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RADIO SPECTRUM POLICY GROUP

Opinion

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

1 Introduction – Scope of RSPG activity

In 2015, the RSPG published the RSPG15-595 FINAL Opinion on a “long-term strategy on the future use of the UHF band (470-790 MHz) in the European Union”¹. In addition to recommendations regarding the availability of the 700 MHz band for mobile, the RSPG also expressed its vision about the long-term use of the band 470-694 MHz, in particular in the recommendations 7, 8, 9 and 11.

In 2017, this RSPG Opinion and the Lamy report recommended the main elements of the compromise which was the basis of the Decision (EU) 2017/899² on “the use of the 470-790 MHz frequency band in the Union”. Under Article 4, this Council and European Parliament Decision is providing legal certainty at least until 2030 to terrestrial broadcasting and Programme Making and Special Events (PMSE), on the basis of national needs, in the frequency band 470-694 MHz.

In order to support the European Commission, to respond to its reporting obligation, under Article 7 of the Decision (EU) 2017/899, there is a need for the RSPG to contribute, from an EU perspective, with a strategic vision for sub-700 MHz spectrum use, including an analysis of latest developments with a review of the background and recommendations of the 2015 RSPG Opinion, and the consideration of possible post-2030 scenarios, taking into account what it is established in Article 4 of the Decision (EU) 2017/899.

RSPG investigated the latest developments, as underlined in Article 7 of the Decision (EU) 2017/899, relating to the band 470-694 MHz and developed the present Opinion for sub-700 MHz spectrum use beyond 2030, including:

- a review of the background and recommendations of the RSPG15-595 FINAL Opinion (Section 2);
- conclusions on how the flexibility set out in Article 4 of the Decision (EU) 2017/899 could be implemented in practice (Section 3);
- possible and technically feasible scenarios concerning development of use in this frequency band with relevant key assumptions and conditions, including potential consequences in terms of EU harmonisation framework in this band, in particular for post-2030, and taking into account the links with content regulation (Section 4);
- a set of conclusions and recommendations (Section 5);
- a summary of the results of the public consultation held from from 16 June to 25 August 2023 (Section 6).

¹ RSPG15-595 FINAL: https://circabc.europa.eu/d/a/workspace/SpacesStore/c88af26c-0f24-4431-8647-56deaa917307/RSPG15-595_final-RSPG_opinion_UHF.pdf

² Decision (EU) 2017/899: <https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A32017D0899>

2 Review of the RSPG15-595 FINAL Opinion on the 470-790 MHz UHF band

In the RSPG15-595 FINAL Opinion, RSPG provided a vision for the use of the UHF band in the next decade, supporting broadcasting and PMSE needs and developed relevant strategic recommendations, regarding the implementation of Wireless Broadband Electronic Communications Services (WBB ECS) in the 700 MHz band and a common timing for the reorganization of the UHF band.

The document is very articulate: first, it gives an overview of the UHF band use in the Member States and the ongoing activities in international regulatory bodies (ITU, CEPT and EC); then it delves into technological developments and related standardisation activities; finally, it provides the elements for defining a long-term strategy, also reporting on critical issues for a migration.

At the present Opinion, RSPG reviews the background and the recommendations of the RSPG15-595 FINAL Opinion.

2.1 Review of the Background

This section aims to provide a revision of the background and how it has evolved since the publication of the RSPG15-595 FINAL Opinion, regarding the 470-790 MHz UHF band.

The Directive (EU) 2018/1972³ of the European Parliament and of the Council establishing the European Electronic Communications Code (EECC), published in December 2018, includes the general provisions especially regarding the strategic planning and coordination of radio spectrum policy objectives including flexibility under conditions (Article 4), as well as the access to radio spectrum (Part II, Title I, Chapter III).

The RSPG-15-595 FINAL Opinion, in 2015, recommended specific provisions regarding the UHF band, including a long-term strategy for the band 470-694 MHz (sub-700 MHz band). These Recommendations are reviewed in detail in the following section 2.2.

The Lamy Report⁴, published in August 2014, recommended a review of the sub-700 MHz UHF spectrum usage by 2025.

Furthermore, two relevant Decisions were published:

- in 2016, Commission Implementing Decision (EU) 2016/687 was adopted, on the harmonisation of the 694-790 MHz⁵ frequency band for terrestrial systems capable of providing wireless broadband electronic communications services, and flexible national use for Public Protection and Disaster Relief (PPDR), Programme Making Special Events (PMSE) and Internet of Things (IoT);
- in 2017, further to the proposal from the European Commission, the European Parliament and Council adopted Decision (EU) 2017/899 on “*the use of the 470-790 MHz frequency band in the*

³ EECC: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv%3AOJ.L_.2018.321.01.0036.01.ENG

⁴ Lamy Report: http://ec.europa.eu/newsroom/dac/document.cfm?doc_id=8423

⁵ Commission Implementing Decision (EU) 2016/687: <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX:32016D0687>

Union” called in this Opinion as “UHF Decision”⁶. The UHF Decision, inter alia, ensured a common timing (by 30 June 2020 with a possible delay of up to two years – see Article 1), for allowing the use of the 694-790 MHz band under these harmonised technical conditions. To support the harmonised usage of the 700 MHz band, this decision set also a deadline (by end of 2017) to conclude all the necessary cross border agreements (Article 1.2), taking into account the cross-border coordination with third countries (Article 1.3). Member States have been requested also to publish a national roadmap for the reorganisation of the UHF before a deadline (mid 2018).

In accordance with Article 4 of the UHF Decision, the frequency band 470-694 MHz will continue, at least until 2030, to be available for the terrestrial provision of broadcasting services, including free television, and for use by wireless audio PMSE on the basis of national needs.

In accordance with Article 7⁷ of the UHF Decision, the EC in cooperation with the Member States shall report to the European Parliament and to the Council on developments in the use of the sub-700 MHz band, taking into account the developments in this band as well as all social, economic, political, cultural, regulatory and technical elements.

To examine latest developments and trends that are relevant to the current and future use of the 470-694 MHz band, the EC performed a study on the use of the sub-700 MHz UHF band (470-694 MHz)⁸.

Below is some information regarding the uses of the UHF band other than broadcasting:

PMSE: Audio PMSE devices are operating in white spaces of the UHF band. Actual use in different countries depends on national needs. According to the RSPG17-037 Opinion⁹, adopted in November 2017, RSPG would have to continue to monitor developments in UHF spectrum, in order to evaluate potential implications for PMSE use in Europe. RSPG also believes that PMSE spectrum requirements need to be considered in the report of the sub-700 MHz UHF band expected by 2025, taking into account the technological developments and the evolution of demand for PMSE.

Radio astronomy and Radiolocation: RSPG, in the RSPG15-595 FINAL Opinion, noted that the operation of radio astronomy needs to be ensured in the long term. In addition, given the operation of Radiolocation (wind profiler) in some countries, the RSPG recognised that the long-term strategy for the UHF band has to respect this service.

PPDR: RSPG recognised also, in the same Opinion, that the implementation of broadband PPDR networks is a national issue. The technical conditions for wireless broadband electronic communications

⁶ Decision (EU) 2017/899: <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32017D0899&from=en>

⁷ Article 7: “The Commission shall, in cooperation with the Member States, report to the European Parliament and to the Council on developments in the use of the sub-700 MHz frequency band, with a view to ensuring efficient use of spectrum, pursuant to the applicable Union law. The Commission shall take into account the social, economic, cultural and international aspects affecting the use of the sub-700 MHz frequency band pursuant to Articles 1 and 4, further technological developments, changes in consumer behaviour and the requirements in connectivity to foster growth and innovation in the Union.”

⁸ Study on the use of the sub-700 MHz UHF band (470-694 MHz): <https://op.europa.eu/en/publication-detail/-/publication/8c6755a1-4f55-11ed-92ed-01aa75ed71a1/language-en/format-PDF/source-search>

⁹ RSPG17-037 Opinion on a long-term strategy on future spectrum needs and use of wireless audio and video PMSE applications: https://circabc.europa.eu/d/a/workspace/SpacesStore/7c4e2799-e32e-42a1-98cb-3f8a1997ce50/RSPG17-037finalrev1_RSPG_opinion_PMSE.pdf

services that should be used and the frequency arrangement for PPDR, if PPDR radio communications are implemented in the 700 MHz band, were provided in the Annex of Commission Implementing Decision (EU) 2016/687. The UHF Decision recognises this right for Member States (Article 1.4).

ITU has published the following technical studies focusing on compatibility issues:

- **Report BT.2337-1 (11/2017)** Sharing and compatibility studies between digital terrestrial television broadcasting and terrestrial mobile broadband applications, including IMT, in the frequency band 470-694/698 MHz;
- **Report BT.2301-3 (03/2021)** National field reports on the introduction of IMT in the bands with co-primary allocation to the broadcasting and the mobile services.

ANNEX I contains a Table with the detailed changes/revisions of the legal documents referred in the RSPG15-595 FINAL Opinion at the “EU regulatory framework and definitions” Section.

2.2 Review of the Recommendations to Commission and Member States

This Section includes a review of the Recommendations, included in the 15 points of Section 10 of the RSPG15-595 FINAL Opinion. As the evolution of the overall strategy depends on the realisation of each one of these 15 points, RSPG assesses whether these points have actually been implemented, whether they are still in the process of being realised, or whether there have been changes in the meantime that make some points no longer necessary or of interest. For each point, a series of actions were identified and a 'state of completion' assessed. The details of the recommendations and their consequences can be found in Annex II.

A general finding is that the RSPG15-595 FINAL Opinion was undoubtedly given great consideration in the drafting of Decision (EU) 2017/899, considering that many recommendations are reflected in the articles of the Decision itself.

A first group of recommendations (1-4) concerned the implementation of WBB in the 700 MHz band, in preferred common timing (by the end of 2020) and the need for a framework of migration of the broadcasting services towards frequencies below 694 MHz (national roadmaps). These recommendations were all incorporated in Decision (EU) 2017/899, in Commission Implementing Decision (EU) 2016/687 and by Member States (national roadmaps). Few Member States are still under process to deliver 700 MHz WBB authorizations in that band (see progress reports to RSPG on State of play regarding award of 5G pioneer bands). Other Member States have already delivered 700 MHz WBB authorizations, but the SDL remained unassigned in many of them.

