

Draft RSPG Opinion

Strategy on the future use of the frequency band 470-694 MHz beyond 2030 in the EU

Nokia's response to the Public Consultation

August 2023

Introduction

Nokia thanks for the opportunity to provide comments to the RSPG Draft Opinion on the “Strategy on the future use of the frequency band 470-694 MHz beyond 2030 in the EU.” This response is complementary to the contributions provided by industry associations of which Nokia is member and observer, namely GSA and ETNO, respectively. We welcome and encourage RSPG to continue its engagement with all stakeholders for developing a strategy for more efficient use of the precious UHF spectrum resources.

General Considerations

Nokia shares the view that RSPG15-595 on the 700 MHz band had been impactful with significant benefits for the deployment of 5G in the EU and beyond by providing access to low band resources for the then emerging new standard.

Nokia shares the RSPG view on a quite diverse situation in the EU member states regarding use of the 470-694 MHz band leading to a need for more flexibility to serve the needs of all EU countries. With the ever-increasing demand for highly performant mobile networks also in remote areas and hard-to-reach places including indoors, Nokia sees a need to plan for additional low-band

spectrum resources for these. Nokia therefore supports a primary mobile allocation of 470-694 MHz in WRC-23 to pave the path for additional flexibility to eventually introduce additional mobile use in the band.

Nokia observes a strong trend towards increasing use of non-linear video across all age groups in all EU countries, c.f. e.g., CEPT draft brief and compendium on WRC-23 AI 1.5 stating that in certain countries daily non-linear video minutes have passed the linear ones. DTT can only deliver linear content while ever improving broadband connectivity to homes along the 2030 EU gigabit connectivity targets covers both non-linear and linear content delivery, eventually making dedicated linear content delivery in UHF spectrum to fixed locations redundant and allowing for more efficient use of that precious spectrum resource. In some European countries, a large majority of TV use is already on alternative platforms such as satellite, cable and increasingly broadband. Consequently, some European countries have terminated DTT, some consider such a step even before 2030, some consider a reduction of the number of multiplexes and related spectrum needs.

Nokia recommends to clearly separate the discussion on public service broadcast content from the one on the best suited distribution paths. Public service broadcast content is increasingly consumed in a non-linear manner via catch-up platforms or OTT offering. Equally, the linear program is offered in multiple ways on broadband connections, either by public service broadcasters themselves, by broadband service providers or by 3rd parties. Consequently, public service broadcast can evolve independent of the preservation of the DTT platform. Nokia sees opportunities in an evolution to all IP based video distribution and possibilities to better access mobile usage scenarios and mobile devices, improving the acceptance of public service broadcast content among younger audiences.

While large screens in homes have long life cycles, codec development and non-linear service offering evolve quickly. New codecs and new formats typically require more computational processing power, based on latest chip generations for cost and energy-efficient implementations. Thus, lack of pure software upgrade possibilities on legacy large screen devices may be seen hindering introduction of e.g., new codecs. There is, however, a wide adoption of small affordable devices attached to the HDMI port of large screens covering the latest offerings also on legacy screens. Thus, protection of investment in a large screen need not necessarily prevent innovation on the codec and distribution side but can be combined with affordability of latest and greatest in distribution technology, including positive effects on overall sustainability. As video codecs improve roughly by factor of 2 in efficiency per generation, use of latest codecs can lead to massive improvements of efficiency in the distribution paths, again supporting sustainability goals. The current standard HEVC (finalised in 2013 and introduced to DTT as early as 2015) can be expected to be superseded by at least one codec generation by 2030, with the next generation codec VVC finalised in late 2020 and is already entering the market in software and hardware products.

At the same time, Nokia observes significant increase in demand for higher performance levels of mobile services in remote areas. Comparable performance of mobile networks in rural and urban areas is required to avoid widening a digital divide. Improved levels of mobile network performance along transportation paths are required for connected and automated driving and in-car or in-train entertainment. Further, emerging services like smart agriculture require coverage and substantial performance levels of networks in remote areas. Performance upgrades of mobile networks are most cost and energy efficient when upgrading existing site grids with

additional spectrum to meet green targets as well as being able to offer affordable services to consumers and businesses. The introduction of 6G around 2030 will need – besides re-farming of already assigned spectrum – access to additional low band spectrum resources to bring 6G services at the right performance and cost levels to remote areas and hard-to-reach places in densely populated areas, reducing the digital inequality.

