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| Background: |
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CEPT BRIEF ON AGENDA ITEM 1.5

1. To review the spectrum use and spectrum needs of existing services in the frequency band 470-960 MHz in Region 1 and consider possible regulatory actions in the frequency band 470-694 MHz in Region 1 on the basis of the review in accordance with Resolution 235 (WRC-15);

# ISSUE

WRC-15, through Resolution 235 (WRC-15), resolved to invite ITU-R, after the 2019 World Radiocommunication Conference and in time for the 2023 World Radiocommunication Conference to:

1. review the spectrum use and study the spectrum needs of existing services within the frequency band 470-960 MHz in Region 1, in particular the spectrum requirements of the broadcasting and mobile, except aeronautical mobile, services, taking into account the relevant ITU Radiocommunication Sector (ITU-R) studies, Recommendations and Reports;
2. carry out sharing and compatibility studies, as appropriate, in the frequency band 470-694 MHz in Region 1 between the broadcasting and mobile, except aeronautical mobile, services, taking into account relevant ITU-R studies, Recommendations and Reports;
3. conduct sharing and compatibility studies, as appropriate, in order to provide relevant protection of systems of other existing services; and

Based on the results of the studies outlined above (and provided that these studies are completed and approved by ITU-R), WRC-23 is invited to consider possible regulatory actions in the frequency band 470-694 MHz in Region 1, as appropriate.

# CEPT position

* CEPT supports a secondary allocation to the mobile service (except aeronautical mobile) in the frequency band 470 – 694 MHz to be made at WRC-23, with a future agenda item for WRC-31 to consider a possible upgrade to a primary allocation.
* CEPT is of the view that sharing studies indicate that due care will be required in any introduction of new applications of the mobile service in the band.
* CEPT is of the view that this agenda item seeks the long-term balance between (1) national requirements, in particular due to the evolution of spectrum usage and demands, and (2) the challenges of effective cross-border coordination between the existing services and various services/applications wishing to access spectrum, including applications of the mobile service.
* In line with Resolution 235 (WRC-15), CEPT acknowledges and supports that no regulatory action is required in the band 694-960 MHz.
* CEPT is of the view that the primary allocation of the 470-862 MHz band to the broadcasting service in Region 1 shall remain, in order to enable the protection and development of incumbent usage of the broadcasting service.
* CEPT is of the view that any possible regulatory action by WRC-23 in the band 470 – 694 MHz shall not be in conflict with any provision of the GE06 Agreement.
* CEPT supports the continuation and development of the incumbent usage by PMSE (SAB/SAP) (in accordance with existing RR No. 5.296).
* CEPT supports the protection of the radioastronomy service within the frequency band 606-614 MHz, where required, to ensure its continued operation. CEPT is of the view that any decision on regulatory action(s) in the band 470-694 MHz at the WRC-23 shall consider regulatory action to protect RAS, taking into account RR No. 5.149.
* CEPT is currently of the view that no changes are necessary concerning RR No. 5.291A addressing the operation of wind profiler radars.

# Background

Resolution 235 (WRC-15), on the review of spectrum use of the frequency band 470–960 MHz in Region 1, notes that:

* the favourable propagation characteristics of spectrum below 1 GHz can provide economic benefits in terms of providing cost effective coverage solutions;
* the GE06 Agreement applies to all Region 1 countries (with the exception of Mongolia), and Iran (Islamic Republic of) for the frequency band 470-862 MHz and makes provision for the terrestrial broadcasting service and other primary terrestrial services, a Plan for digital television and a list of stations of other primary terrestrial services.

It is also noted that the ECC Strategic Plan for the period 2020-2025 provides a high-level overview of the anticipated themes and key issues for the ECC over this five year period. One of the topics which are particularly important is “Reviewing future use of the UHF band (470-960 MHz)”. In this respect, the Strategic Plan notes that ‘the ECC should consider future spectrum needs to support audio-visual media distribution over the longer term, taking into account expected developments in broadcast distribution technologies.

## Spectrum Allocations in the band 470 – 960 MHz

There are a number of services to which the band has already been allocated in the Radio Regulations. In this regard, and of particular relevance, the following is noted:

* The frequency band 470–862 MHz has been harmonised internationally for the provision of terrestrial television broadcast services at a global level and is allocated to the broadcasting service on a primary basis. Given the relatively long lifespan of terrestrial broadcasting networks, Resolution 235 (WRC-15) notes that a stable regulatory environment is required to ensure sufficient protection of investment and future development of such networks. Resolution 235 (WRC-15) further observes that technology trends in digital terrestrial television (DTT) include a migration towards higher bitrate applications for the provision of high-definition television;
* Within Region 1, the frequency range 694–960 MHz is allocated to the mobile, except aeronautical mobile, service on a primary basis. This range is mainly identified for International Mobile Telecommunications (IMT) systems. Such systems are intended to provide telecommunications services on a worldwide basis, regardless of location, network, or terminal used;
* RR No. 5.296 (WRC-19), which is applicable in 40 CEPT Member States[[1]](#footnote-1), makes provision for the allocation of the frequency band 470–694 MHz to the land mobile service on a secondary basis, intended for applications ancillary to broadcasting and programme-making (PMSE);
* In some CEPT Member States, the frequency band 645–960 MHz, or parts thereof, is allocated to the aeronautical radionavigation service (ARNS) on a primary basis by RR Nos. 5.312[[2]](#footnote-2) and 5.323[[3]](#footnote-3);
* In some CEPT Member States[[4]](#footnote-4), the frequency band 470–494 MHz is allocated to the radiolocation service on a secondary basis, limited to the operation of wind profile radars by RR No. 5.291A;
* In Region 1 (except for the African Broadcasting Area), the band 608–614 MHz is allocated to the radio astronomy service on a secondary basis (RR No. 5.306). Furthermore, RR No. 5.149 advises administrations “to take all practicable steps to protect the radio astronomy service from harmful interference when making assignments to stations of other services” within this band. It is noted that RR No. 5.304 applies in the African Broadcasting area, which allocated the band 606-614 MHz to the radio astronomy service on a primary basis.

## Allocations and usage as per ECA Table

A snapshot of the ECA Table (as of October 2021), presenting the current common Allocations and usage within CEPT Member countries, is provided in ANNEX 1: to supplement this review. The ECA Table provides multiple strands of information relating to both allocations and application availability within CEPT Member states.

## considerations regaRDING Spectrum use, Spectrum needs, and associated results of studies in the band 470-960 MHz

A compendium of information regarding current and possible future utilisation of Spectrum across the 470 – 960 MHz band, and some related studies, has been compiled to accompany this Brief (see [CPG(23)036 ANNEX VI-04](https://cept.org/Documents/cpg/78127/cpg-23-036-annex-vi-04_compendium-of-information)). The aim of the compendium is to assist in gauging both the necessity and feasibility of the possible introduction of new allocations to the 470 – 694 MHz band. The compendium has been compiled to supplement and contextualise this review, and contains more detailed information specifically relating to (a) current spectrum usage within CEPT Member countries, (b) possible future needs that may benefit from deployments within the band, (c) sharing and compatibility: studied use cases between Broadcasting and Mobile services, in addition to PMSE and IMT, and (d) consumption trends.

ITU-R studies conducted towards WRC-23 agenda item 1.5 are annexed to the chairman’s report of TG 6/1, Document [6-1/130](https://www.itu.int/md/meetingdoc.asp?lang=en&parent=R19-TG6.1-C-0130).

For the sake of brevity, the key overarching points of note regarding the compendium, amongst other items, are provided below. Those seeking a more in-depth analysis are referred directly to the compendium itself.

Decision (EU) 2017/899

In the European Union, the UHF Decision (EU) 2017/899 Article 4 ensures availability until at least 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. Under Article 7 of the Decision, the Commission is required to report to the European Parliament and the Council on developments in the use of the sub-700 MHz frequency band with a view to ensuring efficient use of spectrum. The Commission shall take into account the social, economic, cultural and international aspects affecting the use of the band, further technological developments, changes in consumer behaviour, and the requirements in connectivity to foster growth and innovation across the EU. In the context of Article 7, LS Telecom and VVA prepared a study for the Commission in 2022[[5]](#footnote-5). It considers the current status and the future trends of the use of the sub-700 MHz band across the EU, as well as changes in viewing habits, the role of DTT in public service media distribution and international developments relating to the use of the band. The study is not covered in the compendium, but provides an extensive overview on the use and development of the sub-700 MHz band in EU Member States.

### Spectrum use within the 470 – 960 MHz frequency band

#### Terrestrial Broadcasting

DTT using the DVB-T/T2 system operates in almost all CEPT countries where DTT cover is available to more than 75% of population, and a significant portion of these countries plan to further extend their DTT coverage. Additionally, spectrum above 694 MHz still remains in use by some CEPT countries for DTTB. Alternative broadcasting technology, such as 5G Broadcast, is also considered to address mobile devices and develop new Standalone Downlink Only (SDO) broadcasting services.

In Region 1 and in Iran, the use of the band 470-862 MHz is regulated by the Geneva 2006 Final Acts (the GE06 Agreement), which is a fundamental tool for the cross-border coordination of broadcasting stations.

In most, though not all, CEPT countries, television broadcasting services operate only in the frequency band 470-694 MHz.

#### PMSE

The frequency band 470 – 694 MHz is used extensively within Europe by applications ancillary to broadcasting and programme-making, and is the core spectrum resource for audio PMSE applications (being used in all CEPT countries).