The focus of the following two recommendations (5-6) was on the need for negotiations between EU Member States to finalise cross-border coordination agreements by the end of 2017. This target date for finalising cross-border coordination agreements has been included in the Decision (EU) 2017/899. In addition, negotiations between EU Member States with neighbouring non-EU countries was encouraged to be initiated as soon as possible. An important role in the implementation of these recommendations was and is still played by the RSPG Good Offices, as appropriate under Article 28 of the EECC (see in particular RSPG18-042). The Commission is providing feedback on Union actions, in relation to third countries and RSPG made relevant recommendations in the RSPG21-033 Opinion on RSPP. At the moment, some situations between EU and non-EU countries remain to be resolved (see progress reports to RSPG on Good Offices). However, due to geopolitical situation, the likelihood of propitious coordination on the eastern border of the EU is not likely of being achieved in foreseeable future. Therefore, EC should continue its efforts to influence non-EU countries (especially potential candidate countries) in order to release the 700 MHz band from DTT use, or at least withdraw DTT from border areas with EU countries and conclude appropriate agreements.

Recommendation 7, which invited the EC to cooperate with the Member States on the introduction of more advanced technologies (e.g. DVB-T2 and HEVC), has been implemented to varying degrees by the Member States, with each Member State balancing this introduction against the assessment of internal market drivers. The result to date is thus an extremely varied picture of the transmission and compression standards adopted and is still under process in some Member States.

The importance of DTT and the need to provide certainty for investments are reflected by recommendations 8-10, which aimed to define a stable framework for the use of the sub-700 MHz band, with a time horizon beyond 2030, and at the same time offering the possibility of national flexible use of the frequency band for WBB downlink: Member States wishing to do so are allowed to use the band for services other than DTT, provided that the needs of DTT both within the Member State and in neighbouring countries are not prejudiced. This is without prejudice to coordination agreements with the

neighbouring countries. These recommendations were implemented in Article 4 of Decision (EU) 2017/899.

Recommendation 11 gives a guideline, when considering any options for the future decisions on the usage of the UHF 470-694 MHz frequency band, including aspects such as the requirements, technological developments, consumer behaviour, the importance of delivering free-to-air television and the various political, social, cultural and economic general interest objectives. This recommendation was reflected in Article 7 of Decision (EU) 2017/899.

Recommendation 12 on PMSE applications indicates the importance of reserving sufficient spectrum, the need for the development of increasingly efficient PMSE technologies in spectrum use and highlighted the role of Member States in spectrum sharing and license conditions. The recommendation, incorporated in Articles 4 and 5 of Decision (EU) 2017/899, has been fulfilled by the RPSG's work on PMSE and Spectrum Sharing (see RSPG17-037 and RSPG21-022¹⁰).

Recommendation 13 states that compensations schemes to UHF broadcasters are a national issue. Compensation schemes are permitted under Article 6 of the Decision (EU) 2017/899.

Recommendation 14 focuses on PPDR networks as a national issue. This has been recognised by the Commission and implemented in Article 1.4 of Decision (EU) 2017/899 and in Commission Implementing Decision (EU) 2016/687.

Finally, the recommendation 15 calls for the standardisation of TV receivers to consider the evolution of the use of the 700 MHz band. RSPG noted that the ETSI EN 303 340 V1.2.1 (2020-09), harmonized standard for Digital Terrestrial TV Broadcast Receivers, takes into consideration deployment of WBB in 700 MHz in Europe. It defines in particular DTT receivers' characteristics to avoid interference from WBB operating in the 700 MHz band. In this respect, ETSI recognises that some EU Member States are still delaying the refarming of the 700 MHz band. This implies that there are still DTT deployments below 790 MHz, which need to be protected by mobile base stations. Therefore, pending the provisions of the ECC/DEC/(09)03 and Commission Decision 2010/267/EU related to 800 MHz band, baseline requirements to protect DTT below 790 MHz are maintained in the EN 301 908 series.

Summing up the recommendations can be grouped in:

- fully implemented: 1-4, 8-10, 13, 14, 15
- on-going: 5, 6, 7, 11, 12

ANNEX II contains a Table with RSPG15-595 FINAL Opinion recommendations assessment, where fully implemented recommendations are in green and the on-going ones are in yellow.

¹⁰ RSPG21-022 RSPG Opinion on Spectrum Sharing – Pioneer initiatives and bands: https://radio-spectrum-policy-group.ec.europa.eu/system/files/2023-01/RSPG21-022final_RSPG_Opinion_Spectrum_Sharing.pdf

3 Existing Flexibility

Article 4 of DECISION (EU) 2017/899 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 May 2017 on the use of the 470-790 MHz frequency band in the Union⁴ reads:

“Member States shall ensure availability at least until 2030 of the 470-694 MHz (‘sub-700 MHz’) frequency band for the terrestrial provision of broadcasting services, including free television, and for use by wireless audio PMSE on the basis of national needs, while taking into account the principle of technological neutrality. Member States shall ensure that any other use of the sub-700 MHz frequency band on their territory is compatible with the national broadcasting needs in the relevant Member State and does not cause harmful interference to, or claim protection from, the terrestrial provision of broadcasting services in a neighbouring Member State. Such use shall be without prejudice to obligations resulting from international agreements, such as cross-border frequency-coordination agreements.”

3.1 Article 4 of Decision (EU) 2017/899 – main points

The availability of spectrum for broadcasting and PMSE is on the basis of national needs. That does not exclude the possibility to other usages while ensuring protection of broadcasting and PMSE usage.

The second part of Article 4 raises the issue of cross-border compatibility of such usage. The second sentence highlights that the status of such operation would be on a non-interference and non-protection basis, in line with the absence of status in the Radio Regulations (RR), for usage other than broadcasting service and PMSE (i.e. operation under RR Art.4.4 in derogation of the Table of Allocation). However, the last sentence opens the possibility for a Member State to negotiate with its neighbours on frequency-coordination agreements, which would enable operation at the border of other usage than broadcasting service and PMSE.

The “envelope concept” introduced in the Geneva 2006 Agreement can facilitate the implementation of the Article 4. The tool is described in the following section.

3.1.1 Geneva 2006 Agreement (GE06) – Envelope concept

The Geneva 2006 Agreement (GE06) was the outcome of the Regional Radiocommunication Conference (RRC-06) for planning of the digital terrestrial broadcasting service in Region 1 (excluding Mongolia) and in Iran, in the frequency bands 174-230 MHz and 470-862 MHz.

Some European countries wished to license part of this spectrum on a technology neutral basis, so during the Conference the “envelope concept” was introduced at the initiative of the European Conference of Postal and Telecommunications Administrations (CEPT). The aim was to introduce a degree of flexibility that would make GE06 Plan suitable for integrating broadcasting technologies other than T-DAB or DVB-T, as well as non-broadcasting applications, by guaranteeing the compatibility of these alternative usages with the DVB-T and T-DAB entries in the plan.

The “envelope concept” relies on the equivalence of spectral power density, allowing the notification of assignments to the Master International Frequency Register (MIFR), corresponding to a digital plan entry in the GE06 Plan, with characteristics different from those appearing in the Plan (i.e. other than T-DAB or DVB-T), for transmissions in the broadcasting service or in other primary terrestrial services, provided that such assignments meet the following conditions:

1. they must not cause greater interference than that caused by any digital entry in the GE06 Plan (i.e. the new terrestrial application must not exceed the power spectral density of the digital entry);

2. they must not require more protection than the digital entry of the GE06 Plan would need;
3. the aggregate interference from the digital Plan entry implementation (notified assignment) should not exceed the interference envelope (levels) derived from the characteristics of the digital Plan entry.

This concept is described in two different but complementary sections of the GE06 agreement:

Paragraph 5.1.3 of Article 5 “*Notification of Frequency Allocation*” of the GE06 Agreement sets the principle of equivalence of spectral power density:

"A digital entry in the Plan may also be notified with characteristics different from those appearing in the Plan, for transmissions in the broadcasting service or in *other primary terrestrial services* operating in conformity with the *Radio Regulations*, provided that the peak power density in any 4 kHz of the above-mentioned notified assignments shall not exceed the spectral power density in the same 4 kHz of the digital entry in the Plan. Such use shall not claim more protection than that afforded to the above-mentioned digital entry."

Based on this principle, the conditions for the conversion (Plan to actual implementation) are presented in Section II of Annex 4 “Examination of conformity with the digital Plan entry” of the GE06 Agreement, whose section 2 “General principles” reads in particular:

“The digital Plan entry implementation is in conformity with the Plan when verification by the Bureau under a) is confirmed and when under b) the interference of the digital Plan entry implementation does not exceed the interference envelope derived from the characteristics of the digital Plan entry at any relevant calculation point.”

According to the above texts, in addition to broadcasting technologies, other than DVB-T or T-DAB (i.e DVB-T2, DAB+, DMB), assignments derived from digital entries of the GE06 can only be notified to the MIFR, with characteristics different from those appearing in the Plan, for non-broadcast terrestrial applications with a primary allocation in the Radio Regulations. To that respect, the GE06 agreement already considered a number of terrestrial primary services in different sub-bands¹¹. Any further changes in the status of a service are only possible at a World Radiocommunication Conference (WRC).

In addition, the GE06 Agreement includes Declaration n.42, signed by several Administrations, including all 27 EU Member States. Declaration n.42 states that “their Administrations may use their digital Plan entries for broadcasting or other terrestrial applications with characteristics that may be different from those appearing in the Plan within the envelope of their digital Plan entries under the provisions of the GE06 Agreement and the Radio Regulations, and that their administrations agree that any such use will

¹¹ See section 4.1.1.1 in Chapter 2 of Annex 2 of the GE06 agreement:

- For band 174-230 MHz, the fixed service and mobile service in Iran; the aeronautical radionavigation service in Iran and in the countries listed in RR No. 5.247; and protection for the land mobile service between the countries listed in RR No. 5.235.
- For 470-862 MHz, the fixed service and mobile service in Iran, and the fixed service in the sub-band 790-862 MHz: the radionavigation service in Iran in the sub-band 585-610 MHz; in the UK in the sub-band 590-598 MHz, and in the countries listed in RR No. 5.312 in the band 645-862 MHz; the mobile, except aeronautical mobile, service in the band 790-862 MHz, between the countries listed in RR No. 5.316; the radio astronomy service, in the whole of the African Broadcasting Area, in the sub-band 606-614 MHz.

be afforded protection to the levels defined by the interfering field strengths as arising from their digital Plan entries, taking into account any relevant bilateral agreements”.

