the standards where the flexibility of these parameters may provide a particular problem¹⁴.

Network operators may test types of terminal equipment and provide transparency on equipment compatible with their networks (by whitelisting equipment) but in practice this is burdensome due to the large number of device models and differences in compatibility (even between sub models). Also, whitelisting equipment likely impedes the free choice of end-user equipment. Device manufacturers, including integrated devices and chipsets, from their side do not seem to provide sufficient transparency on the network compatibility of their products.

Testing for VoLTE in the many scenarios that happen in live networks is crucial. GSMA is working on recommendations to reduce the number of potential profiles¹⁵.

Only handsets that fulfil (parts of) the VoLTE standard which are relevant for the access to 112 in a sufficient manner, e.g. by using an appropriate pre-defined implementation profile, and are configured as such, should have access to the European market. But whether this can be enforced in reality is not certain, because people buy handsets in other countries or enter European country as a business visitor or tourist with their own device of which they assume it can still be used to make and receive voice calls, including emergency calls.

Possible interoperability issues are also reported for SMS. BEREC observes that stakeholders are working on these issues.

Emergency communication not always possible

Similar to the discussion above on service continuity, when next generation voice (VoLTE, VoNR) is used to make an emergency call, but the call cannot be completed due to interoperability issues between handsets and (visiting) networks, normally an automatic fallback to 3G or 2G voice is initiated. But this fallback will not be available anymore in case of 2G and 3G phaseout, resulting that call setup is not completed.

BEREC observes that stakeholders are working on this issue.

Additionally, SMS-to-112 is a mainstream channel of access to emergency services in 23 European countries. In addition, the transmission of handset-derived location from

¹⁴ Verisure notes that even where VoLTE support exists, carriers cannot support VoLTE with roaming SIM cards, which is a particular challenge for M2M users, as many M2M devices that are installed across multiple geographies rely on “global” SIM cards that by design are meant to operate almost entirely via roaming.

¹⁵ <https://www.gsma.com/services/blog/two-ims-profile-chosen-volte/>

smartphones (i.e. Advanced Mobile Location), relies heavily on SMS as does location provided using HTML5 (the link required to transmit device-based location to the PSAP using HTML5 is sent to the end- user in a SMS message). There is a strong expectation that SMS will continue to function correctly following 2G/3G phaseout. However if interoperability of SMS is not guaranteed or adequately supported following 2G/3G phaseout, there may be situations whereby SMS messages are not delivered, which may have implications for these services.

SMS authentication not always possible

Access to some classes of internet services requires multi-factor authentication (e.g. e-banking, e-government services), and sometimes this is an SMS code sent to the user's phone. Because interoperability is not guaranteed or adequately supported, there may be situations whereby SMS codes are not delivered, which may have implications for authentication of these services.

Competition issues for small MNOs and MVNOs.

Different market players may have different abilities to solve, for example, the high impact issue of service continuity – and as a result the market dynamics of different stakeholders may impact competition.

Also, other parties such as OEMs and OS providers may have an ability, maybe even without knowing, to (directly or indirectly) frustrate smaller stakeholders in the value chain – again competition may be impacted.

For example, MVNOs, or small MNOs, may experience more issues and difficulty in putting forward preferred VoLTE, VoNR profile alignments in standards, and implementing them, as compared to bigger MNOs. Bigger MNOs may also have better bargaining power with large smartphone manufactures on the default settings in handsets.

As a result, BEREC is of the view that resellers and MVNOs (and smaller MNOs) should not be discriminated against in relation to setting and implementing profile alignments in standards for VoLTE, VoWiFi and VoNR. BEREC therefore, emphasises that device vendors and network operators (and standards bodies) should ensure that such cooperations align with non-discriminatory competition principles.

In relation to infrastructure sharing during the phaseout itself, BEREC's common position on mobile infrastructure sharing (BoR(19) 110) already envisaged the possibility for a single shared network as a means of offering 2G or 3G technologies in markets.¹⁶

¹⁶

https://www.berec.europa.eu/sites/default/files/files/document_register_store/2019/6/BoR_%2819%29_110_CP_Infrastructure_sharing.pdf

2.1.1 Additional NRA information about impacts (from the BEREC questionnaire to NRAs)

CRC (Bulgaria) notes that, regarding the problem with ensuring customer capability to make emergency calls, the provision of voice calls and text messages over 4G and 5G in general, or complaints regarding difficulties with voice calls or SMS when roaming and issues regarding eCall support, lies in implementations not adopting some of the VoLTE standards features and impacting voice calling. Some 4G/5G voice over LTE implementations do not ensure interoperability between networks and devices. 112 calls and eCall are not guaranteed, particularly when roaming. Operators may demand 2G/3G for 112 and block VoLTE emergency calls.

DBA / ADSI (Denmark) expressed the view that any future regulation on eCall should, to the widest possible extent, be technologically neutral and allow for eCalls also to be routed via other mobile technologies than 2G or 3G. The implications of possible new obligations for existing providers to continue to use legacy wireless technologies, e.g. 2G or 3G, in order to support eCall should be carefully considered. Only proportionate burdens should be imposed, specifically when taking into account that these may disrupt the basis of the issued licenses for mobile providers, which have been issued typically on the basis of auctions or public tenders. Similar considerations are relevant with regard to the implications of imposing specific obligations regarding 4G or 5G technologies on providers or existing spectrum license holders.

MCA (Malta) believes that the fact that current implementation of 4G standards does not ensure compatibility and interoperability between all devices and networks for VoLTE services becomes particularly challenging when phasing out 2G and 3G networks and there is no circuit-switched fallback solution to provide legacy voice services. In particular, roaming activity could be restricted when a subscriber wants to make or receive voice calls whilst roaming abroad and connected to a visited network which depends only on VoLTE technology due to 2G and 3G phase-out. Furthermore, access to emergency services when roaming on such a visited network is also a concern.

MCA believes that for the switch-off of legacy networks (be it 2G, or 3G or both), VoLTE (and/or VoNR) and SRVCC in the interim, have to be in place in a timely manner to enable a smooth transition away from circuit switched voice. The sunset of 2G and/or 3G networks shall have implications on deployed legacy M2M devices which also have to be migrated away from legacy networks. In 2022, the MCA consulted on aspects concerning the phasing out of 2G/3G networks. The MNOs agreed with the initiatives announced by the MCA in this document. The implementation of such are still works in progress.

ARCEP (France), throughout an expertise committee, is leading a deep study to understand the environmental impact of 2G/3G sunset, which considers energy gain, terminal (M2M and general public) replacement impact in phase with ITU recommendation. In the short term, as each MNO releases different network configuration for wifi calling, the validation (i.e. possibility to initiate a wifi calling) is made separately for each terminal, thus it is possible that few VoWiFi capable device are not authorised to wifi call by the network. In the long term this should be fine as terminal manufacturer will converge towards the same configuration.

2.1.2 RSPG's views on impacts affecting services, devices, legacy systems and licences

For the definitive version of RSPG's views on impacts affecting services, devices, legacy system and licences please see the RSPG report.

In summary, BEREC notes that RSPG identifies many of the same impacts as identified here above. In relation to the impact on licences, RSPG sets out that:

- licences should continue to be technology neutral (though it might be necessary to update some harmonized technical conditions)
- licence obligations may be associated with certain frequency bands and/or technologies,
- 2G/3G switch-off should not result in service unavailability
- agreements for passive sharing of older technology infrastructure should continue
- possible changes in coverage should be minimised, particularly if the new technology (such as VoLTE) does not provide the same coverage as the replaced legacy technology on the same band
- the extent of 2G and 3G coverage varies from country-to-country.

