African Union Commission
Department of Infrastructure and Energy

GUIDELINES ON THE HARMONIZED USE OF THE DIGITAL DIVIDEND IN AFRICA

POLICY, TECHNICAL AND REGULATORY PROCEDURES

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ABOUT THE COMMISSION OF THE AFRICAN UNION

The African Union (AU) was officially launched in July 2002 in Durban, South Africa, following a decision in September 1999 by its predecessor, the Organization of African Unity (OAU) which was formed in 1963, to create a new continental organization to build on its work.

A total number of 54 countries joined the new organization, whose headquarters remained in Addis Ababa, Ethiopia.

The Commission of the African Union (AUC) is the secretariat of the AU, entrusted with executive functions, it is composed of ten officials, a Chairperson, a Deputy Chairperson and eight Commissioners.

The structure represents the AU and protects its interests under the auspices of the Assembly of Heads of States and Governments as well as the Executive Committee. The AUC is made up of portfolios which are: Peace and Security, Political Affairs, Trade and Industry, Infrastructure and Energy, Social Affairs, Rural Economy and Agriculture, Human Resources, Science and Technology, and Economic Affairs.

The guiding vision for Agenda 2063 is the AU Vision of: "An integrated, prosperous and peaceful Africa, driven by its own citizens and representing a dynamic force in the global arena". The mission of the AU Commission is "to become an efficient and value adding institution driving the Africa integration and development process in close collaboration with African Union Member States, the regional economic communities, and African citizens

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Comments on the initial outline of the report were provided by experts attending the first ATU WRC-19 Preparatory Working Groups meeting held in Nairobi, Kenya 18 to 20 July 2017.

Additional comments were received at various stages of production of these guidelines by African experts, African Telecommunication Union (ATU), the Industry as well as from Regional Association of Regulators namely Communications Regulators Association of Southern Africa (CRASA).

1. EXECUTIVE SUMMARY

In the emerging markets of Africa, the potential of communications technology to advance economic growth and deliver social benefits is arguably greater than anywhere else in the world. Spectrum policy is fundamental to any effort to realize information and communication technology (ICT) growth. Thus, regulators, policymakers, and stakeholders throughout the region need to develop coherent spectrum policy frameworks that will ensure the value of spectrum is maximized for Africa, its member states and its 1.2 billion citizens.

It is a well-known fact that African delegates to the International Telecommunication Union (ITU) World Radiocommunication Conferences (WRCs) were the key drivers towards the allocation of both the 800 MHz and the 700 MHz as the first and second digital dividends (DDs) at WRC-2007 and WRC-2012 respectively. Despite such efforts, Africa still lags behind other regions in releasing and assigning the dividend bands for broadband services. Due to the delay in planning and releasing the bands, Africa continues to lose potential benefits of broadband penetration that directly correlate to GDP growth.

In an effort to promote the most beneficial use of ICTs and, in particular, the digital dividend, the African Union Commission (AUC) was requested by its organs to help African countries build their radio spectrum management capacity for the optimum and harmonized use of this scarce resource at the regional and continental levels. In this regard, the African Union Heads of States and Government called for the harmonization and efficient management of radio frequency at both national and regional levels as per AU Executive Council Decision Assembly/AU/11 (XIV), adopted in July 2010. To this end, the AUC commissioned in 2016 a consultancy geared towards ensuring that the African region as a whole maximizes the benefits from its 2007 and 2012 WRC investments in realizing the first and second digital dividends. The AUC is not only working to ensure that the digital dividend spectrum is released, but also to encourage a harmonized approach to the digital dividends in order to ensure that there is an appropriate variety of devices able to operate in the bands and which can be used with networks across Africa and beyond. Harmonization will benefit economies of scale and help to lower device costs. Such activities will require considerable engagement with stakeholders, including development of information-sharing and coordination activities.

This report focuses on the policy, regulatory and technical components of the Guidelines for Harmonized Use of Digital Dividend Spectrum in Africa.

The report includes:

- a summary of the status of the migration to digital television in Africa and the plans for analogue television switch-off (ASO);

- introduction to and definition of the digital dividend;
- the details of various options for digital dividend spectrum harmonization;
- a recommended plan for the 700 MHz, 800 MHz, 850 MHz and 900 MHz bands;
- policy and regulatory guidance on the harmonized use of the digital dividend; and
- Opportunities for and effective use of the digital dividend in Africa.

In the report, various channeling plans for digital dividend 1 (DD1) and digital dividend 2 (DD2) are analyzed, leading to a recommendation for deployment across Africa that will offer the best chance of harmonization of both DD1 and DD2 across Africa and between Africa and the rest of the world.