The band is identified in ERC/REC 25-10 Annex 2 and ERC/REC 70-03 Annex 10. ERC/REC 25-10 and ERC/REC 70-03 also identify 823-832 MHz and 863-865 MHz for audio PMSE, the former band being harmonised for PMSE under EC Decision 2014/641/EU. This harmonisation has helped foster an ecosystem of standardised equipment.

At the time of writing, both Recommendations ERC/REC 25-10 and 70-03 are being amended to reflect changes to spectrum availability between 694 to 790 MHz as a consequence of change of use of the 700 MHz band (EC Implementing Decision 2016/687/EU).

#### IMT

The frequency range 694 – 960 MHz is allocated to the mobile service on a primary basis in Region 1, and has been identified for use by administrations wishing to implement IMT (see RR No. 5.317A). The following sub-1 GHz bands are used for IMT, although deployment maturity status varies across countries: the 900 MHz band (880-915 MHz / 925-960 MHz), the 800 MHz band (790-862 MHz) and the 700 MHz band (694-790 MHz). All of these bands provide FDD spectrum, with a portion of the 700 MHz band also making provision for up to 20 MHz of Supplemental Downlink (SDL) Spectrum

#### BB-PPDR

Depending on the national demand, deployment scenarios for BB-PPDR operators may extend beyond those typically covered by mobile network operators (MNO’s), as may quality of service requirements. Some countries currently use, or plan to use, BB-PPDR in the following bands: 698-703 MHz (UL) / 753-758 MHz (DL), and 733-736 MHz (UL) / 788-791 MHz (DL).

#### Radio Astronomy

The frequency range 606 – 614 MHz is important for RAS observations, being used for high-precision timing observations of pulsars, Radio observations of linearly polarized extra-terrestrial radio emissions, solar radio astronomy, and Continuum VLBI observations. Whilst only having a secondary allocation in Region 1 (except in the African Broadcasting Area and a part of the Middle East, where it is primary already), GE06 affords a high degree of protection for RAS.

#### Wind Profiler Radars

RR No. 5.291A allocates the band 470 – 494 MHz on a secondary basis for Wind Profiler Radar (WPR) usage in Germany, Austria, Denmark, Estonia, Liechtenstein, the Czech Republic, Serbia and Switzerland. Despite usage within a limited number of countries, WPR data supports the general weather forecast for the whole of Europe. WPR also operates in the frequency band 904 – 928 MHz.

#### Railway

In CEPT and EU countries, the paired frequency bands 874.4 – 880.0 MHz and 919.4 – 925.0 MHz have been harmonised for railway use in Europe. The frequency ranges 873 – 874.4 MHz and 918 – 919.4 MHz are also used for GSM-R on a national basis.

#### Short Range Devices (SRD’s)

The frequency bands between 862-921 MHz are used in some CEPT Member States by a number of SRD applications, some of which are operating under the existing primary mobile allocation on a non-protected, non-interference basis.

#### White Space Devices (devices using temporarily unused/unoccupied spectrum)

White Space Applications take advantage of locally available spectrum in the band 470-694 MHz to provide broadband connectivity. Determination of frequency and transmission entails the use of a geolocation database which holds information pertaining to DTT and PMSE usage at the desired location of the White Space Device.

### Spectrum needs within the 470 – 960 MHz frequency band

#### Broadcasting Service

All over Europe, broadcasting is an established way of delivering linear video content. Broadcasting serves an important social function, and many countries have established public service broadcasters as a matter of public policy.

Many countries are still investing in development of DTT. In this regard, multiple CEPT Administrations foresee the introduction of a) more programmes, b) enhanced services, c) additional reception modes, and d) interactive broadcast/broadband (IBB) systems.

As per the responses to the ITU questionnaire of circular letter 6/LCCE/104, issued by WP 6A, regarding future DTT spectrum requirements within the 470 – 960 MHz frequency band, 32 CEPT administrations foresee a requirement for 224 MHz or more, but 4 administrations foresee a requirement for less than 224 MHz, and 10 did not answer the question[[6]](#footnote-6).



Figure 1: Required amount of spectrum for DTT in the future in CEPT countries and some neighbouring Administrations. It should be noted that some of the information provided was collected at a point in time when there were 48 CEPT Member states[[7]](#footnote-7)

Consumption of audio-visual content varies between countries and across age groups. In some countries broadcast video consumption of linear services via DTT is still predominant and the increase of on-demand streamed video content consumption has not led to a reduction in the consumption of traditional broadcast TV. If all video services (including non-PSM services such as Netflix or YouTube) are included, in some countries the total share of non-linear video consumption reaches or exceeds 50%, driven mainly by younger and middle-aged audiences. Some countries also show increasing use of mainly fixed broadband networks for distribution of linear TV. Selected examples on consumption trends can be found in Section 3 of the compendium to this draft CEPT brief.

#### Mobile Service (below 694 MHz)

#### IMT

Of the 20 responses received to the ITU-R questionnaire contained in Administrative Circular CACE/963 (issued by ITU-R Working Party: WP5D) (17 of whom were CEPT Admins), 5 CEPT countries have identified a need for IMT in all or part of the 470 – 694 MHz band. Others have indicated that they have either no current (3) or foreseeable (2) need, whilst it has also been put forward that some Administrations (6) need additional time to evaluate such needs on the basis of broadcast and PMSE requirements.

Given its excellent propagation and indoor penetration capabilities, some spectrum up to 224 MHz of the band 470-694 MHz could be valuable for IMT mobile, and may help facilitate a number of use cases, such as 5G unicast in combination with 5G Broadcast, mMTC (Massive Machine Type Communications) and eMBB (enhanced Mobile Broadband) applications requiring wide, deep coverage, whilst certain URLLC services could also be efficiently implemented. Spectrum needs for IMT will depend on a number of factors going forward, such as traffic evolution, improvements in spectrum efficiency rendered by technological progress, IMT network densification, mobile broadband coverage demands, and offloading to fixed broadband networks.

#### BB-PPDR

Depending on the evolution of broadcasting service frequency resources, the 470-694 MHz band may provide a possible solution to accommodate BB-PPDR spectrum needs. In this regard, Band A8 could be extended below 698 MHz (2 x 10 MHz including 6 MHz between 688 and 694 MHz) in order to have the following duplex:

743-753 MHz (DL), where the current SDL frequency band 738-753 MHz is unused in many countries; and

688-698 MHz (UL), used by DTT until at least 2030.

#### Trunked ad hoc mobile

Used for safety and crisis management within a national territory, trunked ad hoc mobile systems (non-IMT applications) contribute towards ensuring national protection, and can complement BB-PPDR systems.

Ad hoc systems are operated within geographically defined areas and/or for limited times. These systems employ an adaptive frequency scheme and can, if necessary, change their operating channel to facilitate coexistence with DTTB.Total spectrum needs for these applications range from around 80 MHz to 120 MHz within the whole tuning range of 470-694 MHz, and would preferably encompass the 470-512 MHz part of the band which is allocated and used in some countries of Region 2 for the mobile service (RR No. 5.293).

#### PMSE

Spectrum requirements for PMSE applications continue to grow in line with the increasing volume and demands of live events and broadcast productions. In the Commission’s study on the use of the sub-700 MHz band5, it is noted that 50% of Member States indicated an observed growth in PMSE spectrum demand. Furthermore, the use of PMSE for audio applications in the 470-694 MHz band is expected to continue as outlined by the replies of Administrations to the BR Circular Letter (5/CACE/966) from ITU-R WP 5A. As noted in the Commission's study, use of alternative bands will not be applicable in all use cases due to their sub-optimal propagation characteristics. Consequently, continued access to 470 to 694 MHz is of critical importance to PMSE.

#### Mobile service *above 694 MHz*

#### IMT

It is expected that IMT usage in the bands above 694 MHz will continue but will adopt newer technologies to gradually replace older systems.

#### BB-PPDR

Some CEPT members indicated that the current spectrum allocation for BB-PPDR purposes above 694 MHz (e.g. 2x3 MHz and 2x5 MHz) may not be sufficient to satisfy future demand. Some countries have reserved additional spectrum (e.g. 2x10 MHz in 703-733/758-788 MHz) for future BB-PPDR needs. Some countries rely on commercial IMT networks for providing future BB-PPDR services.

#### PMSE

It is expected that the use of frequencies above 694 MHz will continue into the future.

#### Radioastronomy

In the case of a new mobile allocation within the 470 – 694 MHz band, and in order to ensure continued RAS operations in the band, a corresponding upgrade in allocation of the RAS, from secondary to primary, may be needed.

#### Radiolocation Service – Wind profiler radars

The effective operation of WPR will need to be ensured into the future. Therefore, WPR will need to be considered in relevant studies.

#### Railway

The Future Railway Mobile Communication System (FRMCS) will be the successor to GSM-R, and it is estimated that a 10 year migration phase to transition from one system to the other will be needed. RMR operations will continue in the band 874.4-880 MHz and 919.4-925.0 MHz.

### Sharing and Compatibility Studies

Sharing and compatibility studies have been carried out, or the need for such studies expressed, for a number of scenarios. The key points are summarised below. The compendium of information referenced at the beginning of Section 3 contains more detailed information specifically relating to these points..

#### Conclusions regarding studied cases between Broadcasting and Mobile Services

Sharing and compatibility studies show that co-channel operation of DTTB transmitter and IMT uplink receiver may not be viable everywhere due to large separation distances which may vary widely (between 100-300 km, depending on the scenario).

In general, these conclusions also apply to BB-PPDR, although stronger protection criteria in this case leads to greater separation distances.

Studies also show that the impact from IMT or BB-PPDR base station to DTTB reception in co-channel requires large separation, although it is typically smaller than in the above case. This separation increases with the number of base stations belonging to the same IMT or BB-PPDR network (50 km or more, depending on the scenario).