2.1.3 Summary illustration about challenges, examples and impacts

The challenges, examples and impacts are summarized in the figure below.

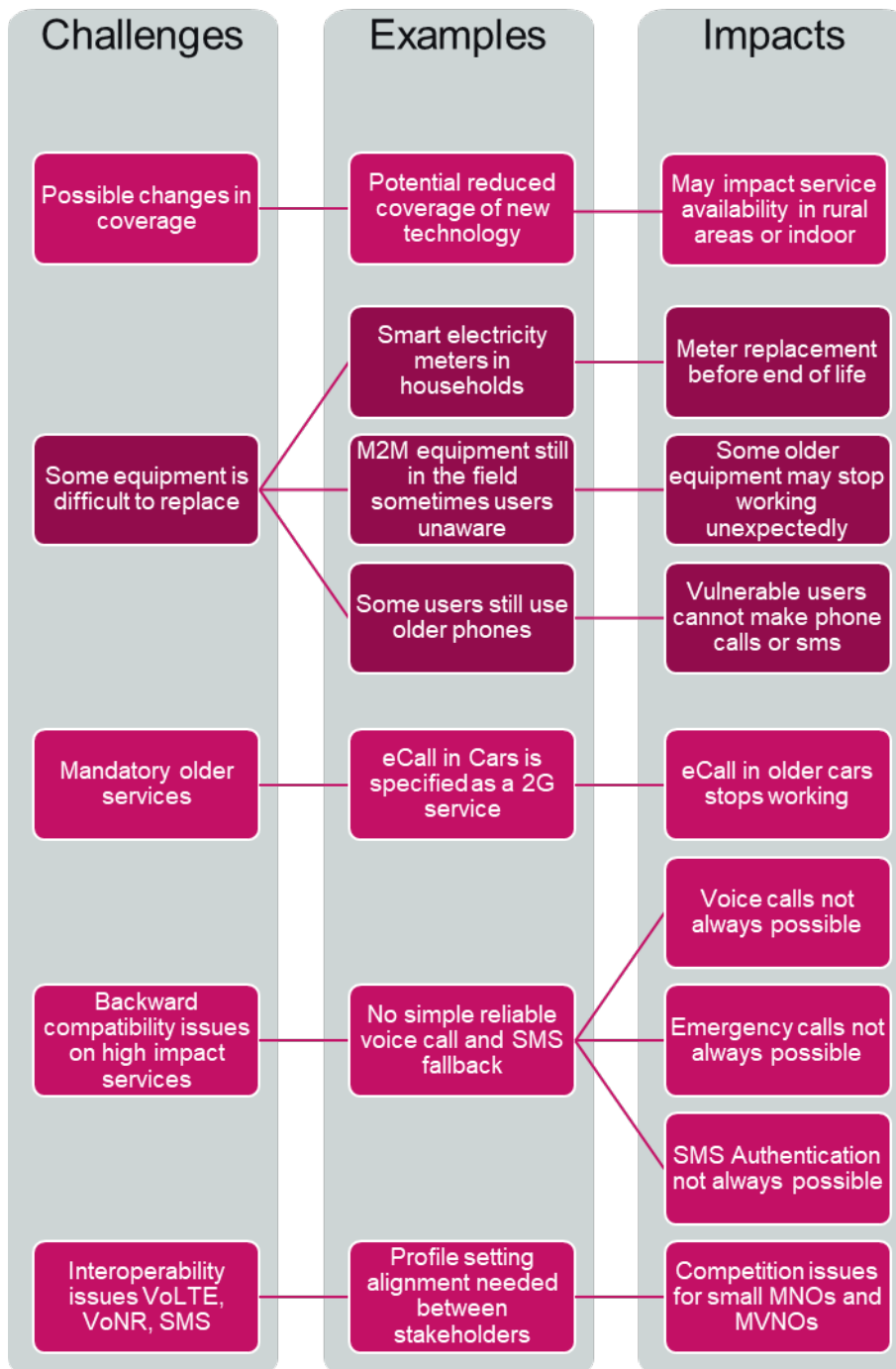


Figure 3: Summary of some of the impacts from 2G/3G phaseout.

3 High-level stakeholder analysis

3.1 Introduction

BEREC recognizes that this is a multi-stakeholder and multi-facet issue. By making a high-level analysis of stakeholders, BEREC hopes to generate constructive debate amongst relevant stakeholders.¹⁷

BEREC sets out a preliminary stakeholder analysis as a means to advance the conversation about the impacts of 2G/3G phaseout forward. BEREC does not assign the responsibility on any individual stakeholder or stakeholder group for solving all problems, because it recognizes that there is an interplay between many stakeholders.

The main goal is to generate further conversation between stakeholders who may or may not recognize the different issues faced by other stakeholders and groups of stakeholders.

3.2 BEREC's preliminary stakeholder analysis

BEREC identified a long list of potential stakeholders¹⁸, listed and grouped in Figure 4. In the next chapter for each stakeholder a short description is given attempting to identify why this stakeholder is involved in addressing the negative impacts of 2G/3G phaseout, as well as some observations of activities and behaviour of each stakeholder in relation to this issue.

¹⁷ See also paragraph 1.3 of the BEREC Report on the outcome of the public consultation on the BEREC Work Programme which sets out relevant responses to this BEREC Work Programme 2023 item (<https://www.berec.europa.eu/en/document-categories/berec/reports/report-of-the-outcomes-of-the-public-consultation-on-the-berec-work-programme-2023>)

¹⁸ The number of possible stakeholders and stakeholder groups who may be impacted by or can have impact on 2G/3G phaseout is numerous. Some stakeholders or stakeholder groups, such as Tech Sverige, Finnish Energy or Elettronica Industriale spa might be relatively unknown to BEREC (or to NRAs, outside of their home markets) yet they have responded to RSPG's consultation on this topic. BEREC is also aware that other stakeholders, including various IoT consultants such as Transforma Insights, have published white papers and provided relevant views for clients on phaseout. As result, there may be stakeholders active in markets that BEREC is not aware of at all.