This implies that assignments resulting from the digital entries in the GE06 Plan, for terrestrial services other than broadcasting, may be recognized by Administrations signatory to the Declaration n.42. However registration of assignments of terrestrial services other than broadcasting in the MIFR without a primary allocation in Article 5 of the Radio Regulations is not possible, thus broader international recognition and protection will not be ensured.

3.2 Article 4 of Decision (EU) 2017/899 – Current status of implementation and evaluation

In the majority of the Member States, the national allocation of the 470-694 MHz frequency band is primary only for broadcasting and secondary for the land mobile service (intended for applications ancillary to broadcasting and programme-making), in line with the ITU-R RR regulatory provisions and the EU regulatory framework. In some Member States, this means also a regulatory limitation of the land mobile service allocation to use cases in relation with broadcasting and PMSE services.

Further to the regulatory aspect, flexibility under Article 4 has not yet been implemented at national level and therefore there is no experience at cross border level either.

3.3 Existing technical solutions – Opportunities and limits

3.3.1 Supplementary Downlink (SDL) implementation

The RSPG15-595 FINAL Opinion recommended that Member States “should have flexibility to use 470-694 MHz for WBB downlink, providing that such use is compatible with the broadcasting needs in the relevant Member State and does not create a constraint on the operations of DTT in neighbouring countries. This is without prejudice to coordination agreements with neighbouring countries “

In practice, mobile SDL provides inherently more flexibility for a Member State to introduce mobile communications in the frequency band 470-694 MHz:

- the amount of spectrum made available for SDL may be adjusted to the remaining broadcasting and PMSE needs of this Member State;
- cross-border coordination will be easier.

Two ways of implementing SDL may be considered:

1. *SDL in the interleaved spectrum* of the broadcasting of the Member State and of the neighbouring country. This solution avoids any replanning and limits cross-border coordination efforts. However,

- it may result in varying number of SDL channels over the country,
- it would multiply, for the case of broadcasting fixed reception, adjacent frequency interference situations, as experienced with the 700 MHz and 800 MHz bands, with no easy fix, since TV installation filters would need to be adapted to each case.
- it would affect as well PMSE service that use the interleaved spectrum and which equipment is not protected against IMT-DL (no antenna discrimination).

2. *SDL in a block of spectrum*. This solution enables to deal properly with adjacent frequency interference situations and is more manageable for the regulator. However, it would require significant replanning and cross-border coordination efforts with neighbouring countries.

3.3.2 5G Broadcast

It should be noted that 5G Broadcast is an application of the Broadcast Service and therefore, in strictly regulatory terms, does not constitute an Article 4 case. However, it is considered useful to describe it in this section because it may become relevant, in the context of the possible uses of the 470-694 MHz band. 5G Broadcast trials, described in Annex III, have been done at national level, in isolated locations but not all over the country.

5G Broadcast ("*LTE Based 5G Terrestrial Broadcast*") is a relatively new broadcasting standard, which was introduced by 3GPP and standardised in Release 16. It was subsequently published in ETSI (ETSI TS 103 720) and the system has been included in the standardisation work of ITU-R Study Group 6.

The existing 8 MHz TV channels in the UHF band which are used for DTT in the framework of the GE06 Agreement (or currently partially unused in some countries) can be used for 5G Broadcast transmissions under the "envelope concept". *LTE Based 5G Terrestrial Broadcast* already supports the bandwidths of 1.4, 3, 5, 10, 15 and 20 MHz. To cope with the GE06 frequency plan and the used channel raster, the bandwidth of 8 MHz has been, among others, recently approved by 3GPP and standardized by ETSI.

Regarding the implementation of 5G Broadcast services there are still open questions (e.g. UHF frequency band plan, business models, availability of equipment, national regulation and strategies) which have to be addressed and to be decided for the completion of a viable ecosystem. At present, only few rudimentary prototypes of smartphones with 5G Broadcast functionalities are available for demonstration purposes, which have been shown at various public events and during national trials. The availability of consumer equipment on a large scale (smartphones, tablets etc.) is crucial for broader implementation of such a system.

From a frequency management perspective,

- Under the GE06 Agreement, the sub 700 MHz band is currently based on 8 MHz channelling, so that it would be more efficient for 5G Broadcast to use the same channelling.
- DTT spectrum planning based on High Tower/High Power allows cost-efficient provision for fixed roof-top reception deployments, in which high quality services can be provided with low level of signal in the edge of the coverage areas. This configuration, however, does not always enable to have sufficient received field strength, necessary for a good mobile reception (e.g. in 5G Broadcast by smartphones, tablets etc.), which has to overcome the intrinsic limitations of portable devices and higher variability of the signal strength. In these scenarios denser network could be needed, using a deployment based on low/medium power/towers.
- An interleaved spectrum usage of DTT roof-top reception and 5G Broadcast would generate interference from 5G Broadcast to DTT fixed reception, as shown in the 700 MHz and 800 MHz bands, if 5G Broadcast is deployed over a dense network (low tower). Mitigation techniques could be needed such as filters to be installed after the DTT receiving antenna. In opposite to the 700/800 MHz cases, the use of interleaved spectrum could require filters adapted to the local circumstances (i.e. local DTT channels), which would imply cost and technical challenges. Also other mitigation techniques could be explored, such as optimum radio planning and cross polarization.

Therefore, 5G Broadcast could be considered under the "broadcasting service", using a technology different from DVB-T/DVB-T2 and offering a different service provision. There is no impact on cross-border coordination with neighbouring countries having traditional DTT networks, taking into account the envelope concept.

3.3.3 Dedicated band for use by the mobile service with uplink - 600 MHz band plan implementation

In order to permit the use by the mobile service with uplink, there would be a need to repurpose a dedicated part of the band. This approach was applied in a number of non-EU nations, including USA and Canada, for the 600 MHz band. An assessment of the implementation of flexibility is provided in this section, according to Article 4 of Decision (EU) 2017/899, by applying this approach in a European country.

RSPG noted 3GPP initiatives to develop specifications in two 600 MHz band plan with Uplink: 1) UL 663 – 698 MHz DL 617-652 MHz and 2) UL 663–703 MHz DL 612-652 MHz. RSPG developed its analysis hereafter on the basis of the first band plan. The second band plan is not applicable due to current EU harmonisation in 700 MHz (i.e. PPDR usage in 698-703 MHz).

Implementing at national level, this option requires the split of the 470-694 MHz spectrum range into two parts. The first range is between 470-614 MHz, used only for broadcast and for PMSE applications. The second range is between 617-694 MHz, used for mobile service including uplink, for example based on FDD Band plan. This means a reduction of the spectrum available to DTT and PMSE by 80 MHz which equals to 10 TV channels to be evacuated from broadcasting service.

Where the entire 470-694 MHz band is intensively used for DTT service, as it happens in a number of Member States in Europe, it is not possible to replan this band in order to implement such 600 MHz band plan approach, because it would prevent those Administrations from meeting their national needs for the broadcasting (e.g capacity for the TV content). Some Member States, where broadcasting continues to use the 470-694 MHz band, may also wish to plan paths for the evolution of broadcasting technology and preserve current spectrum resources compatible with such evolution, even at their borders. Therefore, the use of the FDD 600 MHz band plan is not expected to be implemented throughout the European Union.

For cases where a Member State intends to implement this alternative usage, under the flexibility framework set out by Article 4 of Decision (EU) 2017/899, this Member State needs to enter into cross border negotiation with neighbouring countries and cope with the requirements to preserve their broadcasting needs at the border and the equitable access, noting that the GE-06 envelope concept does not apply for mobile service which includes uplink. In consequence, even if the broadcasting /PMSE capacity needs are preserved at national level, the replanning of the national broadcasting frequency maps will require adequate time for the country concerned to conduct cross-border coordination negotiations.

Another main issue is the high interference risks posed from high power DTT transmissions in neighbouring countries, being co-channel to the uplink of the FDD mobile network. This should be carefully addressed and the consequences are analysed in detail hereafter.

In the case that an EU Member State is wishing to implement the 600 MHz band plan nationwide, thus including its border, under the flexibility conditions of Article 4, no constraint should be caused on the operations of DTT in neighbouring countries. In figures, five channels, i.e. 39 to 43 (614-654 MHz) will be used to cover the 617 – 652 MHz downlink band and another five channels, i.e. 45 to 49 (662-702 MHz) will cover the 663 – 698 MHz uplink band. Considering that channel 49 is already used in Europe for one PPDR block in the 700 MHz band plan, a total of nine channels will be used exclusively by this country, reducing the channels available for its broadcasting usage from 28 to 19, including channel 38 used for radio astronomy and channel 44 in the duplex gap. Since the neighbouring country should keep its rights for broadcasting (i.e. 50% of the initial capacity, namely 14 channels), it means that the Member State wishing to implement a 600 MHz plan would keep only about one third of its initial broadcasting capacity at the border. This illustrates the major impact on its broadcasting service that a country wishing

to implement the 600 MHz band plan would need to accept. Outside coordination areas, more capacity would remain available for broadcasting.

However, several facts could be considered here, in particular that the protection of terminals in the country wishing to implement 600 MHz band plan from broadcasting in the neighbouring country, extend to less than 100 km (i.e. case of the mobile downlink protection). This would probably reduce the impact of enabling base station deployment at the border while avoiding capacity loss for broadcasting in the neighboring country.

At the table hereafter, the values of separating distances between mobile and broadcasting according to the relevant studies are shown.

		INTERFERING SERVICE		
		DTT	MOBILE UL	MOBILE DL
INTERFERED SERVICE	DTT	-	< 1 km	50-200 km ¹²
	MOBILE UL	200-400 km ¹³	-	-
	MOBILE DL	40-90 km ¹⁴	-	-

These interference distances should be considered in the cross-border negotiation along with the diverse requirements of the neighbouring countries to preserve their resources in order to respond to their broadcasting needs. A Member State, implementing a 600 MHz band plan approach, will have to ensure successful cross border negotiation with all neighbouring countries in order to:

- respect the rights of the neighbouring administrations to accommodate their broadcasting needs applying the equitable access principle;
- prevent interference to broadcasting operating in the neighbouring country, in particular from mobile downlink.