The results of studies on coexistence between non-IMT trunked ad hoc mobile systems and DTTB showed that co-channel distances to comply with the assumed protection criterion with DTTB transmitters and receivers are usually in the range of 40-50 kilometres. The non-IMT trunked ad hoc mobile systems can, as necessary, change their operating channel to facilitate coexistence with DTTB.

Compatibility studies for adjacent channel situations show that comparable interference mitigation approaches to those used in the 800 MHz band (before the 700 MHz band was cleared from DTTB) may be needed if IMT or BB-PPDR Downlink is foreseen for operation on channels adjacent to DTTB, including in the interleaved spectrum with DTTB. This includes:

* Defining national and/or regional regulations mandating significantly improved ACLR of the IMT or BB-PPDR Base station compared to the standard ACLR (Studies indicate that interference distances can be limited to hundreds of metres when assuming an ACLR of the IMT base station of 59 dB/8 MHz).
* Identifying a technical mitigation measure that could be used to solve interference cases, as needed. This includes providing suitable filters for the DTTB receiving installations, noting that the use of the interleaved spectrum would require a more elaborate type of filter to reject the IMT or BB-PPDR adjacent channel(s) than the low-pass filters used for the IMT implementation in the 800 MHz band. For example, band-reject filters would be required.
* Setting suitable national coordination procedures to prevent the risk of interference before IMT or BB-PPDR DL deployment and/or solving the interference cases on a case-by-case basis.

The results of compatibility studies for adjacent channel situations for non-IMT trunked ad hoc mobile systems show that interference distances can be limited to 30 metres when assuming a 3 MHz guard band and/or an ACLR around 80 dB/8 MHz for vehicle-based nodes and 76 dB/8 MHz for handheld nodes. Such ACLR values may be further investigated and defined on a national and/or regional basis.

Overloading of amplifiers in the DTTB reception chain by mobile stations in adjacent bands was not considered in these studies and may require further assessment at the national level.

#### Impact from wind profiler radars to mobile services and vice versa

If wind profiler radars and the mobile service are planned to be operated in the same channel, a decoupling distance of some kilometres has to be established This decoupling distance can be reduced by additional protective measures such as lateral earth walls or clutter fences around the wind profiler radar, and by an appropriate planning of the location..

For every wind profiler installation site, an individual consideration is necessary based on local conditions. An additional decoupling can be achieved by a selection of the wind profiler operating frequency to maximise the spectral separation.

#### Radioastronomy Service

Regarding the protection of the RAS, a potential mobile (incl. IMT) usage in or adjacent to the band 608-614 MHz must be considered with care. According to Report ITU-R RA.2332-0, on the compatibility and sharing studies between the RAS and IMT systems in the frequency band 608-614 MHz, coexistence between RAS and IMT in this band will require stringent protection measures. In particular, new sharing studies, taking into account the technical parameters provided by TG 6/1, indicate that for generic (flat-Earth) in-band aggregation scenarios, separation distances of up to 1000 km (BS) / 450 km (UE) or more may be required, which raises the question as to whether sharing between RAS and IMT would be possible at all in the densely populated environment that may be found in CEPT countries. Furthermore, compatibility studies demonstrated that even for adjacent bands or in the spurious domain, relatively large coordination zones with radii in excess of 500 km (adjacent) and 380 km (spurious) are needed for BS, while for UE the distances are about 150 km (adjacent) and 10 km (spurious), respectively.

#### Audio PMSE

Audio PMSE operates in the interleaved spectrum between DTT channels in the band 470-694 MHz. Protection criteria between DTT and PMSE are provided in the GE06 Agreement, but in many cases, administrations have agreed local sharing arrangements specific to their regulatory requirements. A key factor in this sharing arrangement is that DTT transmissions are fixed and constant, which allows for accurate planning of events and confidence that the RF environment will not change.

Studies submitted to TG 6/1[[8]](#footnote-8), providing an MCL (minimum coupling loss) calculation, to assess the separation distances needed to protect PMSE from IMT base stations and user equipment, have concluded that co-channel operation with IMT is not considered a viable possibility.

Report ITU-R BT.2338 and ECC Report 221 also note constraints on PMSE operating in spectrum adjacent to IMT, which can arise due to out of band emissions from IMT without adequate spatial separation between both applications. Whilst coexistence in this regard may be possible to achieve with permanently installed base stations, it cannot be guaranteed for UEs that are brought into venues, or temporary base stations that may be installed at large events.

## ITU-R Study Group Activity

As agreed during CPM23-1, ITU-R Study Group 6 (SG 6) established a dedicated Task Group 6/1 (TG 6/1) to deal with matters concerning WRC-23 agenda item 1.5.

Of particular note in relation to the expected inputs from relevant Working parties to Task Group 6/1, and as outlined in the Decision set out in Annex 9 of Administrative Circular CA/251, CPM23-1 has also directed:

* Working Party 6A, in carrying out studies to review spectrum use and study spectrum needs of the broadcasting service in the 470 -960 MHz band, to take into account the use and needs of co-signatories of the GE06 Agreement;
* Working Parties of Study Group 5 (SG 5) to conduct studies to review the spectrum use and study the spectrum needs of the mobile (except aeronautical mobile) service;
* Working Party 7D on certain specific issues relating to the Radio Astronomy Service: See Document 6-1/10-E Liaison statement to TG 6/1 on protection of the radio astronomy service in the frequency bands 606-614 and 608-614 MHz and Document 6-1/30-E, a Reply Liaison statement to TG 6/1 providing information on spectrum use and spectrum needs of the Radio Astronomy Service within the frequency band 470-960 MHz in Region 1.

In carrying out all such studies, CPM23-1 has stipulated that these studies be supplemented via the provision of, by the relevant Working Parties, the assumptions (which would include system parameters and propagation models) and technical characteristics (including protection criteria) of the broadcasting, mobile (except aeronautical mobile) and other allocations upon which the studies are based. The results of the studies were reported to TG 6/1, by the relevant Working Parties, by the due date of 15 May 2021.

The results of the work of TG6/1 are provided in the following Annexes to the final Chairman’s Report:

• Document 6-1/130 Annex 1: Draft CPM text for WRC-23 agenda item 1.5;

• Document 6-1/130 Annex 2: Review of the spectrum use and the study on spectrum needs of existing services within the frequency band 470-960 MHz in Region 1, in particular the spectrum requirements of the broadcasting and mobile, except aeronautical mobile, services, taking into account the relevant ITU Radiocommunication Sector (ITU-R) Studies, Recommendations, and Reports;

• Document 6-1/130 Annex 3: Review on sharing and compatibility studies in the frequency band 470-694 MHz taking into account the relevant ITU Radiocommunication Sector (ITU-R) Studies, Recommendations, and Reports.

### CPM23-2

In the CPM Report of CPM23-2 for AI1.5, the following methods including alternatives are set out:

• Method A: No change, with two sub-methods to either suppress or modify Resolution 235 (WRC-15);

• Method B: Primary allocation of the frequency band 470-694 MHz to the mobile service, identification of the band, or parts thereof, for IMT (with three alternatives: without identification to IMT, with an identification to IMT in the whole band 470-694 MHz or only in 614-694 MHz) and suppression of Resolution 235 (WRC-15);

• Method C: Primary allocation of the frequency band 470-694 MHz or parts thereof to the mobile, except aeronautical mobile, service, identification of the band, or parts thereof, for IMT (with nine alternatives: different options for the mobile allocation and IMT identification (in the whole Region 1 or only some countries, in the whole band 470-694 MHz or only 614-694 MHz) and conditions for the mobile, in addition to GE06 Agreement, to protect existing services) and suppression of Resolution 235 (WRC-15);

• Method D: Primary allocation of the frequency band 470-694 MHz or parts thereof to the mobile, except aeronautical mobile, service (with five alternatives: different options for the mobile allocation (the whole Region 1 or only some countries) and different options for the entry into force (immediately or as of 2031)) and suppression of Resolution 235 (WRC-15);

• Method E: Primary allocation of the frequency band 470-694 MHz to the mobile, except aeronautical mobile, service, limited to transmissions from base stations to mobile stations and to applications ancillary to broadcasting and programme-making and suppression of Resolution 235 (WRC-15);

• Method F: Secondary mobile allocation of the band 470-694 MHz (with three alternatives: allocation in the table with modification of RR No. 5.296 and upgrade to primary to a later date and therefore modification of Resolution 235 (WRC-15), secondary allocation with application of RR No. 9.21 and modification of RR No. 5.296, a new country footnote RR No. 5.M15 and suppression of Resolution 235 (WRC-15));

• Method G: In conjunction with Methods B, C, D, E, upgrade of the radio astronomy allocation where required to primary status.

## ECC Related Work and activity

In November 2014, ECC Task Group 6 developed ECC Report 224 on the long-term vision for the UHF broadcasting band. This Report addressed trends in the evolution of services and consumer behaviour, as well as the networks and technologies that offer the potential to deliver these services in the band 470-694 MHz. The Report did not make any recommendations for the future use of the UHF band. However, it recognised that this frequency band was essential for the delivery of audio-visual services and concluded that more flexibility might be needed in the regulatory environment to allow for varied use in different countries if required. Furthermore, it was concluded that, with the state-of-the-art of the radiocommunication technologies at the time of development of ECC Report 224, coexistence was feasible between broadcast and mobile downlink networks, whereas the coexistence between mobile uplink and broadcasting, or mobile downlink, was difficult and challenging.