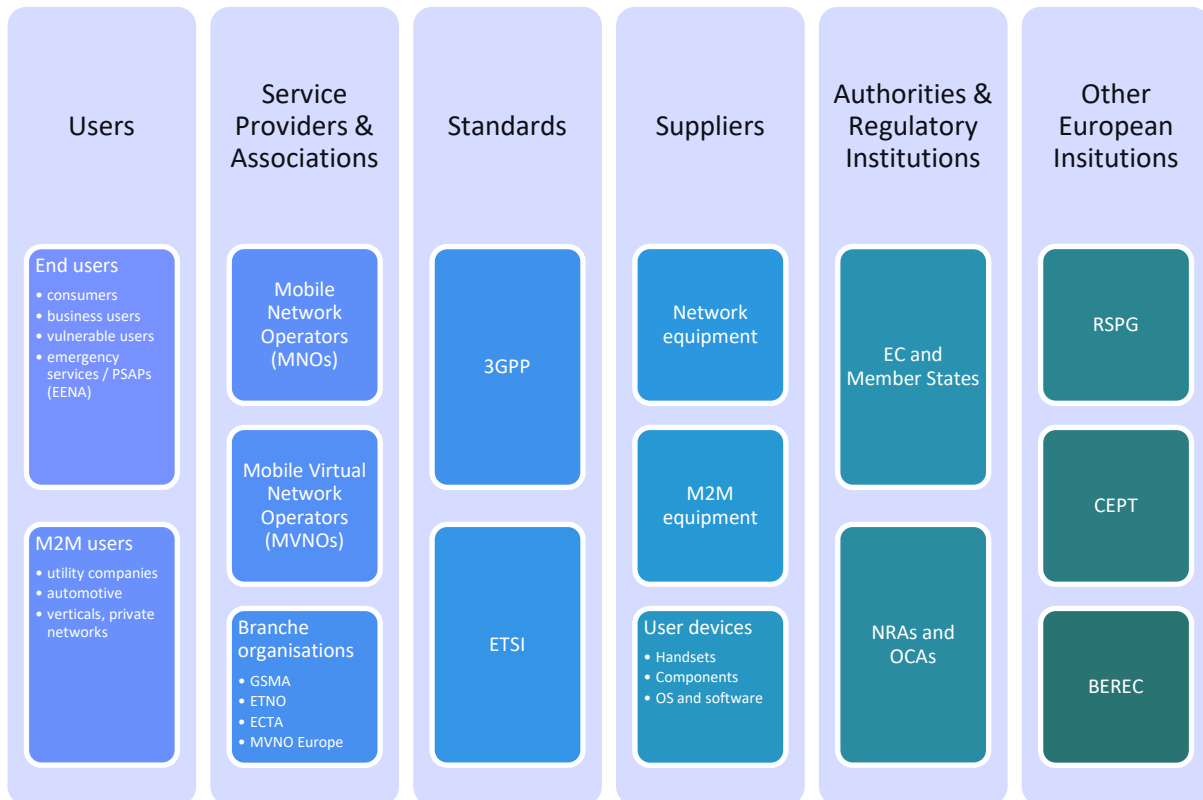


Figure 4: Stakeholders in relation to 2G/3G phaseout issues

3.2.1 Users

3.2.1.1 End users, such as consumers and business users

End users are the users of mobile devices such as smartphones, but also legacy mobile devices, tablets or other user equipment connected to mobile networks. End users include subscribers of mobile network operators as well as business users with contracts for their employees. A special group are the vulnerable users.

Why stakeholders?

End users are considered potential stakeholders because 2G/3G switch-off may impact their ability to use, with their mobile subscription, older and newer mobile equipment, brought new or second hand, independently if not directly purchased from their mobile operator.

Stakeholder engagement

Most end users see their smartphones as a commodity. Many end users buy a new smartphone every few years expecting better performance and new services. But a considerable minority use their phones for a longer period. Some consumers buy their devices not directly from their MNO or MVNO.

Generally, consumers expect their mobile phone and all basic services (voice calling, SMS, IP connectivity) to continue working as they are used to. If services stop working or the expected quality of service or availability of services deteriorates, end users likely see this as an unexpected problem that needs to be fixed fast and without too much cost.

Business users may be more demanding with regard to potential issues with roaming and coverage because of the larger economic consequences these will entail.

Vulnerable users may be more dependent on communication means but also less aware about the possible impacts of 2G/3G switch-off, such as making sure their phone and SIM are compatible with the latest network technology.

The switch-off of 2G/3G could also have an indirect impact on the services included in the individual contract. If functionalities and components of the original contract are affected, it is important that a necessary conversion of the contracts is carried out in consideration of Art 105 EEC and the corresponding national regulations; especially the compliance with user protection rules is important in this context.

Representation of users is fragmented. Associations such as the European Bureau of Consumers Unions (BEUC) can unite these very large user groups of individual, business and vulnerable consumers and defend their interest on a larger political and economic scale, increasing their power. More knowledgeable users may publish their thoughts or complaints in telecom related publications or internet fora. In its response to the BEREC work programme 2023 consultation, BEUC set out that some stakeholders have expressed concerns over the consequences for European consumers from the switch-off of these technologies (e.g. roaming difficulties in Europe and beyond; the continuity of service of voice calls or text messages for end-users using 2G/3G based services in Europe).

BEUC called on BEREC to engage with all relevant stakeholders, including consumer organizations, in order to fully determine and anticipate any impacts of this technological shift, and how this stands to impact European consumers, especially those most vulnerable (in particular, those living in more remote areas and/or still relying on older generation mobile devices).

3.2.1.2 M2M Users such as utility companies and automotive manufacturers

A separate group are the users of Machine to Machine (M2M) services and equipment that operate over mobile networks. In this case the connected devices are not directly related to and operated by end users, but are part of a machine or equipment. Examples of M2M services are smart metering, vehicle telemetry services, asset tracking and automated supply chain management. Examples of large M2M users are utility companies using large amounts of smart electricity, gas or water meters and automotive manufacturers installing and operating connected devices built in cars.

Why stakeholders?

Many utility companies in Europe have large amounts of smart (electricity, gas and/or water) meters in the field with M2M connectivity operating only in 2G or 3G. These utility companies seem more and more aware of the urgency and necessity for organizing alternative solutions before the phaseout of 2G and 3G is a fact. This may involve installing whole new meters, because the radio device is in many cases an integral part of the meter and cannot be replaced separately. In general, they aim to limit the number of physical replacements (including costly and time-consuming visits to households and businesses) to a minimum.

The automotive industry is a stakeholder because a lot of vehicles still in the field contain 2G or 3G equipment. This equipment is used (amongst other things) to provide the mandatory eCall service (that automatically invokes emergency calls in case of accidents).

Stakeholder engagement

Utility companies seem generally aware of the necessity of replacing the meters, but seem in some cases reluctant to do so in an early stage because of their desire to limit the replacement costs and to reduce the total costs of ownership of the installed base. In most cases they appear to see themselves for this issue primarily as customers of connectivity solutions that – in their view – should be able to function in a longer period of time (preferably decades).

They generally expect M2M technology to be stable in time and not have to be replaced every few years. Some (associated) utility companies have chosen to become a private M2M operator themselves because of this reason and they may more actively be involved in exploring optimum solutions for the transition, or in advocating continuing limited use of 2G/3G for a longer transition period.

Comprising of utility companies and other critical infrastructure companies, the European Utilities Telecom Council (EUTC) is a council of members that provides telecommunication providers and network operators with a better understanding of where further assistance and/or input can be offered to utilities for their mutual benefit.¹⁹ This includes mobility related issues.

Automotive manufacturers (under the umbrella ACEA – European Automobile Manufacturers' Association) noted to the RSPG that a prominent issue needing urgent attention is EU's Type Approval Regulations concerning eCall for cars and light commercial vehicles. ACEA indicated to RSPG that Type Approval regulations need to be adapted, otherwise vehicles would continue to be produced and circulate in the EU market with Circuit Switched eCall technology that would be obsolete upon 2G/3G switch-off.

3.2.1.3 Verticals and technology users, such as industrial private networks

A number of (industrial) companies use mobile technology outside the domain of public mobile operators, providing communication services or M2M services in a closed network

¹⁹ [INDUSTRY INSIGHTS & EXPERT SOLUTIONS – EUTC](#)

environment. Private network operators do not (primarily) offer public telecom services, but generally use the same network equipment and (partly) the same devices as MNOs.

Why stakeholders?