Thus, Nokia sees the RSPG Draft opinion as not being sufficiently ambitious looking forward and failing to fully address trends in technology and in the substantial shifts in the consumer behaviour and expectations. All three options discussed for an EU position and a CEPT ECP on the WRC-23 AI1.5 include consideration of a primary mobile allocation effective 2030/31, endorsing the strategic view that after 2030 MFCN services will use the 470-694 MHz band. The scenarios outlined for 2030 onward should consider a large number of European countries without DTT¹. Realistically, we would expect migration from a DTT-heavy scenario like scenario 1 to something going even beyond scenario 3 over time at a different pace in different countries, leading during the migration to a mix of scenarios in the EU where different EU members could face countries closer to other scenarios at their borders.

Existing technical solutions (and their potential evolution)

Nokia would like to point out that any support of a device ecosystem would require clear expression of political will and a supporting regulatory framework to justify the investments in R&D to build such a device ecosystem. Such expressions of political will and accordingly adaptations in the regulatory frameworks have been missing so far. Development of an ecosystem could be triggered by a change decision in WRC-23 adding a mobile allocation in 470-694 MHz.

Starting from the North American markets and increasingly gathering momentum in other regions, 3GPP band B71/n71 provides an existing ecosystem for introducing FDD where possible, attracting also countries in ITU Regions 1 and 3. As a side effect, its 35 MHz wide DL range 617 to 652 MHz can be already used for demos and trials of SDL and 5G Broadcast. Like earlier trials using B28 equipment – when the 700 MHz range was still used for broadcast – results indicate DL co-existence options on adjacent channels even within a country, suggesting that cross-border coordination should not face major issues. 3GPP specifies the bands B107 (612-652 MHz, including the B71 DL range) and B108 (470-698 MHz) for a Standalone Downlink-Only (SDO) mode with carrier bandwidths of 6, 7 and the EU-relevant 8 MHz. While Carrier Aggregation combinations already support SDL-like operation in the B71 DL range for carrier bandwidths of 5 MHz and multiples thereof, 3GPP specifications could be amended on protocol levels – following signals from the regulatory domain – to also support SDL in 470-698 MHz or parts thereof with e.g., 8 MHz carrier bandwidth. With a mobile allocation in 470-694 MHz in ITU-R1 decided in WRC-23, momentum can be created to evolve the required device ecosystem for B108.

A 600 MHz band plan (i.e., B71/n71) implementation will require some border co-ordination, mainly when it comes to protect MFCN UL from co-channel DTT signals. In the past, EU and CEPT agreed on common timelines for the clearing of the entire 800 MHz and 700 MHz bands from DTT across the whole region. Below 700 MHz band, additional flexibility and reduced needs for alignment could be achieved if considering primarily the 35 MHz UL range (663-698 MHz) instead

¹ E.g., Switzerland already abandoned DTT and certain EU members consider such a step even before the next decade

of the full band and only affected DTT transmitters. Such approaches may limit DTT re-planning to a limited number of DTT transmitters withing certain corridors along national or sub-regional borders to e.g., ASMG where some countries have expressed clear intent to deploy 600 MHz B71/n71 soon.

Regarding PPDR, there are multiple options for implementing highly available and resilient broadband communications below 1 GHz.

There is scope for the today's narrow-band mission critical communication systems (2G-like in 380-400 MHz band) covering many European countries to be upgraded to 4G/5G/6G for dedicated PPDR broadband purposes. While this will allow for the use of state-of-the-art technology for mission critical voice and narrowband data, broadband mission supportive communications might be hindered by the limited amount of typically 2x5 MHz in that band.

In CEPT, 410-430 MHz (2x5 MHz typ.), 450-470 MHz (2x5 MHz typ.) and options in the 700 MHz with 2x3 MHz and 2x5 MHz outside bands relevant for European MNOs are harmonised for potential PPDR use. These can be considered for dedicated PPDR networks or – specifically for the 700 MHz options – shared RAN with MNOs but exclusive use of the PPDR resources for PPDR purposes.