After thorough analysis, it is recommended that all African nations adopt a 2x30 MHz band plan consisting of 703-733 MHz (uplink) paired with 758–788 MHz (downlink) as the preferred plan for the 700 MHz band.

Furthermore, we recommend adoption of a 2x30 MHz band plan that consists of 832-862 MHz (uplink) paired with 791-821 MHz (downlink) in the 800 MHz band.

We further recommend the adoption of a 2x35 MHz band plan consisting of 880-915 MHz (uplink) paired with 925-960 MHz (downlink) in the 900 MHz band, extending the existing 900 MHz band usage by 2 x 10 MHz.

Harmonization of spectrum plans and regulatory frameworks across countries and regions leads to lower costs for consumers, as device manufacturers can mass-produce devices with less-complex radio requirements and that work in multiple countries on the same frequency band, enabling seamless roaming. Greater harmonization of spectrum plans also reduces the likelihood of cross-border interference.

In addition, harmonizing spectrum utilization in Africa, particularly for mobile broadband access, will enhance the development of the information society by generating significant social and economic benefits for the citizens of the African states.

2. BACKGROUND

These guidelines are proposed against a backdrop where:

1. The full transition from analogue to digital television broadcasting and the switch off of analogue services was expected before an agreed deadline of 17 June 2015. Recalling that for ITU Region 1, including Africa, the ITU Regional Radio Communication Conference held in Geneva in 2006 (RRC-06) decided that analogue terrestrial television broadcasts would cease by 17 June 2015 in the UHF band and 17 June 2020 for some countries in the VHF band. Several activities, at international and continental levels, have been carried out by the AU Commission in cooperation with Specialized Institutions and Agencies to support AU Member States to accelerate the transition and enable use of part of the digital dividend.

2. Despite their commitment to complete the migration within the ITU deadline, only eight African countries have been able to migrate. Thirty-nine countries are at various stages in the switch-over process due to various challenges, and five countries have not started. As per Decision Assembly/AU/Dec. 533 of the XXIII Assembly of the African Union held on June 2014, the AUC hosted a joint AUC, AUB and ATU experts meeting to review the transition status of the AU Member states and set up the African Technical Committee (ATC) with focus on developing appropriate practical modalities for the implementation of the strategy for African countries to complete the transition.

3. The African Union Commission has been requested by its organs to assist African countries to build their capacity on radio spectrum management for optimum and harmonized use of this scarce resource at regional and continental levels. Consequently, the African Union Heads of States and Government called for the harmonization and efficient management of radio frequency at both National and Regional levels as per the AU Executive Council Decision (Assembly/AU/11 (XIV) adopted in July 2010.

3. STATUS OF MIGRATION IN AFRICA AND OTHER REGIONS

3.1 STATUS OF MIGRATION IN AFRICA

In summary, 8 countries in Africa have migrated, 39 countries have commenced the ASO process and in various stages of actualization, 5 countries have not started, and the status of 3 countries could not be determined.

Success stories	Kenya, Malawi, Mauritius, Mozambique, Namibia, Uganda, Rwanda and Tanzania.
In progress	Algeria, Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroun, Cape Verde, Chad, Congo Republic, Congo DR, Cote d'Ivoire, Egypt, Equatorial Guinea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea Bissau, Lesotho, Madagascar, Mali, Morocco, Niger, Nigeria, Sao Tome & Principe, Senegal, Seychelles, Sierra Leone, South Africa, South Sudan, Sudan, Swaziland, Togo, Tunisia, Zambia, , Zimbabwe.
Not started	Central African Republic, Comoros, Eritrea, Liberia, Libya.
Not known	Djibouti, Mauritania, Somalia.

3.2 STATUS OF MIGRATION AND USE OF THE DIGITAL DIVIDEND IN OTHER REGIONS

3.2.1 REGION 1

3.2.1.1 EUROPE

The analogue to digital TV switchover in Europe began as early as 1997. Following RRC-06, the CEPT countries implemented the new digital frequency plan for terrestrial broadcasting and switched off analogue television by 1 January 2012, releasing DD1 frequencies in the 800 MHz band in Europe. Individual administrations then assigned their DD1 spectrum through auctions.