Like M2M users some other technology users use mobile technology for private networks that need to be operational in the field for a longer period. Phaseout of the technology used has impact on the availability of equipment. Also, when devices are used in a hybrid way both in private networks as well as in public mobile networks, concerns may rise about the availability of devices or firmware and also of the ease to ensure the proper settings can be set for this type of use.

Stakeholder engagement

5G-ACIA (“Alliance for Connected Industries and Automation”) is a forum of stakeholders from the industrial domain, contributing to advancing standardisation and regulation of 5G for vertical industries, which may have different or heterogeneous connectivity requirements. Within vertical domains, requirements also vary and so this attracts niche players.²⁰

EUWENA (“European Users Wireless Enterprise Networks Association”) is a European organization representing private mobile networks. As shutdown of 2G and 3G networks only indirectly impact standalone private networks this issue seems to be not of high urgency yet to this organization, however this may change when shutdown dates come nearer and potential effects become more clear. The organization was founded in 2021 when private mobile network organizations in different countries recognised the urgent need for a European-level initiative to promote the greater uptake of 3GPP-based private mobile networks to improve the power to represent the interests of private mobile networks towards the market, the governments and the EU.

3.2.1.4 Emergency services and other essential users

A special user group of mobile services are the emergency services and organizations that operate PSAPs and control rooms for emergency numbers.

Why stakeholders?

These organizations want to ensure that emergency numbers and emergency services can be reached by any mobile network always and everywhere, and that negative impacts of the phaseout of 2G/3G networks on reachability of emergency numbers or of communication to or between emergency services will be limited to an absolute minimum.

Stakeholder engagement

EENA (“European Emergency Number Association”) is an organization focusing on the reachability of emergency numbers (112 in most of Europe). The organization observes that a lack of interoperability between handsets and 4G networks may cause international roamers (people visiting other countries) to not have any voice or SMS service during their stay. This

²⁰ [Usage of industrial 5G - 5G-ACIA](#)

could mean that they would not be able to place a call to emergency services. This issue emerged now that countries such as the USA start shutting down their 2G/3G networks.

EENA likely sees this as a high urgency issue. The organization states that it is likely that travellers would be unaware of this until they arrive in the country, or even until they try to make a call or send a text, and states that there is no doubt that this issue puts lives at risk. This issue is currently less of a problem in Europe, where a lot of critical infrastructure still relies on 2G and 3G services (like utility smart meters and eCall). But this may change when also in Europe phaseout becomes a reality.

The organisation aims to ensure that end-users are well aware of this issue, so that they may prepare accordingly. Telecom operators have reassured EENA to guarantee as much as possible transparency to customers regarding roaming areas where 2G/3G are no longer available. The longer-term focus is to ensure that stakeholders are mobilized so that they may work together and resolve this issue as soon as possible. In July 2022, EENA wrote to 31 National Regulatory Authorities and a number of European organisations responsible for the management of telecommunications to make them aware of this issue.

3.2.2 Service Providers & Associations

3.2.2.1 Mobile Network Operators (MNOs)

Mobile network operators play a key role in the mobile communications value chain. They offer mobile subscriptions to their customers, enable their customers to roam on other networks, and serve roaming customers on their networks.

Why stakeholders?

These stakeholders have the ability and incentive to maximise returns for their shareholders. One way to achieve efficiencies and reduce costs is through the use of best-in-class technologies. Phaseout of 2G/3G helps to achieve that. On the other hand, their goal is to optimise customer satisfaction, so minimising the negative impacts of the phaseout is also important for MNOs. Many MNOs also offer wholesale services, giving Mobile Virtual Operators (MVNOs) the opportunity to offer services over their networks.

If functionalities or components of contracts with (end) users are affected, telecommunications service providers must ensure compliance with Art 105 EECC in conjunction with national regulations when converting these contracts with their customers. Providers must agree the new content with customers in a clear and legally correct way, taking into account user protection rules.

Stakeholder engagement

Generally, MNOs inform their customers of 2G/3G phaseout and recommend costumers the use of newer and compatible equipment. Some MNOs warn consumers of potential unexpected behaviour when roaming and give guidance on what type of devices are compatible.

The organisation of European Telecommunication Network Operators (ETNO) states in a reaction to the BEREC work item for this report: *“Regarding the Report on practices and challenges of the phasing out of 2G and 3G it is important to acknowledge that decisions to sunset 2G and 3G networks are in the remit of operators and are based on a wide range of considerations, aiming at improving and optimizing networks, services, spectrum efficiency, etc. In drawing conclusions from its analysis of potential consequences of 2G/3G shutdown, as listed in the WP (e.g. environmental impact of replacement of the equipment), it is important that BEREC carefully weights any possible negative impact against the numerous benefits of transition to new technologies, which are most likely to offset the former.”*²¹

The European Competitive Telecommunications Association, ECTA, is an organisation sharing concerns and practices of its members. Because many of ECTA’s members are the competitor networks, they might be cautious that they are not on the backfoot when it comes to phase out preparations and smooth transitions, but this is currently not explicitly expressed through ECTA. In a reaction to the BEREC work item for this report ecta states: *“ecta is aware that concerns have emerged, notably relating to VoLTE-based emergency calling while roaming and eCall, in the context of planned shut-downs of 2G and 3G networks. BEREC’s attention to the topic is welcome, as is the fact that a public consultation will be held on a draft BEREC Report as soon as Plenary 2 2023. However, ecta wishes to emphasise that the answer to certain challenges is not to delay shutdowns. The answer [according to ecta] is to decisively ensure:*

- *VoLTE interoperability, and notably to require all handset manufacturers to support VoLTE-based emergency calling by default;*
- *That companies that embed mobile connectivity in hardware (e.g. in the connected mobility sector) include forward-looking technology in their products and carry out the upgrades to 4G/5G that have been known to be necessary for a decade (eCall, M2M/IoT).*
- *That mobile network operators, customers, and society at large are not held back from reaping the benefits from a long-planned transition to more efficient technologies, including in terms of improvements to environmental sustainability”.*

3.2.2.2 Mobile Virtual Network Operators (MVNOs)

Mobile Virtual Network Operators do not own spectrum There are different type of MVNOs varying from a reseller selling subscriptions of an MNO under his own brand to a full MVNO operating his own network and interconnection resources, but using the radio network of an MNO, each having varying levels of ownership over marketing, value added services functions, and other content features, and operations activities including SIM card management.

Why stakeholders?

²¹ [ETNO response_BEREC Work_Programme 2023.pdf](#)

When an MNO phases out 2G/3G network technology, an MVNO operating over the MNO's network needs to adapt or otherwise move to an MNO still providing 2G or 3G. As set out in the Wik Study, consumer MVNOs have a higher proportion of their customers focus on in-store purchase and/or have handsets which do not support 4G or 5G, than is the case for traditional MNOs.

MVNOs own and control fewer key components than their hosts and depend on the information of MNOs about phase out schedule and standard compliance of their equipment.

Stakeholder engagement

MVNOs do not always have access to all features of MNO mobile technologies or have to renegotiate with host MNOs to use the technologies available to them. Smaller MVNOs also struggle to bargain with large smartphone suppliers in relation to the necessary profile settings to ensure continuity of operation in case of 2G/3G phaseout. MVNO Europe, the organisation that represents European MVNOs, mentions availability of emergency communications and network and handset compatibility with VoLTE in the light of the sunset of 2G and 3G networks as one of its priorities for 2023²².