Multiple countries in Europe have decided to use MNO networks in MNO bands on a shared basis with priority for their communication, both mission critical and mission supportive. Where such agreements have not been made and implemented, due to lack of bandwidth on today's dedicated PPDR networks, mission supportive communication is handled without specific priority on MNO networks, partly under certain frame contracts for official devices, partly even over private devices under private contracts of the PPDR service personnel.

Overall, today's harmonised spectrum resources for PPDR and possibilities to cooperate with MNOs, allow for dedicated, fully shared or hybrid options, where hybrid solution can be considered in a combination of dedicated and shared spectrum resources, in different approaches in different geographies (e.g., stadium scenarios vs. urban vs. rural) and in terms of dedicated or shared infrastructure.

Nokia believes that additional spectrum in 470-694 MHz for mobile broadband purposes further enhances options for broadband PPDR communication in dedicated, hybrid or shared modes with MNOs.

Scenario 1

As outlined above, Nokia believes that over time DTT will become irrelevant in most EU countries. Even today, most DTT households use additional distribution paths both for linear and for non-linear content, with the number of DTT-only households slowly but steadily decreasing. Stated benefits like ease of access, inexpensive, free access, non-traceable access, resilience, etc., also hold for other distribution paths – even today or implemented as needed. Moreover, the energy efficiency of DTT distribution highly relies on large shares of the population using it; single digit percentages of use in some EU countries and secondary use in parallel to other distribution paths are most likely not energy efficient. From a 2030 and beyond perspective, DVB-T2 and HEVC cannot be seen as innovative. Section 2.2 rightly observes that implementation of RSPG15-595

FINAL Opinion Recommendation regarding DVB-T2 and HEVC is still ongoing. Specifically, on the codec side, there should be ambition to use at least VVC by 2030 (see above). Overall, while recognising that some countries in EU still depend on DTT as of today, Nokia expects substantial changes until 2030.

Scenario 2

Nokia agrees that scenario 2 blends well with scenario 1 along country borders. It thus can be seen as a stable solution for some period of time or as a transitional scenario. Co-operative models for video distribution primarily for mobile use cases (as fixed use cases can be reached by other platforms) could evolve in combinations of 5G Broadcast and SDL, benefitting both broadcast and mobile based on a common device ecosystem in remote areas and specifically along transportation paths. Additional downlink use should also consider a possible future use of the B71/n71 UL range 663-698 MHz for UL purposes.

Scenario 3

Nokia sees evolution over the next decade to something close to scenario 3 with reduced DTT or even abolishment of DTT in the long term. Nokia would like to point out, that 600 MHz FDD introduction in a country not needing that range for DTT may not necessarily require clearing the 600 MHz range entirely in the region at the same time, but selective replanning for a limited number of relevant DTT transmitters in neighbour countries in the 600 MHz UL range (see above). This may open options for EU members to consider 600 MHz FDD implementation with some, but limited need to ask for coordination with their neighbours and/or certain limitations along certain country borders where agreements cannot easily be reached. Examples of reduced uplink bandwidth operation exist in some EU countries with borders to non-EU countries even today. Thus, Nokia believes, that with regulatory flexibility based on a primary mobile allocation likely effective from 2030+, migration into scenarios with 600 MHz UL utilisation within a country is possible even with neighbour countries maintaining DTT in large parts of the 470-694 MHz band. Below the 600 MHz FDD band, new mobile DL use can gradually complement and eventually replace conventional DTT.

Specific comments on the RSPG recommendations

1. While MFCN UL protection in a DTT environment certainly leads to some complexity, Nokia believes that there are opportunities for introducing additional UL even before 2030, considering mainly DTT transmitters using that intended UL range near country borders, which may limit the number of affected transmitters substantially. Also, certain impairments e.g., by a partly overlapping TX channel may be considered in MFCN UL operation (as done today along some borders with non-EU members e.g., in the 700 MHz range).
2. Nokia welcomes any options to explore possibilities within the existing flexibility options, given e.g., latest standards development addressing the band 470-694 MHz.