EU countries have now turned their attention towards DD2, namely the 700 MHz band (694-790 MHz). The CEPT countries have adopted harmonized use of the spectrum and decided on the channeling arrangement using a 2×30 MHz channel arrangement based on the "lower duplexer" of the 700 MHz band plan being implemented by several countries in Asia-Pacific (known as the APT band plan), to take advantage of economies of scale. Most EU countries have stated their intention to release the 700 MHz band for mobile broadband services.

3.2.1.2 GULF STATES

Considering the Gulf States, several have completed their migration or are in the process of doing so, while information on some is unavailable.

Migrated	Bahrain, United Arab Emirates, Oman, Qatar and Saudi Arabia.
Partially migrated	Kuwait
Not known	Yemen, Iraq.

3.2.1.3 REGIONAL COMMONWEALTH IN THE FIELD OF COMMUNICATIONS (RCC) COUNTRIES

In the RCC countries, Russia and Ukraine are in the process of their transition to DTT, with ASO scheduled for 2019 and 2018, respectively.

Russian Federation	ASO process began in 2014, expected to end in 2019.
Ukraine	The ASO was planned to be completed by June 2015 but has been delayed until 30 June 2018.
Other RCC countries	Accurate information on the status on migration in other RCC countries was not immediately available within the time of this consultancy.

3.2.2 REGION 2

In Region 2, the transition from analogue to digital television varies from country to country.

3.2.2.1 UNITED STATES

The transition to digital television using the Advanced Television Systems Committee (ATSC) standard took place in 2009. The 700 MHz digital dividend was released through a 2008 auction that divided the band into five blocks and a number of geographic areas. Ultimately, 101 bidders obtained licenses in the 700 MHz band. In 2016-2017, the United States auctioned spectrum in the 600 MHz band through an "incentive auction," a voluntary mechanism that encouraged broadcasters to relinquish their spectrum usage rights in exchange for a share of the proceeds of the auction of the spectrum for new uses.

3.2.2.2 LATIN AMERICA

Mexico completed ASO on 31 December 2015 using the ATSC standard and freed up 48 MHz of spectrum in the 700 MHz band. Brazil and other Latin American countries largely expect to complete ASO by 2018. Brazil has adopted the Integrated Services Digital Broadcasting — Terrestrial (ISDB-T) standard (originally developed in Japan) and renamed it Brazilian Digital Television System (Sistema Brasileiro de Televisão Digital (SBTVD). Following Brazil's lead, Argentina, Venezuela, Chile and Uruguay have also chosen SBTVD for their digital terrestrial television networks.

Panama, Colombia, Suriname and Guyana have adopted the Digital Video Broadcasting — Terrestrial (DVB-T) standard that was adopted in Europe and elsewhere.

3.2.3 REGION 3

With the exception of Iran, the countries in Region 3 are not signatories to the GE-06 ITU agreement, but are also migrating to DTT. For example, Australia completed its migration in 2010 and Japan in 2011. The migration date of other countries varies from 2017 (e.g., India, Sri Lanka and Singapore) to 2020 in countries including China and Vietnam. The compression standards also vary, including DVB-T2, ISDB-T, the DTMB standard developed by China, and the T-DMB standard developed by South Korea.

3.3 INSTITUTIONAL ARRANGEMENTS AND RECOMMENDATIONS FOR SMOOTH MIGRATION AT NATIONAL AND CONTINENTAL LEVELS

The transition from analogue to digital broadcasting is a long and complex process that requires the involvement of various stakeholders throughout. The level of success of the migration process has been low in Africa, with only eight countries having successfully migrated by November 2016. The challenges that have been reported by countries who have migrated have included:

- Lack of political support;
- Lack of funds for the migration process;
- Lack of public awareness and involvement of all the stakeholders;
- Lack of skills and technical abilities; and
- Existing operators' resistance to competition created by the expanded market opportunities.

It is essential, therefore, that those African countries that have not yet migrated take all possible measures to forestall these problems. Recommended guidelines include:

1. Develop and implement a migration strategy and obtain the necessary political backing before commencement of the ASO process, with the full involvement of all relevant stakeholders to spearhead the migration process. These should include, inter alia, regulators, concerned government ministries, broadcasters, telecommunications operators, equipment vendors, and civil society.
2. Ensure adequate funding for the migration process, including funds for consumer awareness campaigns and any necessary subsidy programmes.
3. Ensure availability of affordable digital set-top boxes (STBs).
4. Establish a national digital TV migration project office or identify a responsible government agency to facilitate and coordinate smooth transition, including a well-orchestrated publicity campaign.