In addition, in its response to the BEREC Work Programme 2023, MVNO Europe set out the wholesale roaming dimension of 2G/3G shutdown definitely needs to be addressed as a matter of priority, given that it can potentially lead to lack of availability of emergency calling. MVNO Europe wishes to emphasize that the potential lack of availability of emergency calling is a symptom of deeper problems, at the network/service level, and at the OEM and handset level.

3.2.2.3 Global System for Mobile communications Association (GSMA)

GSMA is an organisation founded by GSM operators, that has evolved to an industry wide association. It is currently open to four different types of members: Operator membership is open to licenced mobile network operators (MNOs, but also satellite, aircraft or maritime operators). Industry membership is open to companies in the broader mobile ecosystem including handset and device makers, software companies, equipment providers and internet companies. Rapporteur membership is open to non-GSM licenced operators including MVNOs. Sector membership is open for industry users including automotive, aviation, tower and fibre infrastructure.

Why a stakeholder?

GSMA is an organisation that unites many players in the mobile industry. Activities include an interoperability Data specifications and Settlement Group and Interoperability testing. This way GSMA is crucial in solving problems when standards are interpreted differently, or when the standards leave too much room for (incompatible) options. These kinds of problems occur with the implementation and introduction of standards for newer services, and also newer

²² <http://mvnoeurope.eu/mvno-europe-priorities-for-2023/>.

versions of voice and SMS (such as VoLTE and VoNR). Interoperability of 4G and 5G services becomes even more important if older generations 2G and 3G are switched off.

Stakeholder engagement

GSMA is advocating the positive aspects of 2G/3G phaseout but also actively tries to limit the possible negative implications and assists its members in identifying and sharing best practices, for example in proposing a minimum set of interoperable profiles for VoLTE²³ or providing 2G-3G Sunset Guidelines²⁴. The GSMA NSX is a tool provided by the GSMA to streamline the implementation of settings relevant for (among others) enabling VoLTE and VoWiFi. This can be used by relevant stakeholders to implement these configurations for handsets and other devices in order to streamline the adoption of VoLTE (and other services such as VoWiFi).

3.2.3 Standardization Bodies

3.2.3.1 3GPP

3GPP is an organisation founded by seven standardization organisations (ARIB, ATIS, CCSA, ETSI, TSDSI, TTA, TTC), originally to produce Technical Specifications and Technical Reports for a 3G Mobile System based on evolved GSM core networks and the radio access technologies that they support.

Why a stakeholder?

3GPP is now the main organisation producing standards for mobile communications. Active members include equipment and device manufacturers and MNOs.

Stakeholder engagement

3GPP was founded to provide a third-generation technology, originally not as replacement for 2G but as an evolution, and after that produced and maintained standards for 4G and 5G. Backward compatibility has always been a key element of the 3GPP standardization process, however main focus is on providing standards for newer, better and more efficient services. Until recently most interoperability problems were invisible due to successful backwards compatibility and co-existence of newer and older technologies. There was always an older, more stable version of a service available that was automatically used when not all equipment involved in a new variant proved to be interoperable.

3GPP is a very diverse organization and consensus in some cases leads to newer standards with too many degrees of optionality, causing interoperability issues. Other organizations such as GSMA produce recommendations to reduce the number of options or settings used and improve interoperability.

²³ https://www.gsma.com/futurenetworks/ip_services/volte/

²⁴ <https://www.gsma.com/newsroom/wp-content/uploads/NG.121-v1.0-2.pdf>

3.2.3.2 ETSI

The European Telecommunication Standardisation Institute (ETSI) is an organisation that is appointed to define European Standards and European Norms.

Why a stakeholder?

ETSI was involved in standardizing 2G, and defined principles such as the Subscriber Identity Module (SIM). ETSI is one of the organisations that founded 3GPP.

Stakeholder engagement

Standardization of mobile communication standards is currently carried out by 3GPP.

3.2.4 Suppliers

3.2.4.1 Network equipment suppliers

Network equipment suppliers provide and, in many cases, also manage, maintain and upgrade networks, switching equipment and radio equipment for mobile communication.

Why stakeholders?

Network suppliers support 2G and 3G equipment and also sell 4G and 5G equipment. They are partly responsible for ensuring interoperability of new services in case settings of the network or network equipment need to be aligned with those in the (user or M2M) devices used.

Stakeholder engagement

Network suppliers such as Ericsson are active in thinking about evolution paths²⁵.

The Global mobile Suppliers Association (GSA) is a large industry organisation representing suppliers in the mobile communication industry, actively promoting 3GPP technology and in close cooperation with other organisations including ETSI, GSMA, ITU, etc.²⁶

3.2.4.2 M2M / IoT equipment manufacturers

For M2M and IoT equipment manufacturers the communication feature of the devices is only one of the aspects to consider. A big share of the IoT/M2M equipment is built with a long lifespan in mind.

Why stakeholders?

²⁵ <https://www.ericsson.com/en/reports-and-papers/books/fundamentals-of-network-planning-and-optimisation-2g-3g-4g-evolution-to-5g-2nd-edition>

²⁶ For example, GSA produces summary reports: [2G-3G Switch-off July-2022 Summary Report - GSA \(gsacom.com\)](https://www.gsacom.com)

A percentage of equipment active in the field is currently still operating using 2G/3G technology.

Stakeholder engagement

The phaseout is both an opportunity to sell new equipment as well as a challenge, because the replacement technology is also expected to be reliable and operating with a long lifespan. Equipment vendors of M2M equipment such as smart meters are more and more focusing on putting communication in a separate module which can be easily replaced or updated, but still cannot be hampered with by unauthorized persons.

3.2.4.3 Smartphone manufacturers

The manufacturers of smartphones and other connected user devices such as tablets with mobile connectivity are part of an extensive ecosystem featuring OS providers, chipset and firmware suppliers.

Why stakeholders?

Smartphone suppliers have an important role in what technology generations a device supports and how the interoperability with different networks is achieved.

Stakeholder engagement

Large smartphone manufacturers usually sell new smartphones with 4G/5G connectivity embedded. They may encourage 2G/3G smartphone users to switch for a more recent one by purchasing old smartphone back in exchange for a new one. Also, suppliers of components of smart phones and OS systems have influence in the interoperability of newer services, because certain settings in these components need to be set specifically to optimize interoperability in certain situations such as roaming.

3.2.5 Authorities & Regulatory Institutions

3.2.5.1 European Commission (EC) and Member States

The EC plays the central role in shaping Europe's digital future, strengthening the European unique social market economy, building a Union of prosperity, and making Europe stronger in the world. Currently the EC is only indirectly involved promoting and stimulating gigabit connectivity for every European citizen using the latest technologies. The EC is involved in regulation of emergency communications, eCall and NG eCall, and related EU Type Approval Regulation²⁷. 2G/3G phaseout is an issue that might have impacts on roaming in the Union

²⁷ The EC is advancing its thinking about two aspects on the eCall issue, with recent publications on: (1) adapt the specifications of emergency call centres receiving and handling eCalls to 4G/5G telecommunications networks (https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13191-Automatic-emergency-112-eCall-by-onboard-vehicle-systems-EU-wide-interoperability-specifications_en) and (2) update standards for the

and/or connectivity in the Union. The urgency of this matter will likely become higher for the EC if solutions are not forthcoming.

Besides other possible EU regulations²⁸, the Radio Equipment Directive may play a potential role. In particular, Article 3.3(b) “radio equipment interworks via networks with other radio equipment” seems to be relevant. This provision might possibly be used to activate relevant requirements for manufacturers of the concerned (parts of) terminal equipment. Also the European Commission can amend the EU Type Approval Regulation.