The ECC Strategic Plan for 2020 – 2025 has since identified the need to review the UHF band over the coming period, and sets out the following requirement:

* “To review, in line with Agenda Item 1.5 of WRC-23, the UHF band (470-960 MHz), taking into account the current use by PMSE in this band. In undertaking this review, the ECC should consider future spectrum needs to support audio-visual media distribution over the longer term, taking into account expected developments in broadcast distribution technologies”.

## The Geneva-06 Agreement

The Geneva Agreement of 2006 (in association with the Radio Regulations) lays out the principles by which administrations in Region 1[[9]](#footnote-9) agreed to manage the use of the frequency band 470-862 MHz by the broadcasting and other primary terrestrial services. It contains a frequency plan for digital TV (DTT) as well as agreed processes for modifying that plan or introducing other services.

Following the decisions at WRC-12 and WRC-07 regarding identification of the bands 700 MHz (694-790 MHz) and 800 MHz (790-862 MHz) for IMT, many administrations have agreed to clear all pre-existing services, including DTT and PMSE, from these bands, or parts thereof. The 470-694 MHz band is now the only remaining spectrum available in many CEPT countries for these DTT and PMSE uses in the UHF band.

The GE06 frequency plan gives administrations rights to use certain frequencies over certain geographical areas for broadcasting services, without specifying exactly which technologies should be used (the so called ‘envelope concept’). This flexibility has been used to facilitate the transition from DVB-T to DVB-T2 in some countries and may also be used for the implementation of 5G Broadcast technologies by some countries while neighbouring countries retain DVB systems (see the section on “technical and regulatory implementation of 5G Broadcast” below).

GE06, in conjunction with Article 4.4 of the Radio Regulations, also allows low-power use of “interleaved” spectrum for services such as PMSE – services which are low enough in power to not cause interference to primary services, such as DTT, or to neighbouring countries. In some countries, some of this spectrum is licensed to so-called “white space” devices – again, these are very low-power and therefore very localised services.

## technical and regulatory implementation of 5G broadcast

3GPP specifications have substantially evolved to support a large-scale distribution of linear radio and TV services including the possibility of deploying dedicated broadcast networks. With the completion of Release 16, a comprehensive set of features is available that constitutes a fully-fledged broadcast called 'LTE-based 5G Terrestrial Broadcast', or '5G Broadcast'.

Some of the main features and functionalities of the 5G Broadcast system include:

* Standalone broadcast network using downlink-only spectrum;
* Single Frequency Network (SFN) deployments with Inter-Site Distance (ISD) up to 100 km suitable for stationary rooftop reception using directional high-gain antennas;
* Support for mobility scenarios including receivers moving at speeds of up to 250 km/h;
* Support of Free-to-Air (FTA) services;
* Support for Receive-Only Mode (ROM) services and devices without an MNO subscription, enabling anonymity of the user;
* Support of shared network functions across multiple 5G network operators;
* Exposure of broadcast service and transport capabilities to third parties;
* Standardised network and client APIs for broadcast services;
* Support for common media streaming formats such as Dynamic Adaptive Streaming over HTTP (DASH), HTTP Live Streaming (HLS), and Common Media Application Format (CMAF);
* Support for native-IP transport, allowing reception of IP-based services in broadcast mode;
* Allows hybrid Broadcast-Broadband services in the presence of an optional return channel, if integrated in the same device as a mobile broadband receiver.
* Support for different file delivery services such as scheduled delivery or file carousels.

In standalone deployments, 5G Broadcast is similar to existing digital broadcasting systems such as DVB-T/T2. Being based on COFDM, it can operate in Single Frequency Network (SFN) mode or in Multi Frequency Network (MFN) mode, much like current DVB-based systems.

A recent study by EBU/BNE[[10]](#footnote-10) concludes that hybrid networks including three layers of High-Power High Tower (HPHT), Medium Power Medium Tower (MPMT) and Low Power Low Tower (LPLT) offer the best compromise between good coverage for mobile reception and reasonable site density. The HPHT sites provide the main large-are coverage, complemented by MPMT sites in some rural and suburban areas, and LPLT sites in urban areas. Such hybrid topologies can provide sufficiently high SINR levels (up to 15 dB), suitable for mobile and handheld reception to give throughputs of up to 7 Mbits/s in a 5 MHz channel[[11]](#footnote-11).

Several European initiatives (trial tests and projects) regarding the use of the LTE-based 5G terrestrial Broadcast system are described in <https://tech.ebu.ch/publications/tr044>.

### Classification of the service provided by 5G Broadcast

The LTE-based 5G Broadcast system is described in ETSI TS 103 720[[12]](#footnote-12). 5G Broadcast has been specified in 3GPP and is part of 3GPP specifications that are referenced in the transposed sets of standards for the terrestrial radio interface of IMT-Advanced (M.2012) and IMT-2020 (M2150). The LTE-based 5G Terrestrial Broadcast System is a standalone Broadcasting system offering a downlink-only service intended for direct reception by all members of the general public across the service area, including the capability of free-to-air reception. This makes it an application of the Broadcasting service in the sense of Article 1.38[[13]](#footnote-13) of the Radio Regulations.

### Compliance with GE06

Within the spectrum currently used for DTT, the provisions of the GE06 Agreement would apply for the introduction of 5G Broadcast. As of today, 5G Broadcast is specified for 5, 10, 20 MHz channel bandwidths. Work is ongoing in 3GPP to specify additional bandwidths of 6, 7 and 8 MHz (expected to be completed in 2023). The objective is to facilitate the introduction of 5G Broadcast alongside DVB services in the sub-700 MHz band. Bandwidths up to 8 MHz can be implemented within existing GE06 plan entries (i.e. without the need to adapt the transmission system or to modify the GE06 frequency plan, under the condition that they comply with the spectrum masks given in Figure 3‑3 and Table 3‑11 in Annex 2 of the GE06 Agreement (the so-called “envelope concept”)). Obviously, an occupied bandwidth of less than 8 MHz would result in a less efficient use of the 8 MHz channel.

For channel bandwidths wider than 8 MHz, the envelope concept for systems other than DVB-T applies as described in Article 5, clause 5.1.3 of the GE06 Final Acts:

“5.1.3 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.”

Signals with bandwidths of more than 8 MHz can comply with the envelope concept constraint only if the whole signal power is reduced enough to meet the masks given in Figure 3‑3 and Table 3‑11 in Annex 2 of the GE06 Agreement, which need to be applied within any 4 kHz. This is likely to result in a considerable reduction of the maximum transmit power of this signal compared to the original plan entry.

The aggregation of two or more adjacent 8 MHz channels into one wider frequency block in a given geographical area may represent a potential solution to accommodate wider channel bandwidth signals without the power reduction constraint mentioned above. However, this would require the availability of sufficient number of adjacent channel entries in the GE06 Plan in any given area, which is generally not the case.

Being COFDM-based, 5G Broadcast signals with bandwidth 8 MHz or lower can be deployed within an existing GE06 plan with minimal constraints.

### COMPATIBILITY WITH OTHER DTT SYSTEMS

Another recent EBU/BNE study[[14]](#footnote-14) concludes that the use of coordinated yet unused GE06 DTT entries by 5G Broadcast will be the most practical way for early introduction of 5G Broadcast in the sub 700 MHz band. The technical compatibility between 5G Broadcast and DVBT/T2 in this scenario is manageable with the same mitigation measures and solutions currently applied to broadcast networks. This might include additional filtering in the DTT receiving installations surrounding 5G Broadcast sites, when possible and as needed. It might also include implementing additional constraints (e.g. ERP, polarisation, antenna adjustments) on 5G Broadcast sites, as needed.

Additionally, 5G Broadcast receivers (handsets) need to have suitable RF characteristics for satisfactory operation in the presence of high signal levels of adjacent channel DTT that may be encountered in some areas.

## Environmental Impact

With concern growing about greenhouse gas emissions and it being an obligation on most companies and administrations to consider the environmental impact of their work, any review of spectrum use and needs should also consider the environmental impact.

# List of relevant documents

ITU-Documentation (Recommendations, Reports, other)