3.4 DIGITAL MIGRATION FUNDING OPTIONS

Deployment of DTT infrastructure is a heavy investment which requires reliable sources of funding to fully realize the digital migration. Therefore, African governments that have not migrated must decide on how to finance the digital migration process, and those that have begun the process must ensure that they have allocated sufficient funds to complete the process they have established.

There are various possible sources of finances to fund digital migration. Some of these sources include:

1. National budgetary allocation from the exchequer;
2. External financing through concessionary loans from institutions such as the World Bank, African Development Bank, Islamic Development Bank, and Regional Economic Communities etc.;
3. Usage of existing national telecommunications development funds, such as an ICT fund or universal service fund;
4. Public-Private Partnership (PPP) vehicles;
5. Auctioning of the planned digital dividend frequencies and use of proceeds to finance the digital migration; and
6. Encouragement of the financing of set-top box manufacturing in the African region in order to both boost local industry and benefit from the overall market effect, and to reduce the cost of set-top boxes brought into African markets.

While a combination of i) and iii) could be considered the fastest and possibly easiest financing solutions to put into place, each country must evaluate its own needs and available resources in order to devise the most suitable financing solution.

3.5 SEGMENTATION OF THE BROADCASTING MARKET IN THE DIGITAL ERA

The broadcasting market in the digital era is radically different from the analogue era. Previously, broadcasters (also known as content service providers) were responsible for content development and delivery of the same to the target market. In the digital era, however, content development/aggregation and content delivery can be two separate and distinct market segments. The content will be developed by broadcasters (or sourced from third parties and aggregated by broadcasters) and content is delivered to viewers by multiplex/signal distributors at an agreed quality of service. It is worth noting, however, that in some cases a single entity may serve as both a broadcaster and a multiplex/signal distributor.

a) Creation of content providers market segment:

The governments of the respective African countries must create very well-defined policies for the creation of the content market segment, as well as for how to license broadcasters. These policies will need to include, at a minimum:

1. Establishment of a national broadcaster for the public agenda, in fulfillment of national goals and aspirations;
2. Determination of whether broadcasters will be licensed for national or regional coverage;
3. Determination of the mix of free-to-air or conditional access for licensed broadcasters' content; and
4. If necessary, determination of the extent of content regulation and mechanisms of such regulation, which may include segregation of adult content, violence, and content likely to cause social disharmony.

b) Creation of multiplex operators/signal distributors market segment

There is a need for legislation in each country that will clearly spell out the creation and governance of the multiplex operators/signal distributors for the delivery of the content created by broadcasters. The number of signal distributors ought not to be capped, but rather be determined through market considerations and available spectrum, so as to allow pluralism and private investments.

In order to ensure the fulfillment of national goals and aspirations, it is recommended that African governments establish measures to ensure that one of the signal distributors is a public entity owned and operated by the national government in order to enable the distribution of a public broadcasting network, as mentioned above.

c) Protection of existing broadcasters

The existing private investments in the broadcasting sector in Africa must be protected and their business continuity

guaranteed despite a change to the regulatory and licensing regime that is likely to occur during the term of their licenses. African governments therefore must develop appropriate policies that will guarantee the smooth migration of existing broadcasters to the new licensing regime. Such policies also minimize disruption to viewers, ensuring that their desired programming remains available during and after the transition.

d) DTT standard

It is important to define harmonized technical standards to ensure compatibility of various digital broadcasting systems within the African region. African countries need to analyze existing DTT standards available globally, conduct technical analyses, and select the best standard, ideally one that is widely adopted in other regions in order to maximize economies of scale. These standards need to be harmonized in Africa in order to achieve interoperability between various operators in the continent and the added benefit of reduced costs of service delivery.

African Member States are encouraged to adopt the following standards:

1. DVB-T2 transmission and MPEG-4 compression for DTT,
2. DVB-H for mobile reception, and
3. DVB-S2 for satellite broadcasting; and

African countries are also encouraged to adopt uniform technical specifications/standards for STBs and integrated digital TVs.

e) Regulatory Considerations

African countries must institute appropriate institutional policy, legislative and regulatory frameworks to enable the realization of the expected consumer and industry benefits. However, such benefits will only be realized in a carefully managed process that does not cause disruption of essential broadcasting services.

The appropriate broadcasting policies, legislation, and regulations need to be established, preferably through a consultative process. In cases where these instruments exist, the same must be revised going forward, so as to address these concerns, namely:

1. Define the mechanisms for licensing content service providers and multiplex operators as mentioned above. For example, multiplex operators may be authorized though a negotiated concession agreement or PPP collaboration, or a competitively sourced service provider, either through a beauty contest or an auction process.

