

Protecting the sub 700MHz band for broadcasting

Introduction

This paper explores the importance of protecting the sub-700 MHz band for terrestrial broadcasting. It has been compiled on behalf of EBU¹ and BNE² to provide a basis for an informed decision in connection with upcoming World Radio Conference 2023.

Both EBU and BNE are conducting and supporting several activities in preparation for WRC-23. This includes active support in ITU studies and participation in ITU meetings, active participation in numerous conferences as well as active membership, support and participation in 3GPP, 5G-MAG and DVB. Both organisations also have regular contacts and discussion with CEPT, the European Commission and other European and International institutions and organisations.

Background

Terrestrial broadcasting is the leading distribution platform in Africa which provides free-to-air TV, universal coverage and high reliability. Reception is simple and low cost through easily-installed antennas and standard TV sets without any supplemental equipment. Decisions affecting the use of the UHF band (470-694 MHz) used for terrestrial Television in ITU Region 1 (Africa, Europe, Middle East) will be discussed and taken at the forthcoming World Radio Conference in 2023 (WRC-23) under Agenda Item 1.5.

Executive summary

In the preparatory discussions for WRC-23 it has been suggested that a co-primary allocation for the Mobile Service in the 470-694 MHz band in Region 1 should be introduced alongside the current primary allocation for the Broadcasting Service. The main justification for this additional Mobile allocation is a claim that this would increase coverage, capacity and performance of wireless internet services in rural areas.

Digital Terrestrial Television (DTT) uses the 470-694 MHz UHF frequency band (the sub 700 MHz band) for TV broadcasting. This is the only UHF spectrum available for broadcasting after clearance of the 800 MHz and 700 MHz bands for use by mobile. The introduction of better digital modulation techniques and compression algorithms allowed DTT to retain its service offering after clearance of the 700 and 800 MHz bands. However, DTT cannot sustain any further reduction or clearance of available spectrum if it is to continue to operate and further develop.

Whilst DTT has no other frequency bands it can use, it should be noted that the mobile service, predominantly IMT, has plenty of unused spectrum. Any issues around capacity in rural areas are due to lack of infrastructure

¹ The European Broadcasting Union (EBU) is the world's leading alliance of public service media (PSM), with 115 member organizations in 56 countries and an additional 31 Associates in Asia, Africa, Australasia, and the Americas. EBU Members operate nearly 2000 television, radio and online channels and services, and offer a wealth of content across other platforms. Together they reach an audience of more than one billion people around the world, broadcasting in about 160 languages.

² Broadcast Networks Europe (BNE) represents Europe's terrestrial network operators in Europe and internationally. Terrestrial broadcast network operators are responsible for managing, operating, and maintaining the infrastructure that brings TV, radio and other wireless and over-the-air services to homes, cars, and other users. As an organisation, BNE support an efficient and fair regulatory environment that gives European citizens universal access to the TV and radio content they watch and enjoy.

and appropriate business models, not one of a lack of spectrum. According to the ITU³, in rural Africa, 20% of the population is not even covered by 2G mobile services, and 78% are not covered by mobile services in the 700 or the 800 MHz bands. Existing use of spectrum by IMT represents less than 10% of the 15 GHz already allocated to it, and this should be examined prior to discussing further allocation of spectrum to mobile.

Regional regulators will need to weigh up the cost-benefit of a further “digital dividend” bearing in mind the impact to both DTT and PMSE, and the limited incremental value of additional spectrum to mobile, also taking into account that the focus for mobile deployment is now shifting to higher bands.

For political, economic, social, technology and environmental reasons, a “no change” to the current primary allocation of the 470-694 MHz band would best support the long-term interest of the overwhelming majority of countries in Africa. It would protect the investment in the roll out of digital terrestrial television networks and the associated growth of a thriving content and cultural industry. It would not preclude alternative uses by some countries.

On the other hand, a co-primary allocation to mobile of the 470-694 MHz band would create major uncertainty on the African continent, at a time when stability and focus is needed to secure the great benefits of both broadcasting and mobile for citizens and society. .

Under the current balanced allocations in the 470-960 MHz UHF band, now is not the time to allocate broadcasting’s remaining spectrum to mobile, thereby putting in jeopardy DTT and citizens’ access to cheap, reliable and inclusive information.

Our position

The position of the European Broadcasting Union and Broadcast Networks Europe is that there should be “no change” to the current primary allocation of the 470-694 MHz band at WRC-23.