Therefore, exercising the flexibility afforded by Article 4 for a mobile frequency arrangement with uplink and downlink is more complex than with mobile downlink only.

3.3.4 Dynamic Spectrum Access (white spaces)

Some flexible use of the band may be envisaged by any Member State, such as for low power white space device, which would not impact the broadcasting use in neighbouring countries. However, PMSE also uses DTT white spaces and this approach impacts spectrum available for this application. Furthermore, despite the few trials of white space devices that have been done in some Member States (in particular to deliver FWA), there has been no commercial follow up yet.

¹² Report [ITU-R BT.2337-1](#) Tables 10, 11 and 12 (pages 13 and 14)

¹³ Report [ITU-R BT-2337-1](#) Table 15 (page 19)

¹⁴ Annex 3 (sec. 3.2.2.1 - pages 177-178) in document [6-1/130-E](#) (*Report of the final meeting of TG 6/1 - Contains sharing and compatibility studies between several applications of the mobile service and other incumbent services in the band 470-694 MHz, developed during the study cycle towards WRC-23*)

NB – In all cases, the data come from theoretical studies based on typical configurations.

3.4 Conclusions

Apart from considerations of the availability of spectrum for broadcasting and PMSE and of cross-border agreement among EU Member States, some other elements may affect the possibility of applying the flexibility built in Article 4 of Decision (EU) 2017/899:

- the lack of any detailed harmonized framework, due to the diversity of situation in Member States;
- the lack of practices for implementing flexibility;
- the perception that land mobile service, except PMSE, cannot be deployed without proper RR allocation;
- the uncertainty regarding the post 2030 EU framework and its impact on any earlier implementation of the flexibility built in the Decision (EU) 2017/899;
- the challenge of renegotiating cross-border coordination agreements within EU and Cross-border coordination issues with countries outside EU;
- no established market demand or business case identified so far for most of the Member States.

On the other hand, there are opportunities for flexibility under Article 4 of Decision (EU) 2017/899, which could be used by a Member State for:

- *Implementing mobile SDL* (in line with the recommendation of the previous RSPG15-595 FINAL Opinion). Two options have been identified: a first one, in the interleaved spectrum of the broadcasting of the Member State avoiding a re-planning and cross-border effort; a second one, with a dedicated SDL block of spectrum, avoiding adjacent channel interference issue with fixed reception broadcasting but requiring a significant replanning and cross-border coordination efforts with neighbouring countries. The approach of “mobile SDL” is compatible with the GE06 envelope concept.
- *5G Broadcast*. There is no impact on cross-border coordination with neighbouring countries having traditional DTT networks, taking into account the envelope concept. However, if 5G Broadcast is deployed over a dense network (Low Tower), 5G Broadcast may generate interference to DTT fixed reception in adjacent channels as shown in the 700 MHz and 800 MHz bands (DTT/mobile coexistence) and the option of a dedicated block of spectrum may be preferred requiring a significant replanning and cross-border coordination efforts with neighbouring countries. The approach of 5G Broadcast is compatible with the GE06 envelope concept.
- *Implementation of a full FDD band plan*, such as the 600 MHz band plan including uplink transmission. The flexibility for a Member State to implement in practice such a plan raises significant impact on cross-border coordination, considering the remaining broadcasting use in neighbouring countries, in accordance with the priority given to broadcasting.

Therefore, there are some strategic challenges in implementing flexibility (Article 4) which depend on circumstances specific to each Member State (and its neighbours). The RSPG invites Member States to explore circumstances, in partnership with neighbouring countries, of flexibility near their shared border.

4 Possible and technically feasible scenarios for post 2030

This Section of the RSPG Opinion is addressing possible and technically feasible national scenarios concerning development of use in the sub-700MHz frequency band (470-694 MHz), taking into consideration the current impact of the flexibility under conditions (see Section 3), the current TV landscapes among EU countries and the main drivers which may influence the future developments.

4.1 Short overview of the TV landscapes evolution

The 470-694 MHz band is harmonised for digital terrestrial television (DTT) all over EU and is also widely used for wireless microphones (audio PMSE) in the white spaces of DTT.

In some Member States, since the rise of cable TV, DSL (IP TV) and later fibre optics, fixed broadband access has increased and is offering a possible alternative to DTT, under different access conditions. Such alternative subscription-based services offer various media contents through fixed broadband. In some cases, as for example Belgium, the Netherlands, Sweden, Finland, Malta, Slovenia, and Germany, this has led to a decrease in the use of DTT. This trend is expected to have an impact on media distribution in the coming years, as media publishers will begin to prioritise the use of alternative platforms that are already prevalent. New distribution media will be needed, in addition to DTT in the 470-694 MHz band, as discussed in Section 4.3.2. Nevertheless, this situation regarding media consumption patterns, evolution of DTT services and availability of high-speed internet connection varies from country to country and across generations.

However, in other Member States the usage of free to air DTT is still very significant and in a large number of EU Member States there is no visibility on short term reduction of DTT spectrum needs, due to a number of factors (see Section 4.3.2, Scenario 1). Representative cases are, for example, those of Spain, France, Poland, Croatia, Italy, and Czech Republic. It is worth to note that in this situation there are Member states with no alternative platform for universal distribution of media contents on a national basis and also Member states where there is an extensive fibre optic fixed broadband network and/or high-speed networks deployed or planned.

Moreover, impact of evolution of DTT usages varies between EU Member States due to a number of factors beyond spectrum management.

The varying broadcasting needs between Member States beyond 2030 may result in significantly different scenarios as described in section 4.3. Some of the drivers are described hereafter.

4.2 Drivers for future scenarios

There are different views in RSPG on how the future will develop further to 2030. The significantly different situations among Member States and the uncertainty regarding the future spectrum needs for broadcasting are the result of a variety of drivers to be taken into consideration. The following analysis is not exhaustive and other drivers, beyond those identified hereafter, could be considered.

From a spectrum management point of view, one element to be considered is the need to achieve an effective usage of the 470-694 MHz band, respecting the different needs of Member States. Currently, the only common basis for the alternative usages to DTT and audio PMSE is the existing EU framework. In the case that a Member State recognises a decrease in broadcasting needs, the implementation of Article 4 (flexibility under conditions) would allow to use the 470-694 MHz band, at national level, by the end of 2030, according to its needs. The fact that no Member State has implemented Article 4 by now, limits the possibility to practically evaluate the situation.

In the present opinion, RSPG identified various drivers, including non-spectrum ones, which may impact future scenarios. Some of them are the diverse requirements in broadcasting and PMSE needs among the EU Member States, the impact of cross border coordination including at EU borders, the expected change in viewing habits, the competition from other technologies, the evolution of investment in DTT, the expiry of DTT authorisations (settled typically for 10-15 years) and their likely extension, the impact of digital 2030 targets, sustainability and energy consumption and the public service broadcasting (free to air).

An important element that need to be considered, when describing future scenarios, is the aim to achieve an effective usage of the sub-700 MHz band in each Member State, balanced with the need for cross border coordination, arising from the co-existence of different scenarios in neighbouring countries.

4.3 Possible and technically feasible scenarios including consequences on EU harmonization framework

RSPG notes that a prior to 2030 implementation of alternative usages under Article 4, might impact opportunities for further EU harmonisation in the future. This issue should be reviewed, as the alternative usages may increase and develop.

4.3.1 Possible long-term future developments, and their drivers

In this section, three possible future national scenarios are presented, considering the main drivers, technologies and trends that have been mentioned as well as existing broadcasting landscapes in the EU. It is important to note that the scenarios described below are deemed feasible only from a technical point of view. Some existing technologies are described in section 3.3 – further development of these can be expected. No detailed analysis has been carried out either of long-term developments or of possible national decisions that might occur in certain Member States before 2030, in case of decreasing spectrum needs for broadcasting and PMSE.

Any alternative to broadcasting and PMSE usage of the sub-700 MHz band, in EU Member States remains a national political decision in compliance with relevant EU Decisions and Regulations framework. As the basic elements of various scenarios may develop in different directions, as outlined below, it is essential to consider that any relevant regulatory framework on the EU level may have significant impact, i.e. limit or strengthen, Member States' abilities to individually implement any of the scenarios mentioned below.

It is also important to recognise the possible diverging trends, resulting in different situations among Member States regarding the spectrum use for DTT, and to consider that their future situations intend to continue to differ, with no visibility yet on the degree of differentiation or on the possibility of convergence. These differences lead Member States to follow different paths, some of them reflected in the possible scenarios described hereafter. This occurrence of significantly different situations will be a key aspect that will require appropriate solutions for a successful coexistence.

In different EU member states, the possible future usage scenarios could be the following.

Scenario 1: Prevalent broadcasting

In this scenario, DTT in sub-700 MHz band could remain the most widespread mean for accessing linear audio-video, at least for the 2030-2040 decade in a given country.

There could be an increase in access to audio-visual content via broadband without a decline in the use of the DTT, but rather with an overall increase in the enjoyment of content, using alternatively the different modes available.

Consequently, hybrid platforms could be developed for content distribution: broadcast network operators could offer content producers well-integrated platforms based on DTT for linear content and broadband access for non-linear content.

Driven by this increasing integration, on one hand the evolution of DTT technologies (e.g. video encoding upgrades, UHD) could continue; on the other hand, also driven by the objectives of the EU Digital Decade and the various national plans to deploy fibre, the penetration of television services delivered over IP networks (IPTV) could also increase as the speed of the Internet available to the end user increases. The possibility of using shared standards for IPTV could also define its ability to be embedded in receivers rather than stacking another powered electronic device that increases energy and recycling bills.

The demand for spectrum for PMSE applications could increase in order to satisfy the growing content production; on the other hand, the planning of DTT channels, necessary to avoid cross-border interference, has as a side effect a large band availability in each country assignable to PMSE.

In this scenario, the primary use of the band remains broadcasting, and the possibility of coexistence with PMSE persists. The usage of spectrum in 470-694 MHz is therefore effective. Still, a given country could experience a decreased use of DTT which makes the assessment of effective usage of spectrum difficult.