In addition, Member States may have a role pursuant Art. 45(5) EEC, which allows Member States to adopt spectrum management/authorisation measures that are necessary to pursue general interest objectives, like safety of life.

3.2.5.2 National Regulatory Authorities (NRAs) and Other Competent Authorities

NRAs or other competent authorities (OCAs) that have the mandate of regulating and monitoring the spectrum in each country, have the competence (among others) of managing nationally available spectrum resources, issuing licenses to MNOs in order to use the allocated spectrum and specifying terms in their licenses that will ensure the continuous provision of services to all users and the protection of competition in the market.

Why stakeholders?

These authorities, in general, allow and promote technological neutrality in the building and usage of networks. They do not interfere with the technological choices of the network and service providers, since these, usually aim at a more efficient use of resources and more efficient networks, which generally result in better and cheaper services for users. However, when these technological choices or migration from one technology to another, affects the continuity of the provided services to the users, these authorities need to intervene in order to ensure user protection.

Stakeholder engagement

Competent authorities may recognize that national phasing out of 2G and 3G can possibly create a breach in the continuity of the provided mobile services and then they will feel the urgency to take appropriate measures in order to fulfil their responsibilities regarding ensuring user protection. Some NRAs and OCAs are already monitoring and identifying possible issues and start information exchanges with other stakeholders like MNOs and GSMA, but at this stage are very reluctant to get more involved maintaining distance respecting the market and neutrality towards technology and services.

transition of eCall to 4G and 5G networks (<https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/13845-Vehicle-safety-updated-standards-for-in-vehicle-emergency-call-systems-eCall-en>)

²⁸ Article 5 of Commission Directive 2008/63/EC on competition in the markets in telecommunications terminal equipment (*Member States shall ensure that all specifications for terminal equipment are formalised and published*).

Usually NRAs/OCAs employ personnel with knowledge and expertise in the relevant fields in order to best complete their obligations in spectrum management and user protection. However, it is undeniable that the industry has deeper and more practical knowledge of the technologies used in the networks, the problems a technological change may create and the ways to solve these problems.

NRAs and OCAs, when perceiving a threat to the protection of the users of electronic communication services through 2G/3G phasing out, have the legitimacy to impose appropriate measures that will ensure continuity of service. This can be done through a transition plan agreed in a volunteer basis with the MNOs or through regulation or other obligatory measures that will enable the swift transition. Usually (in case European and national legislation allows it, and depending on the mandate of the authority) these authorities have the competence to impose such measures, but they only will do that after careful analysis of the problem and how this affects the users, as any obligations imposed should be well justified.

3.2.6 Other European Institutions

3.2.6.1 The Radio Spectrum Policy Group (RSPG)

The Radio Spectrum Policy Group (RSPG) is an advisory body to the European Commission, on radio spectrum policy issues.

Why a stakeholder?

The RSPG was involved in many issues related to mobile spectrum licensing in Europe and smooth evolution towards more efficient mobile technologies. In its Opinion on a Radio Spectrum Policy Programme²⁹ of June 2021, RSPG recommends that the European Commission and Member States should anticipate any impact of possible future phasing out of some legacy systems (2G, 3G, and 4G) in the next decade.

Stakeholder engagement

In February 2023, RSPG adopted a "Report on: "Mobile technology evolution – experiences and strategies" (see sections 1.2.6 and 2.1.2).

3.2.6.2 Body of European Regulators for Electronic Communications (BEREC)

BEREC is a European organization that aims to ensure a consistent application of the EU regulatory framework by all Member States and to promote an effective internal market in the telecoms sector, in order to bring even greater benefits to consumers and businesses alike.

Why a stakeholder?

²⁹ Available in https://rspg-spectrum.eu/wp-content/uploads/2021/06/RSPG21-033final-RSPG_Opinion_on_RSPP.pdf.

BEREC provides advice on request and on its own initiative to the European institutions and complements, at the European level, the regulatory tasks performed by the NRAs at the national level. The NRAs and the Commission have to take utmost account of any opinion, recommendation, guidelines, advice or regulatory best practice adopted by BEREC.

Stakeholder engagement

One of the high-level priorities of BEREC is to promote full connectivity by improving the conditions for the expansion and take-up of secure, competitive and reliable high-capacity networks (both fixed and wireless) across Europe and ensure a smooth transition from legacy infrastructures. Therefore, any problems for the users or the market competition, that may arise from 2G/3G phase out, immediately falls within BEREC's interest. BEREC has already identified the need to examine the issue and the current work item evaluates the urgency to do so.

BEREC is supported by experts from all European regulators thus ensuring a vast pool of expertise and specialised knowledge. Moreover, BEREC issues public consultations on all subjects and has the opportunity to discuss with relevant stakeholders so as to collect valid information and valuable data. By these means BEREC has the power to produce sound proposals of how to face the problems that may arise during 2G/3G phase out.

However, these proposals may only be used as guidelines from NRAs in order to deal with any problems that may nationally arise from 2G/3G phase out and are not in any case binding or obligatory. So, although BEREC may have the ability to provide useful proposals, it does not have the legitimacy to enforce these in the relevant markets.

3.2.6.3 European Conference of Postal & Telecommunications Administrations (CEPT)

CEPT is a European organization with the basic aim to strengthen the relations between members, promote their cooperation and contribute to the creation of a dynamic market in the field of European posts and electronic communications. CEPT comprises of committees which handle harmonization activities within their respective fields of responsibility, and adopt recommendations, reports and decisions.

At the CEPT level, NaN3 is currently evaluating the technological potentials, regulatory requirements, and the possible applications or use cases of NG112, taking into consideration the future challenges in terms of e.g., funding, supply chain for 112 emergency communications, phasing out of 2G/3G amongst other criteria.

3.3 Consultation issues:

- Which other potential challenges/impacts would you identify?
- How urgently do you think the different challenges/impacts need to be addressed (time, priority)?

- What challenges / impacts have already been solved or can be considered minor?
- What stakeholders should initiate (more) efforts to meet the challenges/impacts?
- What stakeholders should be involved in efforts to meet the challenges/impacts? How should they contribute?

4 BEREC's view and next steps

In the figure below a summary is given of the goals that drive 2G and 3G phaseout, the means to achieve those goals and related challenges. Some examples are given of these challenges and potential impacts are described. In the last column found practices are summarized.