Why the “No change” position

In line with United Nations Sustainable Development Goal No. 9⁴, countries are seeking to develop sustainable, resilient and inclusive infrastructure to provide universal access to information and communications technology. Terrestrial broadcasting and satellite have been providing citizens with access to information for many years and, as part of the need to include all citizens, they are expected to do so for many years to come.

The EBU and BNE recognize the need to improve and expand broadband infrastructure, be it through wire/fibre or wireless (mobile) but this must not be to the exclusion of other existing systems; in particular Digital Terrestrial Television (DTT). The 470-694 MHz UHF frequency band (the sub 700 MHz band) is used for TV broadcasting and is shared by Programme Making and Special Events (PMSE) applications⁵ which use the same frequency band for programme and event content production.

While discussion around Agenda Item 1.5 will focus on the needs of mobile it should be recognised that insufficient mobile capacity in rural areas is only an issue because of lack of infrastructure and the problems with coverage this causes, not one of a lack of spectrum. Where the mobile business model prevents it from rolling out infrastructure in sparsely populated rural areas, coverage in such areas should be mandated via regulation at the time licences are awarded, by direct intervention by Government (as seen recently in Germany) or alternative approaches such as the Shared Rural Network (SRN) being deployed in the UK. If infrastructure for such solutions doesn’t exist, then alternative technologies for delivery of broadband may be more appropriate;

³ ITU-D facts and figures 2020, page 5

⁴ UN Sustainable Development Goal No. 9: “Build resilient infrastructure, remote inclusive and sustainable industrialisation and foster innovation”, in particular Goal 9.C: “Universal access to information and communication technology”.

⁵ PMSE includes systems such as wireless microphones which are an essential part of any TV production, and are also widely used in stage shows, community events etc.

such as the LEO satellite systems Starlink or One Web, GSO systems such as Konnect or, in future, base stations based on HIBS (High altitude base stations – automated drones).

None of these solutions require additional sub 1 GHz spectrum for either capacity or coverage and in fact all benefit from the use of higher frequencies to enable the features of 5G such as MIMO and Active Antenna Systems (AAS).

If capacity is really an issue in a particular rural area, then the question must be asked whether existing 700, 800 & 900 MHz bands are being effectively used. It is likely to be more appropriate to address capacity hotspots with higher frequency bands. Additional sub-1 GHz spectrum will not be an effective way of adding capacity or providing the benefits of 5G. The features of 5G that provide capacity and differentiate it from 4G, namely MIMO and AAS, are largely absent from systems operating below 1 GHz.

In the sub 1 GHz spectrum, the mobile service has allocations in the 400 MHz, 700 MHz, 800 MHz and 900 MHz bands. This spectrum is currently inefficiently organised and elements of it are using legacy technology, such as 2G and 3G, that eventually will be phased out. Prior to allocating mobile any further sub 1 GHz spectrum, better use should be made of the spectrum resources already allocated.

IMT has over 15 GHz of spectrum allocated, including 306 MHz of sub 1 GHz spectrum. Yet stakeholders are, in general, using less than 10% of the total allocated spectrum for the Mobile Service⁶.

Furthermore, antenna size in the lower part of the UHF restricts the practical IMT application to devices with external antennas, such as Police Radios.

Any attempt to share spectrum between broadcasting and mobile services following a co-primary allocation will lead to Mutually Assured Destruction as the mobile and the DTT systems will interfere with each other even with separations over hundreds of kilometres (see Reports ITU-R [BT.2301](#), [BT.2337](#) and current TG6/1 studies). Such usage sterilises large geographical areas where neither system can be operated.

Given that;

- Problems with capacity and coverage are not due to a lack of spectrum, but rather a lack of infrastructure to use the available spectrum;
- In any area, but particularly rural areas, most of the spectrum allocated to IMT is unused;
- Only spectrum above 1 GHz allows 5G to deliver its promised improvements;

we suggest that at a regional level there is no need for additional sub-1 GHz spectrum for mobile and there should be “no change” in the current allocation for Region 1.

Political factors

A major political reason for ensuring stability in the current broadcasting allocation is that 41 out of 48 countries in Sub Sahara Africa have launched DTT, including 18 since WRC-15. These are significant national investments bringing long-term benefits to their population.

Giving mobile an allocation in the band (470-694 MHz) would threaten this investment and potential deprive citizens of a valuable source of information and entertainment. The reason is summarized in the Aetha study on the future use of the UHF band: “We note that the history of UHF spectrum previously used for broadcasting being given co-primary status by World Radiocommunication Conferences has directly led to the spectrum being cleared for mobile services or preparations for the spectrum being cleared”⁷.