The main factors that could lead to an evolution in this direction are:

- DTT is an easy-to-access and inexpensive platform for consumers (the most popular model involves a small annual fee);
- the investments of broadcasting operators in technological evolution (e.g. DVB-T2 and HEVC) and innovation need adequate time for return on investment;
- convergence of DTT and IP services can be offered by technologies like HbbTV;
- the licences of current operators expire near 2030 (before or after), with a reasonable possibility of renewal for another 10-15 years;
- free accessibility to content remains a politically supported value for its social and democratic benefits, including pluralism, diversity of opinion, cultural and entertainment nature;
- non-traceable access is recognised as a particular value for the protection of personal privacy (a delicate and difficult issue in IP-based broadband distribution modes);
- well-designed DTT networks are efficient with respect to energy consumption and go well with climate change objectives;
- broadcast networks, including DTT, provide national resiliency and redundancy in case of crisis, natural disasters and/or cyberattacks.

Scenario 2: Broadcasting (DTT and 5G Broadcast), Mobile limited (SDL)

This scenario is very similar to the Scenario 1, as the most widespread platform for accessing linear audio-visual content could still be DTT, in 470-694 MHz. However, spectrum for PMSE may need to be specifically addressed, depending on the spectrum that continues being used by DTT. Mobile SDL and/or 5G Broadcast exist in a given country. This change compared to Scenario 1 would not require significant coordination efforts.

Scenario 3: Broadcasting limited, Mobile (Full FDD band plan)

In this scenario, there is less (up to no) need for broadcasting in the 470-694 MHz in a given country, which gives the opportunity for introduction of, for example, mobile broadband by implementation of the 600 MHz band plan, including uplink transmission. This would also mean that the national solutions for the PMSE usage in this band may be in place, though less spectrum will be available. The coordination efforts needed for this scenario may be challenging, depending on the overall situation. Complexity may remain at the border of EU for implementing this scenario.

Access to linear audio-video content could in most cases take place via means other than DTT: fixed broadband, satellite, FWA, Multichannel Multipoint Distribution Service (MMDS), cable TV or 5G Broadcast.

Moreover, on a national scale, progressive reduction of DTT usage may reach a point in a given country where broadcasters could question the viability of their business model.

This can be influenced by changing patterns of media viewing/consumption, as well as the costs associated with content distribution via other various alternative systems in simulcast.

This evolving landscape in television consumption may trigger a national consultation on long term needs of DTT. This would encompass a wide range of considerations largely beyond spectrum issues, such as content and national public policies, political dimension of DTT, FTA requirements, alternative content distribution needs, provision of alert systems and/or provision of independent public information.

Such national debate would require also studies and assessments to balance the different interests and objectives. The long-term usage of the UHF band should be reflected in national political decisions and changes should be described in the national regulatory framework in order to provide for the issues mentioned above.

Scenarios 2 and 3 would probably develop differently by each country implementing them, depending on the national spectrum needs for broadcasting, PMSE or other uses, as well as on cross border coordination, needed in case of different usage scenarios in neighbouring countries. These scenarios would require high engagement from the Administrations involved.

It is also essential to recognise that scenarios 2 and 3 aim to enable a given country to achieve effective usage of the 470-694 MHz band, in the cases where Scenario 1 does not fulfil the demands of this country anymore. That is the point to be estimated, preferably, at a Member State level.

4.3.2 PMSE

The current trend in audio PMSE usage depends on national usages and special events. Some Member States identified an increase in the need of audio PMSE. Significant improvements in audio PMSE spectrum efficiency have been made with the introduction of digital technology. However, the spectrum available for audio PMSE has been reduced, fallen almost to the half, due to the release of the 700 MHz and 800 MHz Digital Dividends.

Beyond the above scenarios, it is expected that the demand for spectrum for PMSE applications will increase in order to cope with the growing content production, and therefore access arrangements will have to be found to ensure sufficient spectrum for PMSE. This issue should be further analysed at national level, based on the various scenarios described above and the impact of the evolution of content production, including support for special events.

5 Recommendations

As it is expected that, until 2030, different Member States will remain in different situations regarding the usage of sub-700 MHz band, the conclusion of RSPG subgroup is that a common path for all Member States seems difficult even after 2030, due to different national spectrum needs and cross border issues.

Based on the review of the RSPG15-595 FINAL Opinion on UHF band and on the analysis of the national flexibility under the current framework, RSPG is making the following recommendations on possible and technically feasible scenarios concerning development of use in this frequency band.

5.1 Considerations on existing flexibility until 2030

1. RSPG notes that a harmonised implementation of a mobile band plan including uplink (e.g. 600 MHz) up to 2030 is not possible in the European Union. Possible national initiatives, such as 600 MHz band plan, appear complex to implement due to constraints to be addressed/solved in cross border coordination (see section 3).
2. As the implementation of flexibility under conditions, at least till 2030, will be a driving parameter for the future decisions on the issue, RSPG is of the view that the Member States should explore circumstances, in partnership with neighbouring countries, of flexibility near their shared border.

5.2 Recommendations on possible technically feasible scenarios for post 2030

3. RSPG recognises the possibility that, for the use of the 470-694 MHz band, a single scenario may not be applicable to all Member States. Therefore, RSPG recommends any future EU regulatory action to facilitate, to the extent feasible, the implementation of various scenarios among Member States, emphasizing the pursuit of compatible uses and focusing on the means to achieve them. Any regulatory action should also take into account the possible uses, already enabled by the implementation of Article 4.
4. RSPG recognises that, in the border areas of EU, successful coordination negotiations could rely on spectrum regulation at ITU-R level.
5. RSPG recognises also the needs, at national level, for several mobile usages other than Wireless Broadband Electronic Communication Services (WBB ECS) and PMSE, such other usages being PPDR and defence. Therefore, RSPG recommends that in case of decreasing needs for broadcasting at national level, spectrum should also be made available nationally for these use cases, taking into account the possible needs of cross border coordination.
6. RSPG considers that any long-term evolution of the national use in sub-700 MHz band may impact the spectrum available for audio-PMSE. RSPG recommends that those Member States introducing other usages than broadcasting, should preserve sufficient spectrum for PMSE needs, taking also into account possible evolutions of PMSE towards new technologies.
7. RSPG recognises that the operation of radio astronomy, in the 600 MHz frequency band, needs to be ensured in the long term, as well as the operation of Radiolocation (wind profiler) in some countries, in this band. Therefore, RSPG recommends that the Commission should take into account these services in any long-term strategy for the UHF band in the EU.
8. RSPG recognises that the evolution of UHF band broadcasting reception during the current decade, including factors such as the number of programs, the content format (HD/UHD) and technological advancements (e.g. DVB-T2/HEVC, 5G Broadcast) plays a role in shaping any timeline post 2030. Further, any decision on these factors is a national matter determined by market demand, consumer equipment, sustainability, and audio-visual policy. Nevertheless,

RSPG recommends that Member States wishing to continue to use sub-700 MHz band primarily for broadcasting, strive to implement most efficient technologies (such as T2/HEVC),

9. RSPG believes that any outcome of WRC-23 concerning the sub-700 MHz frequency band will be properly considered and balanced with the specific needs of the Member States for any later EU choice or decision on the European legal framework in this band.
10. RSPG is willing to contribute to the process for the review of the Council and EP decision on UHF and, if necessary, its update before 2030, noting the Lamy report, with a deliverable to be published in timely manner.

6 Response to public consultation

Note: this section has been added after the previous ones in order not to alter the section numbering (and corresponding references) already established in the Draft Opinion.

A public consultation on the Draft Opinion was held from 16 June to 25 August 2023. 59 responses were received.

The RSPG has thoroughly examined all feedback and recommendations on the initial proposal and incorporated pertinent modifications where necessary. The insights and suggestions shared by stakeholders were welcomed and duly considered. The RSPG acknowledges all feedback received with gratitude. Stakeholders valued the chance to present their perspectives and recommendations.

Some considerations on the responses received:

- Feedback has been provided by stakeholders from 9 Member States and 3 non-EU countries. 11 contributions came from associations and organisations covering multiple countries, representing stakeholders from various regions. Germany accounted for 27 of the contributions, nearly half of the total, with a majority supporting PPDR applications by various German public bodies, all indicating similar viewpoints.
- The distribution of stakeholders based on their interests is as follows: PPDR received support in 20 comments (taking into account the concentration of comments from Germany), while 18 comments came from broadcast stakeholders, 14 from mobile stakeholders, and 6 were in favour of PMSE applications (though comments in support of broadcast frequently cited the importance of protecting PMSE as well). It is worth noting one contribution in favour of vertical communication apps and the IoT.

Many of the comments received suggest further aspects worthy of further investigation, and thus offer useful material to effectively steer the possible continuation of the RSPG work.

Some recurring requests are to take social, economic and cultural factors into account, with particular reference to Article 7 of Decision (EU) 2017/899, as well as environmental and energy consumption assessments. Another desired objective is harmonisation in the band, which is preferable for market reasons to excessive differentiation on a national basis.

The problem with these demands is that they come from opposing sides, with each claiming to be the most respectful of the above-mentioned factors. These arguments would benefit from being substantiated with more accurate analyses and objective data; furthermore, it is perhaps legitimate to raise the question of whether such assessments fall within the scope of the RSPG – which is a spectrum policy advisory group – or should be subject to the scrutiny of other committees.

In the following subsections, some points brought to our attention from each of the stakeholders' communities in the submitted contributions are summarised. These could be usefully taken into account in subsequent work.

6.1 Broadcast community points

Comments in support of terrestrial broadcasting believe that the service should be protected beyond 2030, mentioning the socio-cultural significance of audio-video content as well as the ease with which it can be enjoyed by the public thanks to broadcasting via DTT. Among the values often cited were 'free-to-air' and the fact that broadcast content distribution allows audiences not to be profiled, thus protecting privacy.

Some comments suggest encouraging innovations with appropriate regulatory decisions (e.g. making HbbTV mandatory in TV sets and 5G broadcast functions in 5G chipsets).

6.2 Mobile community points

Comments in support of mobile services highlight the goal of the Gigabit Society, and see the use of spectrum in the sub-700 MHz band as an opportunity to create digital inclusion and to facilitate broadband access even in rural areas.