* [Administrative Circular CA/251, “Results of the first session of the Conference Preparatory Meeting for WRC-23 (CPM23-1)”](https://www.itu.int/dms_pub/itu-r/md/00/ca/cir/R00-CA-CIR-0251%21%21PDF-E.pdf) – see Annex 1 for Resolution 811, and Annex 9 for CPM23-1 Decision on the establishment and Terms of Reference of Task Group 6/1 (TG 6/1) on WRC-23 agenda item 1.5.
* [GE06 Agreement, “Final Acts of the Regional Radiocommunication Conference for planning of the digital terrestrial broadcasting service in parts of Regions 1 and 3, in the frequency bands 174-230 MHz and 470-862 MHz”](https://www.itu.int/dms_pub/itu-r/opb/act/R-ACT-RRC.14-2006-PDF-E.pdf)
* [Recommendation ITU-R BT.2136-0, “Assessing interference into digital terrestrial television broadcasting from other services by means of Monte Carlo simulation”](https://www.itu.int/dms_pubrec/itu-r/rec/bt/R-REC-BT.2136-0-202012-I%21%21MSW-E.docx)
* [Recommendation ITU-R P.1546 (08/2019), “Method for point-to-area predictions for terrestrial services in the frequency range 30 MHz to 4000 MHz.](https://www.itu.int/dms_pubrec/itu-r/rec/p/R-REC-P.1546-6-201908-I%21%21PDF-E.pdf)
* [Recommendation ITU-R M.1808-1: Technical and operational characteristics of conventional and trunked land mobile systems operating in the mobile service allocations below 869 MHz to be used in sharing studies in bands below 960 MHz](https://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.1808-1-201911-I%21%21PDF-E.pdf)
* [Recommendation ITU-R M.2090-0 (10/2015), “Specific unwanted emission limit of IMT mobile stations operating in the frequency band 694-790 MHz to facilitate protection of existing services in Region 1 in the frequency band 470-694 MHz”](https://www.itu.int/dms_pubrec/itu-r/rec/m/R-REC-M.2090-0-201510-I%21%21PDF-E.pdf)
* [Recommendation ITU-R P.1812 (08/2019), “a path specific propagation prediction method for point-to-area terrestrial services in the VHF and UHF bands”](https://www.itu.int/dms_pubrec/itu-r/rec/p/R-REC-P.1812-5-201908-S%21%21PDF-E.pdf)
* [Recommendation ITU-R P.2001, “A general purpose wide-range terrestrial propagation model in the frequency range 30 MHz to 50 GHz”](https://www.itu.int/dms_pubrec/itu-r/rec/p/R-REC-P.2001-3-201908-I%21%21PDF-E.pdf)
* [Report ITU-R BT 2301-04: National field reports on the introduction of IMT in the bands with co-primary allocation to the broadcasting and the mobile services.](https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-BT.2301-4-2022-PDF-E.pdf)
* [Report ITU-R BT 2302-1: Spectrum requirements for terrestrial television broadcasting in the UHF frequency band in Region 1 and the Islamic Republic of Iran](https://www.itu.int/md/R12-SG06-C-0238/en)
* [Report ITU-R 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”](https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-BT.2337-1-2018-PDF-E.pdf)
* [Report ITU-R BT.2383-3 “Characteristics of digital terrestrial television broadcasting systems in the frequency band 470-862 MHz”](https://www.itu.int/pub/R-REP-BT.2383)
* [Report ITU-R BT.2387-1 “Spectrum/frequency requirements for bands allocated to broadcasting on a primary basis](https://www.itu.int/pub/R-REP-BT.2387)”.
* [Report ITU-R BT.2338-0 “Services ancillary to broadcasting/services ancillary to programme making spectrum use in Region 1 and the implication of a co-primary allocation for the mobile service in the frequency band 694-790 MHz”.](https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-BT.2338-2014-PDF-E.pdf)
* [Report ITU-R BT.2470, “Use of Monte Carlo simulation to model interference to DTTB”](https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-BT.2470-2019-PDF-E.pdf)
* Reports [ITU-R M.2377](https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-M.2377-1-2017-PDF-E.pdf) and [M.2415](https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-M.2415-2017-PDF-E.pdf) (respectively PPDR requirement and spectrum needs)
* [Report ITU-R RA.2332-0: Compatibility and sharing studies between the radio astronomy service and IMT systems in the frequency bands 608-614 MHz, 1 330-1 400 MHz, 1 400-1 427 MHz, 1 610.6-1 613.8 MHz, 1 660-1 670 MHz, 2 690-2 700 MHz, 4 800-4 990 MHz and 4 990-5 000 MHz](https://www.itu.int/dms_pub/itu-r/opb/rep/R-REP-RA.2332-2014-PDF-E.pdf)
* [Report ITU-R SM 2405-0, Spectrum management principles, challenges and issues related to dynamic access to frequency bands by means of radio systems employing cognitive capabilities](https://www.itu.int/md/R15-SG01-C-0075/en)
* [Resolution 235 (WRC-15), “Review of the spectrum use of the frequency band 470-960 MHz in Region 1”](https://www.itu.int/dms_pub/itu-r/oth/0c/0a/R0C0A00000C0029PDFE.pdf)

CEPT and/or ECC Documentation (Decisions, Recommendations, Reports)

* [CEPT Report 32 (2009), Report from CEPT to the European Commission in response to the Mandate on “Technical considerations regarding harmonisation options for the digital dividend in the European Union”, “Recommendation on the best approach to ensure the continuation of existing Program Making and Special Events (PMSE) services operating in the UHF (470-862 MHz), including the assessment of the advantage of an EU-level approach”](https://docdb.cept.org/document/32)
* [CEPT Report 53 (2014), Report A from CEPT to the European Commission in response to the Mandate “To develop harmonised technical conditions for the 694-790 MHz ('700 MHz') frequency band in the EU for the provision of wireless broadband and other uses in support of EU spectrum policy objectives”](https://docdb.cept.org/document/53)
* [ECC Report 224 (2014), “Long term vision for the UHF broadcasting band”](https://docdb.cept.org/download/0ff49ab9-1de7/ECCREP224.PDF)
* [ECC Report 239 (2015), “Compatibility and sharing studies for BB PPDR systems operating in the 700 MHz range”](https://docdb.cept.org/document/345)
* [ECC Report 323, “Spectrum use and future spectrum requirements for PMSE”](https://docdb.cept.org/document/18490)
* [ECC Strategic Plan for the period 2020-2025](https://cept.org/files/6813/ECC%2820%29093%20Annex%2012_ECC%20Strategic%20Plan%202020-2025.pdf)
* [ERC/REC 25-10, “ERC Recommendation of 1995 on frequency Ranges for the Use of Terrestrial Audio and Video Programme Making and Special Events (PMSE) applications, latest amended on 18 October 2016”CC Report 224 (2014), “Long term vision for the UHF broadcasting band”](https://efis.cept.org/reports/ReportDownloader?reportid=6)
* [ERC Recommendation 70-03, “Relating to the use of Short Range Devices (SRD)”](https://docdb.cept.org/download/25c41779-cd6e/Rec7003e.pdf)
* [ERC Report 85 (2005), “Compatibility analysis of radio astronomy in the frequency range 608 - 614 MHz with DVB-T”](https://docdb.cept.org/download/2173)

EU Documentation (Directives, Decisions, Recommendations, other), if applicable

* [Commission Decision 2009/766/EC](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32010D0166&from=EN) on the harmonisation of the 900 MHz and 1800 MHz frequency bands for terrestrial systems capable of providing pan-European electronic communications services in the Community as amended by Commission Implementing Decisions [2011/251/EU](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32011D0251&from=EN) and [2018/637/EU](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018D0637&from=GA)
* [Commission Decision 2010/166/EU](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32010D0166&from=EN) on harmonised conditions of use of radio spectrum for mobile communication services on board vessels (MCV services) in the European Union as amended by Commission Implementing Decision [(EU) 2017/191](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32017D0191&from=GA)
* [Commission Decision 2010/267/EU of 6 May 2010 on harmonised technical conditions of use in the 790-862 MHz frequency band for terrestrial systems capable of providing electronic communications services in the European Union.](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32010D0267)
* [Commission Implementing Decision 2014/641/EU on harmonised technical conditions of radio spectrum use by wireless audio programme making and special events equipment in the Union](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32014D0641)
* 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
* [Commission Implementing Decision (EU) 2018/1538 on the harmonisation of radio spectrum for use by short-range devices within the 874-876 and 915-921 MHz frequency bands](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:32018D1538&from=EN)
* [Council Directive 87/372/EEC](https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:31987L0372&from=EN) on the frequency bands to be reserved for the coordinated introduction of public pan-European cellular digital land-based mobile communications in the Community as amended by [Directive 2009/114/EC of the European Parliament and of the Council of 16 September 2009](https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:274:0025:0027:EN:PDF)
* [Decision no 243/2012/EU of the European Parliament and of the Council of 14 March 2012, establishing a multiannual radio spectrum policy programme.](https://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2012:081:0007:0017:EN:PDF)
* [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](https://eur-lex.europa.eu/legal-content/en/TXT/?uri=CELEX%3A32017D0899)

# Actions to be taken

# Relevant information from outside CEPT

##  Radio Spectrum Policy Group (december 2022)

The RSPG recommends that the European Commission proposes an EU position to the Council to ensure that the decision of WRC-23 on this Agenda Item is compliant with the Decision (EU) 2017/899 providing priority to broadcasting and PMSE usage until at least end 2030.

RSPG has debated on the different possible ways to achieve this EU objective, finding that many Member States do not see the need to adopt regulatory actions at this moment (No Change at WRC-23, with a possible Agenda Item for WRC-27 or WRC-31) and that several other Member States find it necessary to adopt regulatory actions (co-primary allocation to mobile, except aeronautical mobile, service which could become effective at a later stage (e.g. 31.12.2030)).

Further to this debate the RSPG identified a potential compromise solution to be recommended as an EU position. In consequence, the RSPG is of the view that the above outline recommendation can be ensured by an EU position supporting a secondary allocation to the mobile, except aeronautical mobile, service with a WRC-31 Agenda Item to consider a possible upgrade of the secondary mobile allocation

## Regional telecommunication organisations

APT (May 2023)

* APT Members are of the view that conclusions to be reached on the agenda item 1.5 is a Region 1 issue and WRC-23 decisions shall in no way adversely affect Region 3 frequency allocations and existing and future use of the relevant frequency band.

Arab Group (September 2023)

* 614 – 694 MHz: Arab Common Proposal (ACP) for Additional allocation to the Mobile service on a primary basis in the Table of Frequency Allocations of the frequency band 614-694 MHz in Region 1, and identification of the band 614-694 MHz for IMT without any additional conditions. Also, to ensure the protection of the existing broadcasting service in the band 614-694 MHz by applying the GE-06 procedures. Suppress Resolution 235 (WRC-15).
* 470 – 614MHz: ACP to support NOC in this sub-band.

ATU (September 2023)

* Support Method A1 (i.e. No change) as an African Common Proposal (AfCP).
* Notes the national positions held by Egypt (Method C1), Namibia (Method C1), Nigeria (Method C1) and Tanzania (Method F2).

CITEL (September 2023)

* Proposal: NOC for Region 2.