⁶ Following WRC-19, over 15 GHz of spectrum has been allocated to mobile. Usage is presently limited to the lower and medium frequencies under 4 GHz which accounts for about 10% of the total available spectrum.

⁷ Aetha study on the [“future use of the 470-694 MHz band”](#), 2014 – see page 42 in particular

Furthermore, more low-band spectrum for IMT would not solve the digital divide. According to the ITU⁸, in rural Africa, 20% of the population is not even covered by 2G mobile services, and 78% not covered by mobile services neither in the 700 nor the 800 MHz bands. The digital divide is not caused by insufficient allocation of low band spectrum to IMT, but rather by insufficient infrastructure investment by the mobile industry. It should also be noted that at the previous World Radio Conference, WRC 2019, African states supported a position against the co-primary allocation of the core audio-visual band (470-694 MHz).

From the political standpoint, the current allocation in the 470-960 MHz band is well balanced between broadcasting and telecommunication needs, and any change in the 470-694 MHz band would be at the expense of the long-term political goals on DTT.

Economic factors

Efficient and well-balanced use of spectrum will bring needed investment, innovation, reliable and equitable distribution of information, as well as impact positively on climate change and contribute positively to the achievement of the Sustainable Development Goals.

The development of a healthy broadcasting sector through digital terrestrial television is an essential driver for the African content and cultural industries, which in turn foster national status, tourism and soft power. The role of DTT in building African human capital based on ethically controlled local content was emphasized by the African Union of Broadcasting⁹, while the role of the UHF spectrum in fostering national and regional content and cultural industries is indisputably recognized in other continents such as Europe¹⁰.

This does not contradict the development of the telecommunication sector, which in Africa, has already potential access to about the same spectrum as in all other ITU regions, thanks to the IMT allocation of the 900, 800 and 700 MHz bands, although spectrum for different services may be stacked differently between regions.

Regional regulators will need to weigh up the cost-benefit of a further “digital dividend” bearing in mind the impact to both DTT and PMSE, and the limited incremental value of additional spectrum to mobile, also taking into account that the focus for mobile deployment is now shifting to higher bands.

Other aspects to consider are the time required to re-plan and re-farm DTT and PMSE services, bearing in mind DTT is still being rolled out in many countries and in some, 700 MHz or 800 MHz clearance hasn't yet happened. In addition, the costs associated with re-farming are substantial.

Social factors

The United Nations Sustainable Development Goals (SDGs) require universal access to information. TV and Radio are currently the most accessible and most affordable media for information distribution. No other distribution platforms can realistically replace DTT in the foreseeable future. DTT is part of a much broader discussion relating to the support and promotion of local content and culture, as well as social cohesion and a catalyst for bonding communities. Terrestrial broadcasting services are essential for African citizens, for upholding civic values and for the African Content and Cultural industries. Broadcasting is important in Africa because most Africans get their information, education, and entertainment from radio and television. African states stand to gain most if the current use of spectrum for broadcasting is maintained. Broadband and data cost are still expensive in African countries and most Africans still rely on terrestrial broadcasting for public information and entertainment. The result of a recent ITU questionnaire¹¹ show that 95 Countries in Region 1 will require 224 MHz or more in the UHF band for DTT in the future. The result also shows that current framework serves the general interest best.

⁸ ITU-D facts and figures 2020, page 5

⁹ AUB presentation at the 5th Sub Sahara Spectrum management conference, 2020

¹⁰ [A shared vision for the members of the Wider Spectrum Group](#), 2018

¹¹ Circular letter 6/LCCE/104 addressed to all Region 1 member states in February 2020

Technological factors

Technically, Broadcasting and IMT cannot share spectrum between neighbouring countries without interference. Furthermore, studies being conducted to prepare for WRC-23 show that mobile services and DTT cannot share spectrum at the same location because they have fundamentally different technical characteristics.

Therefore, it is not realistic to state that a coprimary allocation would allow each country to decide now or in the future on the best use of the spectrum independently of their neighbours.

The primary features of 5G that allow it to offer increased capacity are more bandwidth, massive MIMO, and active antenna systems (AAS). These are not implemented in sub 1 GHz because the wavelengths are too long, and the low frequencies limit usable bandwidth. Providing additional sub 1 GHz spectrum will not enable the full benefits of 5G.

Small differences in building penetration across the frequency range 470 MHz to 3 GHz, to handheld devices, are offset by much better antenna efficiency as frequencies increase. The commonly held belief that low frequencies offer better coverage is only correct if receive antennas are an appropriate size. If you don't have an efficient antenna your device will be deaf. The lower UHF spectrum is therefore best suited for fixed applications such as TV or professional applications where receive antenna size is not constrained by aesthetics or device size.