Many comments consider the 600 MHz band plan to be a real possibility, viable first and foremost in countries where DTT is already scarcely used, and call for further investigation into whether such countries can be grouped into clusters that would reduce the number and complexity of cross-border situations.

6.3 PMSE community points

Comments in support of PMSE applications first of all point out that the need for bandwidth is by no means decreasing, on the contrary increasing, given the growth in the number of events and content productions. Furthermore, very often events are transnational, which makes it important to be able to use the same equipment cross-border.

The sub-700 MHz band is considered to be the core for audio PMSE. A management by separate national choices is perceived as a losing proposition, while the hope would be to achieve harmonised regulation beyond 2030.

6.4 PPDR community points

This topic was compactly brought to attention by contributions from Germany, but it is also fair to mention one contribution from Italy, two from Switzerland and two from multi-country entities. The common position expressed can be summarised as follows.

PPDR mobile broadband communication cannot be implemented with current voice radio technology (like *Terrestrial Trunked Radio*, TETRA), but is already necessary to manage operations today. Reliability, availability, area coverage and security against eavesdropping as for the TETRA voice communication currently used cannot be guaranteed with commercial mobile networks. Public safety services therefore need a self-controlled broadband-capable network infrastructure for the transmission of large amounts of data. The UHF band is the only possibility of a timely and, above all, economical realization of comprehensive broadband coverage for PPDR and defence. Both mobile uplink and downlink are required to meet these requirements.

Comments in support of PPDR consider that a harmonised European approach should be the ultimate goal. Establishing harmonised spectrum for PPDR at European level would promote interoperability between EU countries and pool the needs of many PPDR users in the EU. This could attract the interest of suppliers to invest in this sector and to develop and deploy equipment, devices and infrastructure at competitive costs.

ANNEX I

Revision of EU regulatory framework and definitions

The following table contains any changes/revisions, of the legal documents referred in the RSPG15-595 FINAL Opinion at the “EU regulatory framework and definitions” section

	RSPG15-595 FINAL Opinion references	Status	Document/Text in force:
1.	Radio Spectrum Policy Programme (RSPP ¹⁵), Articles 3 and 7	No change	changed by EECC (Article 5 repealed) ¹⁶
2.	Treaty of the Functioning of the European Union ¹⁷ , Article 167(4)	No change	
3.	AVMS Directive (2010/13/EU) ¹⁸	revised in 2018	consolidated version ¹⁹
	Recital(5) Audiovisual media services are as much cultural services as they are economic services. Their growing importance for societies, democracy — in particular by ensuring freedom of information, diversity of opinion and media pluralism — education and culture justifies the application of specific rules to these services	there is not a corresponding recital	most relative recitals in 2018 revision: <ul style="list-style-type: none"> • No (61): Any measure taken by Member States under Directive 2010/13/EU is to respect the freedom of expression and information and media pluralism, as well as cultural and linguistic diversity, in accordance with the Unesco Convention on the Protection and Promotion of the Diversity of Cultural Expressions. • No (62) The right to access political news programmes is crucial to safeguard the fundamental freedom to receive information and to ensure that the interests of viewers in the Union are fully and properly protected. Given the ever-growing importance of audiovisual media services for societies and democracy, broadcasts of political news should, to the greatest extent possible, and without prejudice to copyright rules, be made available cross-border in the Union.

¹⁵ <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32012D0243>

¹⁶ [EUR-Lex - 02012D0243-20201221 - EN - EUR-Lex \(europa.eu\)](https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32012D0243-20201221-EN)

¹⁷ <https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:12012E/TXT:en:PDF>

¹⁸ <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32010L0013>

¹⁹ <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02010L0013-20181218>

<p>Article 13</p> <p>1. Member States shall ensure that on-demand audiovisual media services provided by media service providers under their jurisdiction promote, where practicable and by appropriate means, the production of and access to European works. Such promotion could relate, inter alia, to the financial contribution made by such services to the production and rights acquisition of European works or to the share and/or prominence of European works in the catalogue of programmes offered by the on-demand audiovisual media service.</p> <p>2. Member States shall report to the Commission no later than 19 December 2011 and every 4 years thereafter on the implementation of paragraph 1.</p> <p>3. The Commission shall, on the basis of the information provided by Member States and of an independent study, report to the European Parliament and to the Council on the application of paragraph 1, taking into account the market and technological developments and the objective of cultural diversity.</p>	Replaced	<p>Article 13</p> <p>1. Member States shall ensure that media service providers of on-demand audiovisual media services under their jurisdiction secure at least a 30 % share of European works in their catalogues and ensure prominence of those works.</p> <p>2. Where Member States require media service providers under their jurisdiction to contribute financially to the production of European works, including via direct investment in content and contribution to national funds, they may also require media service providers targeting audiences in their territories, but established in other Member States to make such financial contributions, which shall be proportionate and non-discriminatory.</p> <p>3. In the case referred to in paragraph 2, the financial contribution shall be based only on the revenues earned in the targeted Member States. If the Member State where the provider is established imposes such a financial contribution, it shall take into account any financial contributions imposed by targeted Member States. Any financial contribution shall comply with Union law, in particular with State aid rules.</p> <p>4. Member States shall report to the Commission by 19 December 2021 and every two years thereafter on the implementation of paragraphs 1 and 2.</p> <p>5. The Commission shall, on the basis of the information provided by Member States and of an independent study, report to the European Parliament and to the Council on the application of paragraphs 1 and 2, taking into account the market and technological developments and the objective of cultural diversity.</p> <p>6. The obligation imposed pursuant to paragraph 1 and the requirement on media service providers targeting audiences in other Member States set out in paragraph 2 shall not apply to media service providers with a low turnover or a low audience. Member States may also waive such obligations or requirements where they would be impracticable or unjustified by reason of the nature or theme of the audiovisual media services.</p> <p>7. The Commission shall issue guidelines regarding the calculation of the share of European works referred to in paragraph 1 and regarding the definition of low audience and low turnover referred to in paragraph 6, after consulting the Contact Committee.’;</p>
Articles 16 and 17	No change	
<p>Recital(53)</p> <p>For the purposes of this Directive, ‘free television’ means broadcasting on a channel, either public or commercial, of programmes</p>	there is not a corresponding recital	

	which are accessible to the public without payment in addition to the modes of funding of broadcasting that are widely prevailing in each Member State (such as licence fee and/or the basic tier subscription fee to a cable network)		
4.	Framework Directive 2002-21-EC ²⁰ _amended by 2009-140-EC ²¹	Repealed	EECC ²²
	Article 1 (4) This Directive as well as the Specific Directives are without prejudice to measures taken at Community or national level, in compliance with Community law, to pursue general interest objectives, in particular relating to content regulation and audio-visual policy		EECC/PART I/TITLE I/CHAPTER I/Article 1/Par.3 This Directive is without prejudice to: <ul style="list-style-type: none"> • (a) obligations imposed by national law in accordance with Union law or by Union law in respect of services provided using electronic communications networks and services; • (b) measures taken at Union or national level, in accordance with Union law, to pursue general interest objectives, in particular relating to the protection of personal data and privacy, content regulation and audiovisual policy; • (c) actions taken by Member States for public order and public security purposes and for defence; • (d) Regulations (EU) No 531/2012 and (EU) 2015/2120 and Directive 2014/53/EU
	Definitions : Electronic Communications Network (ECN)	No change	
	Definitions : Electronic Communications System (ECS) electronic communications service' means a service normally provided for remuneration which consists wholly or mainly in the conveyance of signals on electronic communications networks, including telecommunications services and transmission	Changed	electronic communications service' means a service normally provided for remuneration via electronic communications networks, which encompasses, with the exception of services providing, or exercising editorial control over, content transmitted using electronic communications networks and services, the following types of services: <ul style="list-style-type: none"> (a) 'internet access service' as defined in point (2) of the second paragraph of Article 2 of Regulation (EU) 2015/2120; (b) interpersonal communications service; and

²⁰<https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A32002L0021>

²¹<https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02002L0021-20091219>

²²[EUR-Lex - 02018L1972-20181217 - EN - EUR-Lex \(europa.eu\)](https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=celex%3A02018L1972-20181217)

<p>services in networks used for broadcasting, but exclude services providing, or exercising editorial control over, content transmitted using electronic communications networks and services; it does not include information society services, as defined in Article 1 of Directive 98/34/EC, which do not consist wholly or mainly in the conveyance of signals on electronic communications networks;</p>		<p>(c) services consisting wholly or mainly in the conveyance of signals such as transmission services used for the provision of machine-to-machine services and for broadcasting'</p>
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ANNEX II

Table with RSPG 15-595 FINAL Opinion recommendations assessment

	RSPG15-595 FINAL Opinion recommendations	Status	Actions triggered on the EU and national level
1.	RSPG supports the provision of wireless broadband services in the 700 MHz band, and recommends that the Commission, in cooperation with the Member States, strive towards a coordinated approach, including:		
	<ul style="list-style-type: none"> Defining, as early as possible the harmonised technical conditions for the use of 700 MHz by wireless broadband services. 	EU framework in place	COMMISSION IMPLEMENTING DECISION (EU) 2016/687 of 28 April 2016 on the harmonisation of the 694-790 MHz frequency band for terrestrial systems capable of providing wireless broadband electronic communications services and for flexible national use in the Union ²³
	<ul style="list-style-type: none"> Proposing in a binding legislative measure such as an RSPG, the deadline by which the national authorisation process should be finalised and the deadline for making the band available for effective use by ECS in line with harmonized technical conditions. 	EU framework in place	DECISION (EU) 2017/899 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 May 2017 on the use of the 470-790 MHz frequency band in the Union ²⁴
2.	Recognising the importance of the 700 MHz band in the provision of wireless broadband across the EU, the RSPG recommends that Member States should undertake the transition as soon as possible , noting that there are numerous challenges to overcome but urging Member States to move quickly.	DECISION (EU) 2017/899 (bidding deadlines for national roadmaps and availability of 700 MHz)	<ul style="list-style-type: none"> Transition issues managed nationally (under finalisation in few EU countries) national roadmaps have been established Regular review of the state of play within RSPG²⁵ RSPG Good Offices: Questionnaire on cross-border coordination issues regarding 700 MHz spectrum clearance and migration of broadcasting service below 694 MHz)