WRC 23 agenda item 1.5 addresses the spectrum use and spectrum needs of existing services in the frequency band 470-960 MHz in Region 1 and considers possible regulatory actions in the frequency band 470-694 MHz in Region 1 only. Any changes made to the Radio Regulations under WRC 23 agenda item 1.5 must not impact the existing allocations and identifications for Region 2, nor subject Region 2 to any changed procedural or regulatory provisions. Therefore, no change is proposed for Region 2 under agenda item 1.5, and this proposal does not address Region 1 or 3.

RCC (June 2022)

* The RCC Administrations oppose changing the regulatory conditions of using the frequency band 470-694 MHz in Region 1 within this WRC-23 agenda item due to the current and future intensive use of this frequency band and the inability to ensure electromagnetic compatibility with existing services allocated in the frequency band 470-694 MHz in Region 1 in accordance with the RR Table of Frequency Allocations on a primary and secondary basis (Method A).
* The RCC Administrations believe that no regulatory actions are required in the 694-960 MHz band and no particular actions for study are defined by Resolution 235 (WRC-15).
* The RCC Administrations believe that when studying compatibility in the 470-694 MHz range, allocations of this frequency band to services on both a primary and secondary basis should be taken into account. RCC Common Proposal: Method A, Alternative A1 from the CPM Report

## International organisations

NATO (July 2023)

NATO Military Interest Statement

NATO military support the evolution of the regulation in the frequency range 470 - 694 MHz for a future mobile allocation (technology neutral), with regards to the saturation of the frequency band 225 - 400 MHz. It will provide the opportunity to assign spectrum to military/governmental use by the national authorities.

NATO military is highly interested to utilise a possible regulatory change as an enabler for a NATO harmonised approach (e.g., NJFA) to establish broadband communication capabilities in a medium time horizon. This would enable nations to provide flexible national regulations supporting as appropriate Defence/NATO needs.

NATO Position Statement

Future broadband capabilities could be further investigated as an opportunity for a NATO harmonised approach to cover spectrum needs for military systems in a part of 470 - 694 MHz, as and when appropriate.

WMO and EUMETNET (May 2023)

WMO/EUMETNET would appreciate the development of a solution to ensure the continued effective operation of the wind profiler radars in the 470-494 MHz frequency band in accordance with RR No 5.291A.

## Other organisations

APWPT (July2022)

APWPT is of the position that a sufficient amount of spectrum in the range 470 – 694 MHz has to remain available to PMSE beyond 2030.

In the majority of CEPT countries, the frequency band 470 - 694 MHz is used by PMSE in accordance with the provisions of RR No. 5.296. Countries, which have not signed No. 5.296 allow the use with related national ruling (e.g., SRD).

Within the European Union, the decision of the European Parliament and the European Council (EU) 2017/899 supports the spectrum needs of PMSE with the access to the band 470-694 MHz until at least 2030.

European Commission Implementing Decision 2014/641/EU asks to support PMSE with efficient amount of spectrum within the band 470 - 694 MHz recognizing that the available spectrum above 694 MHz cannot support the frequency needs.

* The frequency bands 823-832 and 863-865 MHz are limited in their bandwidth receiving an higher RF noise floor from out-of-band emissions from adjacent bands.
* More broadly there are currently no internationally available bands above 694 MHz able to support the demand for PMSE and its high-quality requirements. The frequency band 470 – 694 MHz will therefore remain the primary option for PMSE. PMSE applications with high quality requirements cannot be supported within the bands between 694 – 960 MHz.
* For large events, which might be also of international interest, frequency coordination is conducted by the national frequency authority.

Deployments of PMSE are generally planned and coordinated for specific locations and venues, either on a temporary basis for short term events or for permanent installations in fixed locations such as studios and theatres.

Within the frequency band 470 – 694 MHz these deployments provide the essential applications for daily content production for the broadcasting service as well as other cultural and social purposes. Please see ECC Report 323, which outlines the importance of PMSE use.

APWPT supports no change in relation to WRC23 AI 1.5.

Broadcast Networks Europe (BNE) (August 2022)

Broadcasting is important to European citizens. DTT in many European countries, is a critical element in the delivery of news and entertainment to citizens, especially the less well-off and elderly.

Broadcasting needs a period of stability. For the past 16 years, since Geneva 06[[15]](#footnote-15) (GE06), broadcast has been in a constant state of turmoil. At the World Radio Conference in 2007 (WRC-07) mobile was allocated the 800 MHz band quickly followed by the 700 MHz band at WRC-12. Both allocations required broadcast to vacate the spectrum. At WRC-23, with the clearance of the 700 MHz and 800 MHz bands just being completed (2022), we have the possibility of further disruption as allocating the remaining broadcast spectrum to mobile is on the agenda. Such an environment of constant change and uncertainty about tenure of spectrum is not conducive for investment or development of the platform.

Where spectrum has been allocated to mobile the incumbent services have always had to move. Given that sharing between mobile and DTT isn’t possible/practical, a mobile allocation in the band 470 – 694 MHz means that broadcast services, as with the 700 MHz and 800 MHz bands, will be displaced. The alternative is mobile services will be deployed in areas adjacent to DTT resulting in widespread interference to both Systems.

There is no clear case for allocating mobile more spectrum. Only 20 countries out of the 121 countries in Region 1 responded to the ITU-R questionnaire on mobile spectrum use and needs, and of those only 8 indicated a requirement for additional spectrum for mobile.

Mobile needs to make better use of the spectrum it has. At the WRCs since WRC-07, mobile with IMT identification has hoovered up over 15 GHz of spectrum. Much of this spectrum is yet to be used, and where spectrum is used it is often used inefficiently. Mobile needs to make better use of the spectrum it has allocated before seeking more.

Mobile doesn’t share spectrum. It is known that certain systems, PMSE, Radio Astronomy and wind profiler radars, can co-exist under the umbrella of television and share the same spectrum, and have done so for many years. By contrast there are no examples of any systems sharing spectrum with mobile sub 1 GHz, so services displaced by mobile will need to be found alternative spectrum.

CEPT should look to the environment. [ITU-R Resolution 60](https://www.itu.int/pub/R-RES-R.60-2-2019) addresses the need to reduce energy consumption and the CEPT Brief on Agenda Item 1.5 specifically mentions the need to consider the environment when reviewing spectrum use and needs. With DTT, as shown in a recent study[[16]](#footnote-16), being the ‘greenest’ method for delivery of audio-visual content, it would appear to be contrary to the aims of the ITU and CEPT to place at risk the DTT platform by allowing a mobile allocation at WRC-23.

Broadcast Innovation and Convergence. Broadcasters have been developing a specification for LTE-Based 5G Terrestrial Broadcast aimed at providing a service to handheld devices that complements the current unicast delivery of audio-visual content. Broadcasters also continue to innovate the existing DTT platform with use of improved compression allowing UHD and HDR, as well as combination with streaming services (HbbTV) making best use of delivery platforms.

WRC-23 with little evidence supporting the need for more mobile spectrum and given the continued value of DTT and the growing needs of PMSE - BNE supports a position of No Change to the Radio Regulations under WRC-23 agenda item 1.5.

CRAF (September 2023)

CRAF supports the protection of the radio astronomy service in the frequency band 606–614 MHz to ensure its continued operation. In case of regulatory changes decided by WRC-23 with mobile service primary allocations, the necessary protection can be achieved by upgrading the RAS secondary allocation to a primary status. This should not change the status of the RAS relative to the broadcasting service as both services are already coordinated in the Geneva Agreement GE-06 provisions.

Digital Europe (May 2022)

DIGITALEUROPE notes the importance and needs of DTT in many European countries and also understands that other countries in Europe are relying less on DTT.

3GPP is currently standardizing 5G 5G broadcast technologies (including LTE based 5G terrestrial broadcast and NR broadcast). LTE based 5G terrestrial includes a band definition for the range 470- 694 MHz and broadcast channel bandwidth of 8 MHz. NR broadcast can be implemented with relatively small changes in the 3GPP specifications. 3GPP also has standardized spectrum in this range for mobile use (i.e. n71 663 – 698 / 617 - 652 MHz).

DIGITALEUROPE recognizes that additional UHF spectrum in rural areas would contribute to delivering media e.g. along the transport paths and would help to reduce the digital divide (home and enterprise broadband), as well as provide deep indoor coverage (e.g. in urban areas).

Thus, DIGITALEUROPE supports co-primary mobile allocation towards WRC23 to allow countries to use mobile and/or broadcast depending on their national circumstances, noting that PMSE is also used.

DIGITALEUROPE is of the view that after WRC-23, European administrations need to study how to allow for flexibility, within the planned UHF review. This will include considerations and may include conditions of usage of respectively broadcast and mobile services within the range 470-694 MHz in neighboring countries, accounting for protection to existing DTT reception and PMSE, as appropriate.

EBU (October 2022)

The UHF band is widely used by broadcasting and other cultural organisations and returns huge public and societal value, both through allowing access to universally available media services, enabling content production and facilitating the creative industries. Almost all CEPT countries use the UHF band for the distribution of digital terrestrial TV by public service and private media companies. The use of interleaved spectrum for PMSE audio systems such as radio microphones by broadcasters, and by artistic, religious and other civic society organisations is also found in almost all countries. The 470-694 MHz band, governed by the GE06 Agreement, is the only spectrum available for these DTT and PMSE uses in the UHF band.

The UHF broadcasting band has been subject to a lot of change in recent years: the loss of the 800 MHz band in the early 2010s was offset by the move to digital transmission, but clearance of the 700 MHz band around 2020 has, in some countries, resulted in a reduced DTT service, with fewer multiplexes transmitted and fewer services available and the future potential for DTT platforms was reduced in all countries.