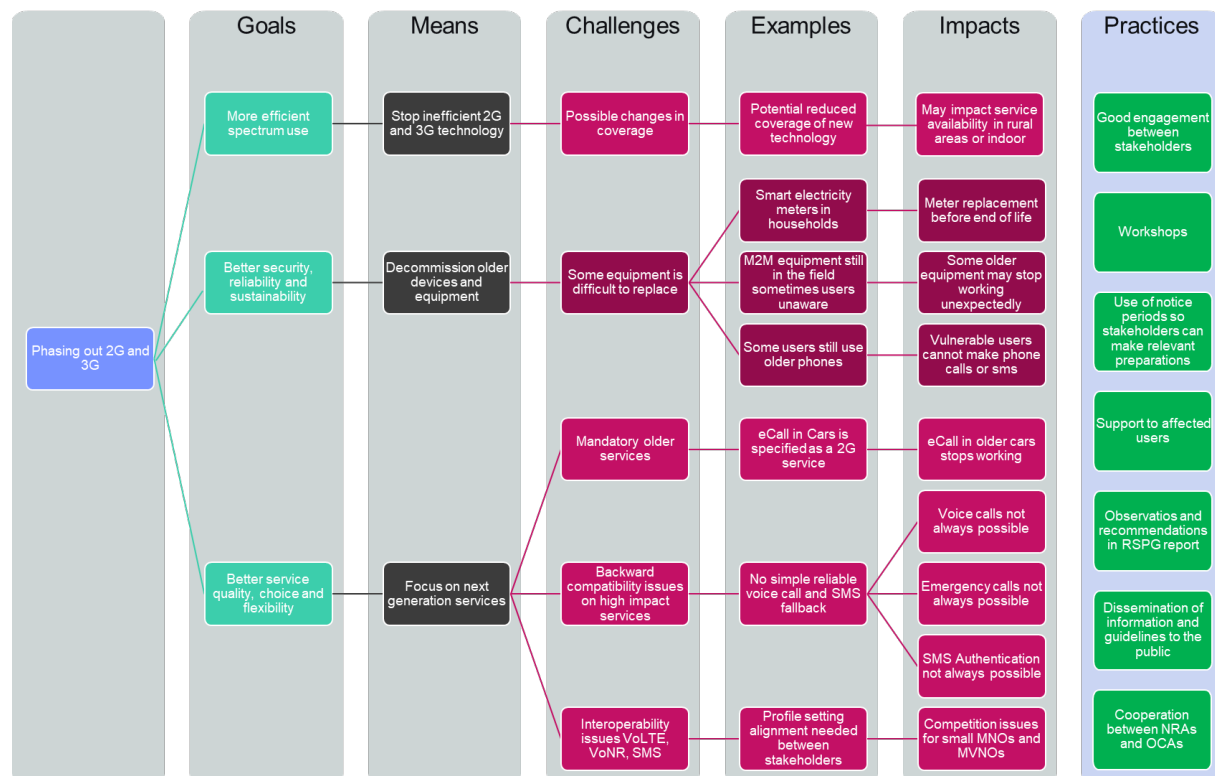


Figure 5: Overview of potential challenges with 2G and 3G phaseout, with examples, impacts and identified practices

Sharing experiences, lessons learned, and common approaches will have positive effects on successfully phasing out 2G and 3G generations of mobile technologies in markets, while maximizing service continuity of high impact services that are currently still provided (partly) using 2G and 3G technology.

Because the impacts on stakeholders are not always well communicated / understood due to the issue being at different stages in different markets, stakeholder engagement is a valuable tool for preparing for mobile technology phase out.

In this regard, respondents to the consultation on the draft Report³⁰ set out specific proposals that they considered stakeholders should take to address the impacts and challenges of 2G and 3G Phaseout. Some proposals seemed to be aligned with the practices already identified by BEREC above (see Chapter 1.2) but there were other more tailored and extended suggested proposals calling for bespoke actions by industry, policy makers and regulators / BEREC. For completeness, BEREC summarises the high-level stakeholder proposals at Figure 6.0 below, observing that these are proposals by stakeholders that have not been (i) subjected to public consultation, (ii) considered in detail by BEREC beyond the preliminary assessment and response set out in BoR (23) 203, and (iii) subjected to a feasibility or cost benefit study before being proposed by particular stakeholders. BEREC therefore highlights that undue reliance on the effectiveness or suitability ought not be placed on these proposals, but that by summarising them provides supplemental information that might assist possible future work by stakeholders or groups of stakeholders.

In addition, BEREC would note that 2G and 3G phaseout is likely to be on the agenda of stakeholders for some time to come, so that it might be a topic which BEREC itself could consider again, with the benefit of further practical experiences in Member States.

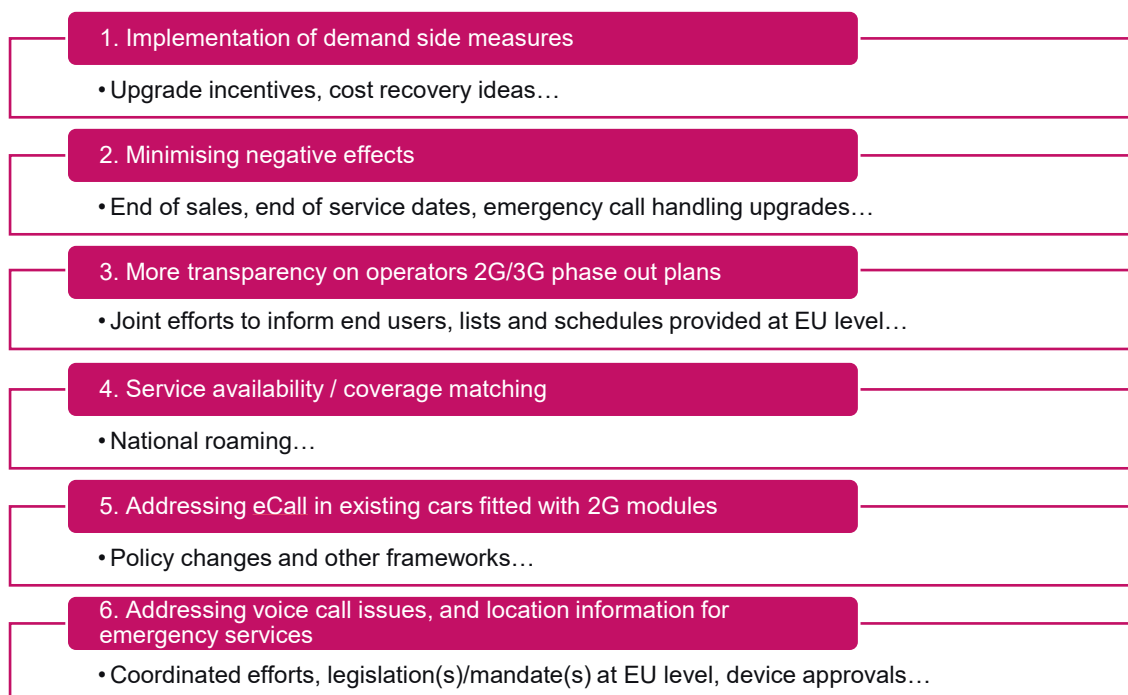


Figure 6: High-level summary of stakeholder's proposals on addressing the impacts and challenges from 2G and 3G phaseout (please see Document BoR (23) 203 for BEREC's preliminary assessment and response on some of the new points from stakeholders).

³⁰ <https://www.berec.europa.eu/en/document-categories/berec/reports/draft-berec-report-on-practices-and-challenges-of-the-phasing-out-of-2g-and-3g>

BEREC is satisfied that this workstream has contributed significantly to advancing stakeholder engagement on this topic and looks forward to engaging with all its stakeholders, including in particular end users and vulnerable end users, to assist the smooth phase out of 2G and 3G mobile technologies.

Annex A BEREC and RSPG Member Questionnaires (high-level summaries)

Introduction

As part of preparing this report, BEREC issued a short questionnaire to its Members and Participants without Voting Rights so that it could consider what information NRAs may have on 2G/3G phaseout in their countries.

In addition, BEREC noted that RSPG issued a questionnaire to its Members as part of preparing its “Mobile technology evolution – experiences and strategies” Opinion, which was published in February 2023.