²³ <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32016D0687&qid=1651156663275&from=en>

²⁴ <https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32017D0899&from=en>

²⁵ https://radio-spectrum-policy-group.ec.europa.eu/system/files/2023-06/RSPG23-018final-state_of_play_5G_bands.pdf

3.	RSPG recommends that Member States make the 700 MHz band available for WBB as early as possible . RSPG supports making the band available for effective use by ECS by the end of 2020, noting that Member states may decide for duly justified reasons and without the need for derogation to delay the availability of the band by up to two years. This is without prejudice to constraints arising from cross border frequency coordination with third countries.	Art 1 DECISION (EU) 2017/899 Common deadline for establishing cross border agreements and making available	<ul style="list-style-type: none"> • Common deadline established for making available 700 MHz (30 June 2020 + possible 2 years in addition) and a need for coordinated transition, including cross border agreements in order to make possible this coordinated transition. • Regular review of the state of play within RSPG²⁵ (authorisations granted in 700 MHz)
4.	RSPG recommends that Member States should develop and communicate to stakeholders and neighbouring countries in due time, a framework for the migration of broadcasting services towards the frequencies below the 694 MHz band and also to take into consideration all practicable efforts to accommodate the various timelines of their neighbours for migration.	Art. 5 of DECISION (EU) 2017/899 + initiatives from RSPG good offices	<ul style="list-style-type: none"> • National Roadmaps are published • RSPG Good offices help to provide better visibility on these national roadmaps: Good offices Project on “700 MHz spectrum re-planning and clearance, particularly on issues of cross-border coordination”
5.	In order to facilitate adequate time for implementation of the necessary provisions to facilitate all Member States meeting the final deadline and noting that some Member States have already started cross-border negotiations, RSPG recommends that the remaining Member States begin negotiations as early as possible to ensure that all necessary cross-border coordination agreements , including transitional arrangements, will be finalized at the latest by the end of 2017, taking into account the 3 year period envisaged by the RSPG Report “on proposed spectrum coordination approach for broadcasting in the case of a reallocation of the 700 MHz band”. Member States should apply guidelines of the RSPG Report referenced above.	RSPG Good Offices supporting this recommendation	See above and Progress Reports of the RSPG Sub-Group on “Good offices” to assist in bilateral negotiations between Member States ²⁶

²⁶ RSPG22-031 Good Offices Progress Report: https://radio-spectrum-policy-group.ec.europa.eu/system/files/2023-01/RSPG22-031final-Progress_report_Good_Offices.pdf

6.	RSPG recommends that those Member States with non-EU neighbouring countries to start, with the support of the Commission if necessary, bilateral negotiations with those countries as early as possible to reach the necessary crossborder coordination agreements.	Art 1.3 of DECISION (EU) 2017/899 + support from EU and RSPG Good Offices ongoing	See: Progress Reports of the RSPG Sub-Group on “Good offices” to assist in bilateral negotiations between Member States ²⁶
7.	RSPG recognizes that the DTT platform evolves to new broadcasting technologies in the UHF band (i.e. DVB-T2 and/or possibly HEVC) and recommends that the European Commission should, in cooperation with Member States support national measures to facilitate transition to more spectrum efficient technology , including those mandating the inclusion of such technologies in the TV receivers;	ongoing	<p>Broadcasting technologies in the UHF band evolves to DVB-T2 and/or HEVC.</p> <p>AT: national level: DVB-T2 MPEG-4; local level: 2 DVB-T2 MPEG-4 and DVB-T MPEG-2</p> <p>BE: Flemish community: DVB-T2 MPEG-4; French community: DVB-T MPEG-2</p> <p>BG: DVB-T MPEG-4</p> <p>CY: DVB-T MPEG-4</p> <p>CZ: national level: DVB-T2 HEVC; regional/local level: DVB-T or DVB-T2 HEVC</p> <p>DE: done - DVB-T switch off completed in 2019 (DVB-T2, HEVC in service)</p> <p>DK: DVB-T2 MPEG-4</p> <p>EE: currently both DVB-T and DVB-T2, using MPEG4 or HEVC; plans to migrate all multiplexes to DVB-T2 MPEG4 and HEVC between 2022 and 2025</p> <p>EL: DVB-T, MPEG-4, no current plans for change of technology</p> <p>ES: DVB-T MPEG-4, no concrete plans for a move to DVB-T2 HEVC. In Spain, since 2019 is mandatory that all receivers in the market include DVB-T2, and there are already experimental emissions in DVB-T2 and UHD (the World Cup was broadcasted using this technology).</p> <p>FI: currently a mixture of DVB-T and DVB-T2, after the conclusion of the upgrade programme DVB-T2 MPEG4</p> <p>FR: DVB-T, MPEG-4 in service. Transition towards DVB-T2, HEVC planned in order to improve the quality of the DTT signal</p>

			<p>HR: DVB-T2 HEVC for FTA, transition done in 2020; DVB-T2 MPEG-4 for pay-TV</p> <p>HU: DVB-T MPEG-4 for FTA, no plans to further update the transmission technology; DVB-T2 HEVC for prepaid multiplex</p> <p>IE: DVB-T, MPEG-4, no current plans for change of technology</p> <p>IT: DVB-T, MPEG-4. Transition to DVB-T2/HEVC will happen in the future, but currently it is not scheduled.</p> <p>LT: DVB-T MPEG-4, no plans to migrate to more updated standards, just encouragements to TV and set top box manufacturers</p> <p>LU: DVB-T MPEG2, no plans to move to newer technologies</p> <p>LV: DVB-T MPEG-4, no plans to migrate to newer standards</p> <p>MT: DVB-T MPEG-2</p> <p>NL: DVB-T2 HEVC</p> <p>PL: DVB-T2 HEVC, except 4 local multiplexes in DVB-T MPEG-4</p> <p>PT: DVB-T MPEG-4</p> <p>RO: DVB-T2 MPEG-4</p> <p>SE: a mixture of DVB-T and DVB-T2, MPEG4; no current further plans to upgrade</p> <p>SI: a mixture of DVB-T and DVB-T2, MPEG4 on national, and DVB-T MPEG4 on regional/local level; no plans to move to more recent standards</p> <p>SK: currently a mixture of DVB-T, DVB-T2, MPEG2, MPEG4 and HEVC; after the improvement will be completed in 2023/2024: DVB-T2 HEVC on national and a mixture of DVB-T MPEG2 and MPEG4 on local level</p>
8.	RSPG recognises that the band 470-694 MHz is mainly used for downstream audiovisual content distribution and recommends that it remains as such for the long term, even beyond 2030;	Art 4 DECISION (EU) 2017/899 (at least until 2030)	Any future set of options has to respond to the need for ensuring possible "downstream audiovisual content distribution in the band 470-694" and remains a priority, also beyond 2030.
9.	RSPG recognises the importance of the DTT platform and the need to provide certainty for investments in broadcasting infrastructure . Therefore RSPG recommends that the frequency band 470-694 MHz shall remain available for DTT in the foreseeable future, i.e. 2030.	Art 4 DECISION (EU) 2017/899 (at least until 2030)	Art. 4 of DECISION (EU) 2017/899 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 17 May 2017 on the use of the 470-790 MHz frequency band in the Union

10.	Notwithstanding, the RSPG recommends that Member States should have the flexibility to use the 470-694 MHz band for WBB downlink, provided that such use is compatible with the broadcasting needs in the relevant Member State and does not create a constraint on the operations of DTT in neighbouring countries. This is without prejudice to coordination agreements with the neighbouring countries.	Art 4 DECISION (EU) 2017/899 (at least until 2030)	See relevant RSPG analysis in Section 3 of the present Opinion.
11.	RSPG recommends that, when considering any options for the future usage of the frequency band 470-694 MHz, aspects such as the requirements, technological developments, consumer behaviour, the importance of delivering free-to-air television and the various political, social, cultural and economic general interest objectives, should be taken into account.	Art 7 DECISION (EU) 2017/899 + ongoing actions from RSPG and EC (study)	<ul style="list-style-type: none"> • RPSG Work Programme 2022-2023 started the subgroup “Strategy on the future use of the frequency band 470-694 MHz beyond 2030 in the EU”. • EC Study on the use of the sub-700 MHz UHF Band (470-694 MHz) - CNECT/2021/MVP/0020²⁷ • Report from EC to be submitted to Council and EP (no deadline). According to the Decision, the report has no deadline, even if the Lamy Report suggests to have it in 2025 at latest. •
12.	The RSPG believes that there is a need to have technically appropriate and sufficient spectrum for PMSE and considers that depending on developments and requirements of such services, there could be a need to identify additional spectrum.	Art 4 + Art 5.2 DECISION (EU) 2017/899 RSPG Opinion on PMSE strategy	<ul style="list-style-type: none"> • PMSE in 470-694 MHz frequency band in the Union (until at least 2030) • RSPG Opinion on a long-term strategy on future spectrum needs and use of wireless audio and video PMSE applications²⁸: this strategy should be reviewed in 2025.
	RSPG recommends that the PMSE industry develops more advanced and spectrum efficient technologies.	ongoing	System Reference document (SRdoc); Technical characteristics and parameters for Wireless Multichannel Audio Systems (WMAS) ²⁹ (currently under review)

²⁷ “Study on the use of the sub-700 MHz band (470-694 MHz) Final Report”, <https://digital-strategy.ec.europa.eu/en/library/study-use-sub-700-mhz-uhf-band-tv-broadcasting-and-events>

²⁸ RSPG17-037, https://circabc.europa.eu/d/a/workspace/SpacesStore/7c4e2799-e32e-42a1-98cb-3f8a1997ce50/RSPG17-037finalrev1_RSPG_opinion_PMSE.pdf

²⁹ https://www.etsi.org/deliver/etsi_tr/103400_103499/103450/01.01.01_60/tr_103450v010101p.pdf