At the same time, the interleaved use of the spectrum for PMSE by broadcasters, and more widely across the creative industries, has been squeezed. The move to digital techniques for these systems has allowed some efficiencies in spectrum use, but as demand for complex productions continues to increase, there is a real risk of supply of spectrum for these audio PMSE applications not meeting demand in a not too distant future.

Broadcasters have been developing new transmission technologies designed specifically for reception on handheld devices, and the EBU has worked with ETSI to produce a specification for LTE-Based 5G Terrestrial Broadcast. Across Europe, broadcasters are trialling the technology and developing plan to deploy 5G Broadcast systems. In other countries, broadcasters are continuing to invest in DTT systems with increased use of DVB-T2 and HEVC. Some broadcasters are considering the use of DTT for distribution of UHD content.

These advances, which can already be accomplished under the framework provided by the GE06 Agreement, require stability in the Radio Regulations to be delivered. Indeed, introducing changes at this time would be likely to jeopardise the investment required to maximise public value from the UHF spectrum.

Studies submitted to ITU-R Task Group 6/1 as per Resolution 235 (WRC-15) have shown that:

* The large majority of Region 1 Administrations requires full access to the 470-694 MHz band for DTT.
* Co-channel sharing between DTT and IMT is very difficult requiring very large separation distances.

The studies were not “completed or approved by ITU-R” as required by Resolution 235 (WRC-15).

The EBU therefore supports a position of No Change to the Radio Regulations under WRC-23 agenda item 1.5.

Considering a possible agenda item at either WRC-27 or WRC-31, the EBU notes that the pace of market development is such that DTT and PMSE will need to retain access to the sub-700 MHz band well beyond 2030 in most European countries. Therefore, the EBU is of the view that WRC-27 would be too early to make an informed decision, and that WRC-31 would be a more appropriate timeframe to review the technological and market developments in the UHF band.

ETNO (April 2022)

ETNO supports the primary allocation of the band 470-694 MHz to the Mobile Service at WRC-23.

Additional low-band spectrum is essential to be able to increase the mobile broadband capacity and performance especially in areas where higher frequencies have less effective propagation characteristics, e.g.in rural areas, transport paths, as well as inside buildings. It enables offering more equal mobile service in sparsely populated areas compared to sub-urban and urban areas and thus supporting targets for digital inclusion and equal digital opportunities, including healthcare, education but also media. Additional low-band spectrum supports meeting the growing demand for higher speed broadband in these areas in an economically and environmentally sustainable way.

In many European countries other broadcasting platforms (e.g. cable, IPTV, satellite) are more popular than DTT. In addition, there is ongoing change in media consumption. People use increasingly more on-demand video content and streaming services instead of traditional linear TV. This increases data in broadband, including mobile broadband.

In its review by 2025 Europe intends to evaluate the developments concerning the use of the band 470-694 MHz for taking a decision on the future use of this band from 2030 onwards. ETNO supports a primary mobile allocation in Radio Regulations at WRC-23 because it would create flexibility to enable Europe to decide on the most efficient usage scenario and to allow for future development of feasible technical and regulatory solutions for more flexible and efficient use of this valuable low band spectrum.

GSA (May 2022)

* GSA has commissioned an independent report by Plum Consulting to look at the future of the UHF spectrum in Region 1 (Available at <https://plumconsulting.co.uk/the-future-use-of-uhf-in-itu-region-1> and <https://gsacom.com/reports>). The study investigates the various uses and respective usage trends of different services including mobile, broadcast, PMSE, PPDR and Radio Astronomy in UHF.
* The study indicates the need to review some assumptions on the prospects of spectrum use by existing services and it also investigates and reviews the spectrum use of existing services and the highly diverse situations country to country specifically in term of broadcast use, one dimension being the declining share of the population using DTT, another one being the number of channels offered and thus the amount of spectrum actually used for DTT.
* The study clearly identifies additional spectrum needs for mobile in low bands in order to cost-efficiently provide the mobile broadband service performance levels required in remote and rural areas, deep indoor or underground areas and along the transportation paths. This would help to reduce the digital divide between urban and rural areas. Given that diversity, the study concludes that under careful consideration of existing services, additional flexibility should be given to national administrations in the form of a co-primary mobile allocation in 470-694 MHz at WRC-23 in ITU Region 1. GSA concurs with the need of additional spectrum for mobile and supports the study conclusions.
* GSA believes that Broadcast and Mobile industries / technology will continue to evolve and are likely to integrate &/or work more closely in the future. A number of duplex arrangements exist (FDD, TDD, SDL/DL etc) and GSA suggests that these should be studied after WRC23 if a co-primary mobile allocation / IMT footnote is agreed at the WRC-23. A co-primary mobile allocation at WRC-23 keeps the options open and provides future flexibility for Administrations to decide within the 2025 – 2030 timeframe what to do with the UHF spectrum taking into account the latest market/technology developments in both broadcast and mobile. GSA notes the large differences within CEPT in terms of DTT usage and believes that flexibility will allow nations to use this spectrum asset as per national needs. A co-primary mobile allocation would also provide additional flexibility for some Administrations to enable mobile technology within a country/sub-region subject to coordination arrangements with neighbours. An IMT footnote is also important to help market development and ecosystem scale if Administrations subsequently decide to make spectrum available for IMT.

Consequently, GSA supports a primary allocation of the band 470-694 MHz to the Mobile Service at WRC-23.

1.

An excerpt from the ECA Table for the frequency range 470-960 MHz is provided in Table 2, below, together with the list of relevant applicable ECC Decisions and Recommendations in the range.

The European Table of Frequency Allocations and Applications for the frequency range 8.3 kHz to 3000 GHz (the ECA Table) is provided in EFIS. With EFIS, users can search for and compare spectrum use across Europe as well as related information such as CEPT activities, radio interface specifications and other national or international regulations. Additional [information on EFIS](http://www.cept.org/eco/eco-tools-and-services/efis-eco-frequency-information-system) is available on the ECC webpage, at <https://efis.cept.org/sitecontent.jsp?sitecontent=ecatable>.

Explanatory Note:

One of the key objectives of the ECC, as defined in its Terms of Reference, is to develop European common positions and proposals for use in the framework of international and regional bodies, so as to harmonise within Europe the efficient use of the radio spectrum in order to satisfy the requirements of users and industry. In order to help achieve this objective, CEPT endorsed in 2002 the principle of adopting a harmonised European Table of Frequency Allocations and Applications (“the Table”) to establish a strategic framework for the utilisation of the radio spectrum in Europe. One key aspect of the Table is to deliver information on the current situation regarding spectrum use in CEPT Member States, and this information can be used as a resource for the development of European Common Proposals (ECPs) for future Radiocommunication Conferences of the ITU. In addition to reflecting the RR (2020) Region 1 Allocations, the Table also provides European Common Allocations which are of major use or major interest in CEPT Member countries. Allocations made available in at least 15 CEPT administrations are classified within the CEPT framework as being of major use or interest within the collective CEPT community.

In addition to providing information relating to European Common Allocations, the Table further provides further information pertaining to radio applications commonly used within CEPT administrations. Such application listings are added to the ECA Table when:

* 1. At least 10 CEPT administrations have made available the relevant frequency band for a radio application according to EFIS; or
	2. WG FM has decided to do so (based on other aspects).

Table 2: ECA Table for the frequency range 470-960 MHz (source: [EFIS](http://www.efis.cept.org))