BEREC Questionnaire

BEREC issued a questionnaire to ascertain whether or not the NRAs collect information on:

- the availability and usage of older devices that can only use 2G or 3G
- the types of tariff plans subscribers have signed up to
- voice and SMS volumes on different mobile technologies 2G, 3G, 4G, and 5G
- traffic generated on 2G and 3G networks for subscribers who have signed up for a 4G tariff plan (when the subscriber is not connected to 4G networks)
- the volume of voice traffic that might originate as a 4G (Vo LTE) but falls back to a circuit-switched technology to complete a call successfully
- Machine-to-Machine traffic volumes

Twenty-eight responses were received and, in most cases, NRAs did not collect the aforementioned information. For example, in relation to voice and SMS volumes on different mobile technologies, 24 NRAs indicated that they do not collect such information.

Do you collect information about voice and SMS volumes on different mobile technologies 2G, 3G, 4G, and 5G?

YES	4																						
	DE	IE	SE	SK																			
NO	24																						
	AT	BE	BG	CY	CZ	DK	ES	FI	FR	GR	HR	HU	IS	IT	LT	LV	ME	MT	NL	PL	PT	RO	RS

Even so, 2 NRAs (RATEL and TRAFICOM) added that they do collect information about the number of devices that only use 2G or 3G. In addition, 2 NRAs (ECOI and SPRK) responded that they do not collect such information but MNOs in their countries do. 1 NRA (NMHH) indicated it collects voice and data traffic based on technological capability of the devices (2G/3G/4G/5G).

For the majority of countries, it seems that the NRA does not distinguish tariff plans between different technologies³¹, but only in the case of Sweden is there a distinction between 5G and the rest (PTS). ARCEP collects information about the number of SIM cards which haven't been connected to a 4G network over the last 3 months and RRT collects the number of active sim cards using the following technologies: UMTS, UMTS HSDPA, UMTS HSUPA, LTE, 5G.

To the question whether NRAs collect information about the volume of voice traffic that might originate as a 4G (Vo LTE) but falls back to a circuit-switched technology to complete a call successfully, only 2 NRAs provided a positive response (BNETZA and PTS).

Other answers from BEREC Questionnaire

Do you collect information about the extent of the use of, or level of availability of (equipment or tariff plans that are restricted to) different mobile technologies 2G, 3G, 4G, 5G in your country?

YES	20																		
	AT	BE	CY	DE	DK	ES	FI	FR	HR	HU	IE	IS	IT	LT	LV	ME	MT	PT	RS
NO	8																		
	BG	CZ	GR	NL	PL	RO	SI	SK											

From the members answering YES to the first question:

Do you collect (or is collected by MNOs) information about the availability and usage of older devices that can only use 2G or 3G?

YES	10									
	DE	FI	HU	IE	IS	IT	LV	MT	RS	SE
NO	10									
	AT	BE	CY	DK	ES	FR	HR	LT	ME	PT

Do you collect (or is collected by MNOs) information about the types of tariff plans subscribers have signed up to?

YES	12											
	BE	CY	DK	FR	HU	IS	IT	LV	ME	MT	PT	SE
NO	8											
	AT	DE	ES	FI	HR	IE	LT	RS				

³¹ AGCOM (Italy), Comreg (Ireland) and DBA/ADSI (Denmark) collect information about the number of subscribers per technology

How do you collect statistics about Machine-to-Machine traffic volumes? Withing a same, separate or other category.

SAME	2		
	ME	SK	

SEPARATE	9								
	AT	BE	BG	CZ	ES	FI	FR	GR	IE

OTHER	17															
	CY	DE	DK	HR	HU	IS	IT	LT	LV	MT	NL	PL	PT	RO	RS	SE

Do you collect information about what different mobile technology M2M uses?

YES	3		
	HR	IT	MT

NO	25																								
	AT	BE	BG	CY	CZ	DE	DK	ES	FI	FR	GR	HU	IE	IS	LT	LV	ME	NL	PL	PT	RO	RS	SE	SI	SK

Preliminary conclusion on BEREC's Member Questionnaire

There seems to be a great heterogeneity in the categories of data that NRAs collect regarding mobile technologies. Few (4) NRAs collect information about voice and SMS volumes on different mobile technologies and even less (2) NRAs collect information about the fall back from 4G-5G technology to 2G/3G when needed during a call, in order to complete the call.

BEREC considers that current data gathering provides little additional insight about 2G/3G phaseout and the scale of potential challenges and impacts so overall BEREC supports wider engagement with all stakeholders to support 2G/3G phaseout.

Summary of RSPG benchmarking questionnaire on 2G/3G phaseout activities in countries

RSPG also conducted a benchmarking questionnaire of its Members asking whether MNOs in the different countries had announced plans about 2G/3G phaseout. The results from RSPG Members with additional BEREC input is as follows:

Did the MNOs already start or announce/inform about their (partial) plans to switch-off 2G technologies?

YES	9								
	CH	ES	FI	DE	IE	LT	NL	NO	SE

NO	17																
	AT	BE	CY	CZ	DK	FR	GR	HU	HR	EE	IT	LU	LV	MT	PT	RS	SI

Did the MNOs already start or announce/inform about their (partial) plans to switch-off 3G technologies?

YES	20																		
	AT	BE	CZ	DK	ES	FI	FR	DE	GR	HU	HR	EE	IE	IT	LT	LV	NL	NO	PT

NO	6					
	CH	CY	LU	MT	RS	SI

Based on the information in the RSPG and BEREC surveys no European country has already completed a country wide full phaseout of both 2G and 3G networks. Projected phaseout completion dates vary from within a few years from now to postponed or unknown.

RSPG also set out some high-level information gathered from the survey of its Members as follows:

Country	Further detail set out by RSPG: "Did the MNOs already start or announce/inform about their plans to switch-off the 2G technologies"
AT	No plans due to e-Call challenge & circuit switched data.
BE	No specific dates are known yet. After 3G phaseout.
CH	In a process of evaluating this possibility.
CZ	No migration plans have been announced.
DK	No announcements of specific plans to switch of 2G technologies.
ES	Gradually phased out shutting down by 2030.
FI	Parts of the 900 and 1800 MHz bands previously used for 2G are now being used for 3G and 4G.
FR	1 out of 3 operators announced its decision by end 2025. Small increase in 2G radio sites in 900MHz band.
DE	Not any announcement in 900MHz band. Legacy systems and devices are deployed.
GR	No plans.
IE	All 3 operators have reduced the number of channels used for 2G carriers to make space for 4G and 5G carriers. Vodafone will maintain this network.
HR	1800 MHz band is currently used for 4G technology only. 2G is implemented in part of the 900 MHz and No complete shutdown of 2G technology is expected during the next 8-10 years.
IT	No specific plans.
LT	End of 2025 for one operator. Others in 2026-2028. This is due to M2M/telemetry devices requiring only basic low data-rate connectivity.
LU	No Migration plans.
MT	No plans announced.
NL	One operator zto keep active 2G until end of 2025. VF at least until 2024. T-Mobile is to be switched off in 2023
NO	2 out of 3 operators use part of the 900 MHz band for 2G. GSM-R is also implemented in the 900 MHz band.
PT	No phase out in 900MHz band announced.
SI	NO short-term plans for phasing out. One MNO stated that 2G in 900 MHz band stays for some years
SE	Announced for 2025 by all MNOs Switching off asap but latest 2025. Migration of customers has started.
SK	Gradually phased out shutting down by 2030.
RS	No exact plans. After 3G phase-out.