	In addition Member States should also seek to promote spectrum sharing and ensure that licence conditions in bands currently used are as flexible as possible;	RSPG Opinion, reports	RSPG Opinion on Spectrum Sharing – Pioneer initiatives and bands ³⁰ RSPG Report on Spectrum Sharing – A forward-looking survey ³¹
13.	RSPG recognises that the scope and mechanism of possible compensation is a national issue . RSPG recommends that the Commission assists the transition by providing early guidance to the relevant Member States, in particular clarifying cases where it may or may not be compatible with state aid rules.	Art 6 DECISION (EU) 2017/899	Contributions expected (Spain, Italy) Spain: <ul style="list-style-type: none"> • Aid to compensate the costs of adapting television signal reception equipment in multi-households buildings affected by the release of the 700 MHz band³², approved by the Commission, State Aid SA.51079 (2018/N) – <i>Spain Audiovisual broadcasting reception aid for multi-households buildings</i>. • Aid to compensate the direct costs incurred by digital terrestrial television (DTT) broadcasters to migrate from the 694-790 MHz frequency band (the “700 MHz band”) to lower frequencies³³, approved by the Commission, State Aid SA.51080 (2019/N) – <i>Audiovisual broadcasting transmission aid for audiovisual service providers</i>.
14.	RSPG recognises that implementation of broadband PPDR networks is a national issue.	Art 1.4 DECISION (EU) 2017/899 + EC DECISION (EU) 2016/687 + ECC/DEC/(16)02	National initiatives in coherence with DECISION (EU) 2016/687 and ECC Decision (16)02.
15.	RSPG notes that TV receiver standards should take full account of the evolution of the 700 MHz band and include as early as possible appropriate receiver parameters (e.g. selectivity and blocking).	Standardisation in ETSI	TV receiver standards contain "appropriate receiver parameters (e.g. selectivity and blocking)" ³⁴

³⁰ RSPG21-022, https://radio-spectrum-policy-group.ec.europa.eu/system/files/2023-01/RSPG21-022final_RSPG_Opinion_Spectrum_Sharing.pdf

³¹ RSPG21-016, https://radio-spectrum-policy-group.ec.europa.eu/system/files/2023-01/RSPG21-016final_RSPG_Report_on_Spectrum_Sharing.pdf

³² <https://www.boe.es/boe/dias/2019/06/25/pdfs/BOE-A-2019-9514.pdf>

³³ <https://www.boe.es/boe/dias/2020/07/29/pdfs/BOE-A-2020-8684.pdf>

³⁴ See EN 303 340 V1.2.1, p. 7, „The present document includes considerations of interference from LTE transmissions in the 700 MHz and 800 MHz bands and DTT transmissions in UHF band IV. The requirements of the installation system (antenna, feeder cable, amplifiers, etc.) are not addressed.”, https://www.etsi.org/deliver/etsi_en/303300_303399/303340/01.02.01_60/en_303340v010201p.pdf.

<p>Therefore, RSPG recommends that the Commission liaises with ETSI and CENELEC to ensure that the introduction of WBB in the 700 MHz band will be fully taken into account when writing or revising EMC and “radio” harmonized standards for TV receivers and for any other electronic products (such as antenna mast amplifiers) intended for TV installations.</p>	<p>ETSI Report to RSC#80 (5 Oct ‘22)</p>	<p>The provisions of the ECC/DEC/(09)03 and Commission Decision 2010/267/EU related to 800 MHz band, baseline requirements to protect DTT below 790 MHz are maintained in the EN 301 908 series</p>
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ANNEX III

5G Broadcast Trials

1. Austria

The trial in Austria, conducted by the broadcast network operator ORS, started 2019 in Vienna with the goal of comparing existing DTT technologies (DVB-T2) with 5G broadcast. According to the results of this trial the 5G broadcast system is considered as a promising technology which could enormously increase the reach of mobile users with broadcasting services, transmitted by terrestrial broadcasting networks. After the first phase, which lasted 1.5 years, it was found that 5G broadcast, which was tested for portable outdoor reception, can achieve comparable performance compared to DVB-T2, and can enable innovation in terrestrial broadcasting services³⁵. With these results, a second phase, also funded by the RTR Media and the Austrian Communications Authority, was launched in summer 2021 with the aim of investigating applications in a hybrid 5G broadcast and broadband distribution system and planning a suitable 5G broadcast roll-out after a pre-commercial phase³⁶. Besides broadcasting transmissions also other possible technical functionalities (emergency warning, positioning and navigation) are investigated³⁷.

2. Czech Republic

Several trials on 5G Broadcast have been carried out. For example, in the Czech Republic, the company České Radiokomunikace a.s. performed 5G Broadcast transmission trial from April to December 2022 in Prague. A second phase of testing is currently (2023) being performed, involving two high power – high tower transmitters within the single frequency network. The following parameters and features are used during the experiments: the first TV tower height 209 m near the Prague city center with e.r.p. 32 kW; the second TV tower high 67 m on the border of Prague city;; frequency 746 MHz (TV channel 55); channel width 3/5/8 MHz; Rohde & Schwarz equipment implementing 5G Broadcast FeMBMS standard (rel. 16); broadcast content: up to 3 HDTV channels and 1 radio station; available bitrate up to 24.7 Mbit/s. The company tested both mobile and fixed reception, focusing on mobile reception around the city. The test showed, i.a.:

- (i) The real availability of TV reception on a mobile phone without the need to connect to a public mobile network.
- (ii) More robust 5G Broadcast modes (MCS 9, MCS 12) are required for mobile reception with lower data throughput.
- (iii) The need for further technological developments in SFN broadcasting.

České Radiokomunikace a.s. prepares the upgrade of 5G Broadcast technology and launches the next phase of trials, including the implementation of innovative OTT services and switching data traffic between standard 5G networks and 5G Broadcast on a mobile device.

3. France

A trial has been done in France with two emission sites next to Paris (10 MHz channel, coverage at 1 m/ground) during some 5G broadcast shows at Eurovision and Roland Garros. According to the company that conducted this trial, it was highlighted in conclusion, the need to identify business models, use cases

³⁵ <https://www.ors.at/en/5g-broadcast/testbed-austria/>

³⁶ <https://www.nakolos.com/>

³⁷ <https://navisp.esa.int/project/details/167/show>

for the eco system, to perform test with French TV eco system, to identify relevant spectrum resources and to plan penetration model for the future of DTT.

4. Spain

In Spain, trials on 5G Broadcast have been conducted by the Spanish public broadcaster RTVE, Cellnex, Rohde & Schwarz and Qualcomm during Mobile World Congress event of 2020, 2022 and 2023.

The main goals of the trial held in 2020 were: Testing further enhanced/evolved multimedia broadcast multicast service (FeMBMS) in 700 MHz band in a real environment and testing delivery of TV and radio channel providing information services. Some mobility measures (antenna on a vehicle) and at street level (pedestrian) have been carried out. The main conclusion was that such a high-performance configuration faces challenges for mobility and pedestrian reception.

In 2022, the main goal of the trial was to showcase the first Qualcomm mobile devices, embedding the 5GBC decoder. It was the first worldwide real demonstration of devices with embedded 5GBC chipsets and the very first time that a smartphone formfactor has been utilized in such demonstration without the need of SDR.

In 2023 the main goal of the trial was to showcase how the full value chain works, from taking the signal to watching the content on a mobile device. New use cases relating to original monetization models were demonstrated.

Some conclusions from the companies involved in the trials are that 5GBC looks like a promising solution to reach mobile and portable devices, with a guaranteed quality, independently of the number of concurrent users and without the need of any subscription. Alongside the current DTT networks, it can complement current services, without the need of any regulatory intervention and increasing the already highly efficient use of the spectrum. These companies consider that the ecosystem is discussing and investing on innovative use cases, related to its potential to offer massive downlink-only services, but there is still work to be done on this field.

More information is provided at: <https://www.5g-mag.com/trials>

5. Germany

Between October 2020 and December 2022, a cross-industry consortium consisting of public service media, car manufacturers, telecom operator, network infrastructure providers and universities carried out a comprehensive 5G Broadcast project, called 5G Media2Go, in the wider Stuttgart area with the following objectives:

- Verification of 5G Broadcast as a system being capable of delivering linear media services to in-car infotainment systems.
- Deployment of a 5G broadcast network in the wider Stuttgart area consisting of two high-power-high-tower transmitters (HPHT) and a set of low-power-low-tower stations (LPLT).
- Integration of different media services in the infotainment system of a car, i.e. linear TV, ARD Mediathek and georeferenced recommendations.
- Execution of measurement campaigns to assess quality of service and coverage of the 5G Broadcast transmissions.

To this end, a 5G Broadcast network was deployed consisting of two HPHT stations operating at 73 and 20 kW, respectively, and up to four smaller stations with ERPs in the range of 200 W-1 kW. The coverage

was provided to a large extent by the two HPHT stations. The TV channel 40 was used. As this frequency was fully coordinated upfront, no interference issues were reported.

Prototype smartphones could be used to receive and display 5G Broadcast signals showing satisfying performance within the expected range. Moreover, emergency alert notifications over 5G Broadcast were implemented on the occasion of the so-called German “Warntag” where all emergency systems in Germany were tested.

In summary, the following major conclusions can be drawn from the investigations carried out in 5G Media2Go:

- 5G Broadcast is capable to deliver linear TV and radio services to smartphones and infotainment systems in vehicles.
- 5G Broadcast supports delivering linear services at high speeds of up to 180 km/h.
- 5G Broadcast can be configured to distribute different data stream formats, e.g. MPEG Transport Stream and MPEG Dash.
- 5G Broadcast supports network operation in single frequency mode including both HPHT and LPLT transmitters.
- The integration of 5G Broadcast transmissions alongside with unicast communication on infotainment systems of vehicles to grant access to nonlinear services is straightforward. This allows to offer hybrid services which combine linear and nonlinear elements.
- A particular spin-off of the project is the Travelguide application. The relevance of geo-referenced recommendations will increase as mobile media consumption will grow.

More information is provided at: <https://www.5g-mag.com/trials>

ANNEX IV

Mobile downlink trials

1. 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 demonstration³⁸ in 2016 in Espoo, Finland, where mobile downlink (DL) was interleaved with the then active DTT in the 700 MHz band.

One output from the study³⁹ 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 output⁴⁰ 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..."

³⁸ <https://yle.fi/aihe/artikkeli/2016/09/02/yle-qualcomm-and-nokia-announce-worlds-first-demonstration-lte-supplemental>

³⁹ "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>).

⁴⁰ "Coexistence of DTT and Mobile Broadband: A Survey and Guidelines for Field Measurements" (<https://www.hindawi.com/journals/wcmc/2017/1563132/>).