3. Nokia agrees with the view that any migration in EU will happen at different pace in different member states. Nokia believes that technology can provide for certain flexibility for co-existence along country borders and even within a given country. 3GPP currently specifies new band definitions for DL operations i.e., including 8 MHz carrier bandwidth for 612-652 MHz and 470-694 MHz which may accommodate migration paths over time, at the individual pace of the member states. Such new band definitions could be applied to e.g., start early with additional DL use below the 600 MHz band or up to ~652 MHz and reserve the UL range 663-698 MHz for future use when coordination can be accomplished.
4. Nokia supports a co-primary mobile allocation in 470-694 MHz which would lay the foundation for coordination negotiations both inside EU as well as at EU borders. Besides the regulatory aspects, a mobile allocation would help to justify R&D investment into the mobile ecosystem required for migration paths.
5. PPDR has multiple options for implementing highly available and resilient 3GPP-based broadband communications below 1 GHz in 380-400 MHz, 410-430 MHz, 450-470 MHz and the harmonised options in the 700 MHz band.

Nokia believes that additional harmonised spectrum in 470-694 MHz for mobile broadband purposes further enhances options for broadband PPDR communication in dedicated, hybrid or shared modes with MNOs.

6. Nokia acknowledges certain needs for PMSE in low band spectrum, benefiting from large “white spaces” in the current DTT spectrum use. Nokia would like to point out, however, that most of the PMSE use is very local, often indoors, and often limited to the duration of a specific event. Thus, their use cannot compensate for the inefficiencies in spectrum use by DTT. Nationwide reservation of large swaths of spectrum in 470-694 MHz does not seem to be appropriate in the sense of efficient spectrum use. Nokia sees opportunities for continued shared use of spectrum for PMSE where and when needed also with additional mobile broadband use in 470-694 MHz.
7. Nokia acknowledges a need to consider Radio Astronomy and Wind Profiler Radars in some countries in the band.
8. Nokia agrees that the future path of DTT use will play a significant role and expects a further steady decline in favour of other distribution paths with an increased share of broadband connections for fixed reception scenarios, eventually eliminating the need for distribution in UHF spectrum for fixed reception scenarios. Nokia sees opportunities for cooperation in 470-694 MHz on bringing non-linear and linear audio and video including broadcast content to mobile devices in mobile reception scenarios when commuting or when travelling. Nokia recommends considering codecs more recent than HEVC like VVC or even newer for a 2030+ timeframe, as HEVC needs to be considered by far outdated by then.

9. Nokia strongly supports a co-primary mobile allocation in 470-694 MHz in order to provide additional flexibility to EU and its member states, improving mobile services for consumers and businesses and reducing the digital gap in rural areas and hard-to-reach places, provide choices for better audio-visual content delivery to consumers including mobile use cases, and more efficient spectrum use in the band.
10. Nokia welcomes any activities for more efficient UHF use within the Council and EP decision on UHF and its review before 2030 and is willing to contribute. Nokia sees specific value in a review of the UHF band use as originally proposed in the Lamy report by 2025. We invite therefore RSPG and the European Commission to consider the formal process of engaging in such review, inviting all EU member states and stakeholders to contribute.

Specific text changes proposals

Throughout the document, RSPG often uses the adjective “effective” for spectrum use, whereas often “efficient” spectrum use is the overarching target in spectrum regulation. Oxford Advanced Learners Dictionary gives the following definitions:

effective: producing the result that is wanted or intended; producing a successful result

efficient: doing something in a good, careful and complete way with no waste of time, money or energy

Thus, efficient spectrum use seems to be the more desirable and more ambitious goal, specifically for scarce spectrum resources like 470-694 MHz. Nokia suggest RSPG to consider maintaining efficient spectrum use as the main guideline for regulatory decisions on bands like 470-694 MHz and amend the text as appropriate.

P10 section 3.1.1 last paragraph: the term “steaming from” may be intended to read “**stemming from**”

P10 section 3.2 last paragraph refers to Annex III which may miss relevant trial and demo activities e.g. on SDL, see proposal on Annex III

P10 section 3.3.1 2nd bullet item: the sentence could be amended to read “it would multiply **within a given country**, for the case of broadcast reception ...” as the introductory text mentions Member State and neighbouring countries.

P11 section 3.3.1 for completeness could conclude with the sentence taken from section 3.3.2 “**There is no impact on cross-border coordination with neighbouring countries having traditional DTT networks, taking into account the envelope concept.**”, also in line with the conclusions in section 3.4 on SDL and 5G Broadcast.

P12 section 3.3.3 4th paragraph, last sentence reads excluding a relevant option too generally, not considering a time component, and could be amended to “Therefore, the use of the FDD 600 MHz band plan is not expected to be implemented **soon** throughout the European Union.”