Coverage in rural areas isn't limited by lack of sub 1 GHz spectrum, but rather by a lack of infrastructure and the commercial business case to deploy it. If the mobile business model prevents it from rolling out infrastructure in deep rural areas (sparsely populated), coverage in such areas should be mandated via regulation at the time licenses are awarded, by direct intervention by Government. Some European countries¹² have reached this conclusion and are working on their rural coverage plans looking for strategies to make it economically viable to deploy in rural areas, such as infrastructure sharing. If the size of a country means that infrastructure for such solutions doesn't exist or isn't commercially viable, such as in many African countries, then alternative strategies for delivering broadband are required, either the LEO satellite systems Starlink or One Web, GSO systems such as Konnect or future base stations based on HIBS. None of these solutions require additional sub 1 GHz spectrum for either capacity or coverage and in fact all benefit from the use of higher frequencies to enable the features of 5G such as MIMO and AAS, and or HIBS.

Environmental factors

Practically all countries in Africa are using DVB-T2 technology and the sub 700 MHz spectrum for broadcasting. This is because DTT is the most sustainable form of broadcast distribution in the long term. It is reliable, more energy efficient¹³, and it has a wider population coverage per mast making it more sustainable and climate smart. It is more robust with regards to its ability to withstand bad weather and its impact on climate change is low. It can use renewable energy¹⁴.

Legal factors

Following the decisions to clear the 800 MHz and 700 MHz bands and use these bands for mobile services, African states have made a formidable effort to plan, re-stack and align their spectrum plans to accommodate the Broadcasting services in the sub 700 MHz band. This took many years to achieve; therefore, any changes to the underlying agreements will undoubtedly be disruptive. Introduction of alternative use of spectrum below 700 MHz would still need to respect the GE06 agreement granting protection to the Broadcasting Service and - in Africa, as a primary allocation - Radio Astronomy, and be done at regional level.

¹² For example, in the UK the Shared Rural Network (<https://srn.org.uk>), and in Germany the formation of a government backed company MIG (<https://netzda-mig.de/>) to manage filling in areas of poor or no coverage.

¹³ BBC white paper : <https://www.bbc.co.uk/rd/blog/2020-09-sustainability-video-energy-streaming-broadcast>. The results which are in the UK context are currently being reproduced and confirmed in a wide range of countries by studies carried out by BNE.

¹⁴ Report ITU-R BT.2385.

Reciprocally, it must be stressed that stability in the current international framework (ie of primary allocation only to Broadcasting in the 470-694 MHz band) would not prevent introduction of other uses for some individual countries, if they so choose, provided they respect the GE06 agreement¹⁵.

In summary, a co-primary allocation would not in practice be a step towards more flexibility, as it is already possible under the current framework. It would simply on the contrary generate uncertainty for the overwhelming majority of countries which have invested in DTT.

Development of terrestrial Broadcasting services

DVB-T2 offers unbeatable spectrum efficiency, but DTT networks and systems continue to innovate to offer improved services to viewers. Recent improvements in video coding technologies hold out the prospect of widespread UHD services on DTT in coming years; interactive broadcast/broadband systems (such as HbbTV) can make use of the best features of both broadcast and broadband for a truly integrated viewing experience, and these are now being deployed by broadcasters across the world. Newly standardised broadcast systems such as 5G Broadcast¹⁶ are designed to allow free-to-air reception of broadcast services on mobile handsets without the need to change allocations in the Radio Regulations. More details of expected future developments in DTT can be found in the recent revision of Report ITU-R BT.2302.

Conclusion

In conclusion, we are of the view that digital terrestrial broadcasting provides the most affordable and most equitable form of media distribution. While spectrum is a scarce natural resource, in Africa, there will still be ample spectrum for all uses, without changing the allocation of the band 470-694 MHz. In our view, there are strong arguments in favour of a “no change” decision for the spectrum allocation with regard to the sub 700 MHz UHF band at WRC-23, thus securing the great benefits of both broadcasting and mobile for citizens and society.

Going forward

EBU and BNE has engaged Mr Joe Frans at NGA Novum AB for support in liaising with African stakeholders in close cooperation with representatives from EBU and BNE. Further contacts following this White Paper will primarily be handled by Mr Joe Frans of NGA Novum AB, on behalf of EBU and BNE.

Geneva and Brussels, August 2021

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¹⁵ The current UHF decision in Europe, for instance, includes such provisions for flexibility while clearly emphasizing certainty and protection for terrestrial broadcasting and PMSE in the 470-694 MHz band.

¹⁶ 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