|  |  |  |
| --- | --- | --- |
| Frequency band (MHz) | European Common Allocations | Applications |
| 470-6945.149 5.291A 5.296 5.306 | BROADCASTING | Broadcasting (terrestrial)/Wind profilers/Radio astronomy/Radio microphones and ALD/PMSE |
| 694-7905.312 | BROADCASTING/MOBILE EXCEPT AERONAUTICAL MOBILE(5.312A)(5.317A) | PMSE/PPDR/MFCN/Radio microphones and ALD/Broadcasting (terrestrial) |
| 790-8625.312 5.316B5.317A | MOBILE EXCEPT AERONAUTICAL MOBILE | Radio microphones and ALD/PPDR/MFCN |
| 862-8705.323 | MOBILE(5.317A) | Wideband data transmission systems/Radio microphones and ALD/RFID/Tracking, tracing and data acquisition/Alarms/Non-specific SRDs/Land military systems/Maritime military systems |
| 870-8765.323 | MOBILE(5.317A) | Maritime military systems/Land military systems/Tracking, tracing and data acquisition/Non-specific SRDs/FRMCS |
| 876-8805.323 | MOBILE(5.317A) | FRMCS/GSM-R/Maritime military systems/Land military systems |
| 880-8905.323 | MOBILE(5.317A) | GSM/IMT/MCV |
| 890-9155.323 | MOBILE(5.317A)/Radiolocation | MCV/IMT/Maritime military systems/GSM/Land military systems |
| 915-9215.323 | Radiolocation/MOBILE(5.317A) | Maritime military systems/Land military systems/Non-specific SRDs/RFID/FRMCS |
| 921-9255.323 | MOBILE(5.317A)/Radiolocation | FRMCS/GSM-R/Land military systems/Maritime military systems |
| 925-9425.323 | Radiolocation/MOBILE(5.317A) | Maritime military systems/Land military systems/GSM/IMT/MCV |
| 942-9605.323 | MOBILE(5.317A) | MCV/IMT/GSM |
| RR Footnotes 5.149 In making assignments to stations of other services to which the bands:13360-13410 kHz,25550-25670 kHz,37.5-38.25 MHz,73-74.6 MHz in Regions 1 and 3,150.05-153 MHz in Region 1,322-328.6 MHz,406.1-410 MHz,608-614 MHz in Regions 1 and 3,1330-1400 MHz,1610.6-1613.8 MHz,1660-1670 MHz,1718.8-1722.2 MHz,2655-2690 MHz,3260-3267 MHz,3332-3339 MHz,3345.8-3352.5 MHz,4825-4835 MHz,4950-4990 MHz,4990-5000 MHz,6650-6675.2 MHz,10.6-10.68 GHz,14.47-14.5 GHz,22.01-22.21 GHz,22.21-22.5 GHz,22.81-22.86 GHz,23.07-23.12 GHz,31.2-31.3 GHz,31.5-31.8 GHz in Regions 1 and 3,36.43-36.5 GHz,42.5-43.5 GHz,48.94-49.04 GHz,76-86 GHz,92-94 GHz,94.1-100 GHz,102-109.5 GHz,111.8-114.25 GHz,128.33-128.59 GHz,129.23-129.49 GHz,130-134 GHz,136-148.5 GHz,151.5-158.5 GHz,168.59-168.93 GHz,171.11-171.45 GHz,172.31-172.65 GHz,173.52-173.85 GHz,195.75-196.15 GHz,209-226 GHz,241-250 GHz,252-275 GHz are allocated, administrations are urged to take all practicable steps to protect the radio astronomy service from harmful interference. Emissions from spaceborne or airborne stations can be particularly serious sources of interference to the radio astronomy service (see Nos. 4.5 and 4.6 and Article 29). (WRC-07)5.291A Additional allocation: in Germany, Austria, Denmark, Estonia, Liechtenstein, the Czech Republic, Serbia and Switzerland, the band 470-494 MHz is also allocated to the radiolocation service on a secondary basis. This use is limited to the operation of wind profiler radars in accordance with Resolution 217 (WRC-97). (WRC-15)5.296 Additional allocation: in Albania, Germany, Angola, Saudi Arabia, Austria, Bahrain, Belgium, Benin, Bosnia and Herzegovina, Botswana, Bulgaria, Burkina Faso, Burundi, Cameroon, Vatican, Congo (Rep. of the), Côte d'Ivoire, Croatia, Denmark, Djibouti, Egypt, United Arab Emirates, Spain, Estonia, Eswatini, Finland, France, Gabon, Georgia, Ghana, Hungary, Iraq, Ireland, Iceland, Israel, Italy, Jordan, Kenya, Kuwait, Lesotho, Latvia, Lebanon, Libya, Liechtenstein, Lithuania, Luxembourg, North Macedonia, Malawi, Mali, Malta, Morocco, Mauritius, Mauritania, Moldova, Monaco, Mozambique, Namibia, Niger, Nigeria, Norway, Oman, Uganda, the Netherlands, Poland, Portugal, Qatar, the Syrian Arab Republic, Slovakia, the Czech Republic, Romania, the United Kingdom, Rwanda, San Marino, Serbia, Sudan, South Africa, Sweden, Switzerland, Tanzania, Chad, Togo, Tunisia, Turkey, Ukraine, Zambia and Zimbabwe, the frequency band 470-694 MHz is also allocated on a secondary basis to the land mobile service, intended for applications ancillary to broadcasting and programme‑making. Stations of the land mobile service in the countries listed in this footnote shall not cause harmful interference to existing or planned stations operating in accordance with the Table in countries other than those listed in this footnote.    (WRC‑19)5.306 Additional allocation: in Region 1, except in the African Broadcasting Area (see Nos. 5.10 to 5.13), and in Region 3, the band 608-614 MHz is also allocated to the radio astronomy service on a secondary basis.5.312 Additional allocation: in Armenia, Azerbaijan, Belarus, the Russian Federation, Georgia, Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan and Ukraine, the frequency band 645-862 MHz, and in Bulgaria the frequency bands 646-686 MHz, 726-753 MHz, 778-811 MHz and 822-852 MHz, are also allocated to the aeronautical radionavigation service on a primary basis. (WRC-19)5.312A In Region 1, the use of the frequency band 694-790 MHz by the mobile, except aeronautical mobile, service is subject to the provisions of Resolution 760 (Rev.WRC-19). See also Resolution 224 (Rev.WRC-19) (WRC-19)5.316B In Region 1, the allocation to the mobile, except aeronautical mobile, service in the frequency band 790-862 MHz is subject to agreement obtained under No. 9.21 with respect to the aeronautical radionavigation service in countries mentioned in No. 5.312. For countries party to the GE06 Agreement, the use of stations of the mobile service is also subject to the successful application of the procedures of that Agreement. Resolutions 224 (Rev.WRC-19) and 749 (Rev.WRC-19) shall apply, as appropriate. (WRC-19)5.317A The parts of the frequency band 698-960 MHz in Region 2 and the frequency bands 694-790 MHz in Region 1 and 790-960 MHz in Regions 1 and 3 which are allocated to the mobile service on a primary basis are identified for use by administrations wishing to implement International Mobile Telecommunications (IMT) – see Resolutions 224 (Rev.WRC-19), 760 (Rev.WRC-19) and 749 (Rev.WRC-19), where applicable. This identification does not preclude the use of these frequency bands by any application of the services to which they are allocated and does not establish priority in the Radio Regulations. (WRC-19)5.323 Additional allocation: in Armenia, Azerbaijan, Belarus, the Russian Federation, Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan and Ukraine, the frequency band 862-960 MHz, in Bulgaria the frequency bands 862-880 MHz and 915-925 MHz, and in Romania the frequency bands 862-880 MHz and 915-925 MHz, are also allocated to the aeronautical radionavigation service on a primary basis. Such use is subject to agreement obtained under No. 9.21 with administrations concerned and limited to ground-based radiobeacons in operation on 27 October 1997 until the end of their lifetime. (WRC-19) |

1. In Albania, Germany, Austria, Belgium, Bosnia and Herzegovina, Bulgaria, Vatican, Croatia, Denmark, Spain, Estonia, Finland, France, Georgia, Hungary, Ireland, Iceland, Italy, Latvia, Liechtenstein, Lithuania, Luxembourg, Republic of North Macedonia, Malta, Moldova, Monaco, Norway, the Netherlands, Poland, Portugal, Slovakia, the Czech Republic, Romania, the United Kingdom, San Marino, Serbia, Sweden, Switzerland, Turkey and Ukraine. [↑](#footnote-ref-1)
2. Azerbaijan, Bulgaria, Georgia and Ukraine [↑](#footnote-ref-2)
3. Azerbaijan, Bulgaria, Romania and Ukraine [↑](#footnote-ref-3)
4. In Germany, Austria, Denmark, Estonia, Liechtenstein, the Czech Republic, Serbia and Switzerland. [↑](#footnote-ref-4)
5. Study on the use of the sub-700 MHz band (470-694 MHz), Final Report, November 16, 2022, LS Telecom and VVA for the European Commission [(link](https://digital-strategy.ec.europa.eu/en/library/study-use-sub-700-mhz-uhf-band-tv-broadcasting-and-events?utm_source=dae&utm_medium=email&utm_campaign=dae%20Newsroom&utm_content=Publication&utm_term=dae%20Newsroom)) [↑](#footnote-ref-5)
6. Responses of administrations are available in full in Report ITU-R BT.2302-1. The responses of Spain and Lithuania were updated in 2021/2. These modifications are included in Figure 1 and have been included in the proposed revision of Report ITU-R BT.2302-1 submitted to Study Group 6 in September 2022 (Doc 6/267). [↑](#footnote-ref-6)
7. Source : 2020 answers to the WP 6A’s questionnaire on spectrum use and spectrum needs of the broadcasting service in the UHF band, as presented in Report ITU-R BT.2302-1. [↑](#footnote-ref-7)
8. Task Group 6/1 Chairman’s Report Annex 3 – Document 6-1/106 (<https://www.itu.int/md/meetingdoc.asp?lang=en&parent=R19-TG6.1-C-0106>) or <https://www.itu.int/md/meetingdoc.asp?lang=en&parent=R19-TG6.1-C-0106> [↑](#footnote-ref-8)
9. Except Mongolia and including the Islamic Republic of Iran. [↑](#footnote-ref-9)
10. EBU Technical Report 063: 5G Broadcast Network Planning and Evaluation – <https://tech.ebu.ch/publications/tr063>. [↑](#footnote-ref-10)
11. This approximately equates to 11 Mbits/s in an 8 MHz channel. [↑](#footnote-ref-11)
12. See ETSI TS 103 720 V1.1.1 (2020-12) 5G Broadcast System for linear TV and radio services; LTE-based 5G terrestrial broadcast system - <https://www.etsi.org/deliver/etsi_ts/103700_103799/103720/01.01.01_60/ts_103720v010101p.pdf>. [↑](#footnote-ref-12)
13. 1.38 broadcasting service: A radiocommunication service in which the transmissions are intended for direct reception by the general public. This service may include sound transmissions, television transmissions or other types of transmission (CS).” [↑](#footnote-ref-13)
14. EBU Technical Report 64: Compatibility between 5G Broadcast and other DTT systems in the sub 700 MHz band – <https://tech.ebu.ch/publications/tr064> . [↑](#footnote-ref-14)
15. Geneva 06 was a regional agreement dealing with the broadcast frequency bands 174 – 230 MHz and 470 – 862 MHz covering ITU Region 1 and the Islamic Republic of Iran but excluding Mongolia. [↑](#footnote-ref-15)
16. [Home - The Locat Project](https://thelocatproject.org/) [↑](#footnote-ref-16)