P12 section 3.3.3 5th paragraph could mention explicitly that focus of such negotiations could be on the UL range, helping to implement flexibility in the band. Proposal for a last sentence

added to the paragraph could be **“Such negotiations may be primarily concerned with the UL range 663-698 MHz and thus reduce replanning efforts.”**

P14 section 3.4 elements that may affect applying flexibility under Article 4: an additional bullet item in the 4th position (after the one on perception) could read **“lack of investment into ecosystem development due to lack of proper RR allocation”**

P14 section 3.4 bullet item on “Implementation of full FDD band plan” could consider that cross-border coordination may be eased by mainly addressing UL protection needs and end with an additional sentence **“Such impact e.g. on DTT network replanning may be reduced by the fact that mainly the UL range 663-698 MHz requires specific protection.”**

P15 section 4.1 2nd paragraph could recognise Satellite besides cable and broadband as a means of distributing TV content, proposal would be “since the rise of **satellite TV**, cable TV, ...”

P15 section 4.2 seems to focus on the evolution of DTT but does not seem to recognise additional low-band spectrum needs for MFCN as a main driver for future scenarios. Thus some text e.g. along the lines of the draft CEPT brief section 3.3.2.2 could be added as 2nd paragraph

“Given its excellent propagation and indoor penetration capabilities, some spectrum up to 224 MHz of the band 470-694 MHz could be valuable for IMT mobile, and may help facilitate a number of use cases, such as 5G unicast in combination with 5G Broadcast, mMTC (Massive Machine Type Communications) and eMBB (enhanced Mobile Broadband) applications requiring wide, deep coverage, whilst certain URLLC services could also be efficiently implemented.”

P17 2nd bullet item, at least VVC should be added in the technical evolution, i.e. “(e.g. DVB-T2 and HEVC, **VVC**).”

P17 7th bullet: proposal to add **“, subject to the population percentage using DTT”** at the end, as dedicated multiple MUX DTT networks operated 24/7 for small shares of pop cannot be considered energy efficient.

P18 3rd paragraph “... of their business model **and their carbon footprint.**”

P18 additional 8th paragraph: **“Scenarios 2 and 3 could provide migration paths with first introducing new DL use e.g. in the range 470-652 MHz while reserving the UL range 663-698 MHz for future UL use without immediate coordination and protection needs, and later introduction of UL use when feasible more easily in e.g. a group of neighbouring member states.”**

P20 Recommendation 8 last sentence “... such as T2/HEVC/**VVC**)”

Annex III: Proposal to add a 5th trial/demo along the lines of the compendium to the draft CEPT brief including the relevant footnotes with references.

5. Finland

In the Finnish national research project Future of UHF, multiple stakeholders including broadcast and mobile sides have studied options of coexistence of conventional DTT broadcast and mobile DL. This has led to a joint demonstration² in 2016 in Espoo,

² <https://yle.fi/aihe/artikkeli/2016/09/02/yle-qualcomm-and-nokia-announce-worlds-first-demonstration-lte-supplemental>

Finland, where mobile downlink (DL) was interleaved with the then active DTT in the 700 MHz band. One output from the study³ concluded that ‘...collaborative complementary hybrid usage scenarios of the lower UHF spectrum by the DVB and LTE Supplemental Downlink introduce a flexible way to transfer unused TV channels to mobile broadband...’. Another output⁴ concluded that ‘...LTE SDL seems to be the most feasible MBB coexistence scenario in the UHF broadcasting band in terms of technical compatibility with DTT and in terms of compatibility with the GE06 agreement...’

Closing Remark

Nokia sees the band 470-694 MHz as a critical resource for digital inclusion, specifically in rural areas and hard-to-reach places and thus is ready to support RSPG in evolving the use of that resource for the benefit of European citizens and businesses and open to any engagement with European institutions and administrations on the matter.

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³ “Coexistence of Digital Terrestrial Television and 4G LTE Mobile Network Utilizing Supplemental Downlink Concept: A Real Case Study” (IEEE Trans. Vehicular Technology, Vol 66, NO 6, June 2017, <https://ieeexplore.ieee.org/document/7742346>)

⁴ Coexistence of DTT and Mobile Broadband: A Survey and Guidelines for Field Measurements (<https://www.hindawi.com/journals/wcmc/2017/1563132/>)