2. Determine how existing broadcast licenses will migrate to the new regime and address associated issues such as:
   - the duration of the new licenses and the fees payable,
   - whether content providers will be required to pay for spectrum,
   - the differential of the fees payable for various geographical areas, if any, and
   - Whether spectrum fees are payable during the simulcast period, and if so, the amount of such fees.

3. The conditions of the free-to-air and conditional access content.

4. The extent and method of content regulation, if necessary.

5. Define the quality of service parameters for DTT, and ensure obligatory inclusion of this obligation in the service provider licenses.

6. Enhance existing legislation to enable competition in the expanded broadcasting space and ensure consumer protection mechanisms, such as customer care and complaint handling mechanisms.

7. Mandatory provision of service on a non-discriminatory basis, including sign language for people with impaired hearing.

8. Universal access to services.

4. THE DIGITAL DIVIDEND AND OBJECTIVES OF THESE GUIDELINES

4.1 INTRODUCTION TO THE DIGITAL DIVIDEND

It is a well-known fact that radio spectrum is a finite and limited natural resource, and that therefore ICT industry stakeholders are continuously researching and developing ways to optimize its use by way of improving spectral efficiency. Digital technology has advanced enough that we are now able to broadcast television signals much more efficiently than has been possible with analogue broadcasting.

Analogue television broadcasts occupy a large amount of sub-1 GHz spectrum in both the Very High Frequency (VHF) and Ultra High Frequency (UHF) bands. In some countries, the allocation to broadcasting (developed for analogue TV) is more than 50% of all sub-1 GHz spectrum. A single analogue TV channel can occupy 6 MHz to 8 MHz of bandwidth, but with the recent developments in digital broadcasting technology, the same 6 MHz to 8 MHz of spectrum can carry a multiplex of up to 20 digital channels, each at a quality level that is equivalent to or better than that delivered by analogue technology.

Thus, the ability to propagate up to 20 digital TV channels in an amount of spectrum equivalent to that used by just one analogue channel offers a valuable spectrum savings. The spectrum that is saved or made available as a result of the switchover from analogue to digital technology is known as the "digital dividend." In other words, the digital dividend is the amount of spectrum made available by the reduction in spectrum needed for terrestrial television broadcasting due to the transition from analogue to digital technology. In particular, in the arrangement where 8 MHz bandwidth is used as the standard analogue channel in the UHF band and 48 analogue channels were used for terrestrial television – that is, Channels 21 to 69 (470-862 MHz) – the efficiency improvement brought about by digital technology enables the use of 32 MHz of spectrum to deliver the same amount of programming via DTT as compared to the 392 MHz required for equivalent analogue broadcasts.

Considering that African countries and regions are comprised of different backgrounds, languages, and a mixture of rich cultures, the spectrum remaining after the digital transition can then be used to transmit either more digital terrestrial TV channels and programmes to support diversity, or can be made available for broadband communications services such as International Mobile Telephony (IMT), also known as 3G, 4G, and 5G, which can further enhance Internet coverage for both highly dense and rural areas. Today, the Internet plays an important role in delivering a variety of services to customers, such as education and raising literacy rates and positive impact on national gross domestic product (GDP).

The digital dividend in the UHF band remains the most important spectrum to become available in the last decade, and probably for the next decade to come. It falls in the "sweet spot" in the radio spectrum that is well-suited for both capacity and coverage, and is therefore attractive for a wide range of mobile applications in view of its suitability for indoor, outdoor and rural coverage.

A research study carried out by European Branch of Spectrum Value Partners has shown that the European economy would receive a financial boost of at least €95 billion over the next 20 years if approximately 25% of the UHF broadcasting spectrum were allocated for mobile broadband services. However, this type of value can only be realized if there is a harmonized market for mobile hardware and terminals. This, therefore, requires a common, or harmonized, spectrum allocation and channeling plan across Africa if the region is to enjoy benefits similar to Europe.

It should be noted that there are many benefits of switching from analogue to digital broadcasting, including reduction in power usage and energy consumption due to the ability to transmit several channels from a single transmitter as opposed to each broadcaster deploying parallel transmission infrastructure, and the increase in transmission quality such as via high-definition television (HDTV). However, the most valuable benefit to service providers, the government and, by extension, consumers, is the amount of spectrum that will be freed up once the migration from analogue to digital has been completed. In particular, it is expected that African countries will have up to 168 MHz of spectrum - from 694 MHz to 862 MHz (channels 49 to 69) - that was hitherto exclusively allocated to broadcast and used for analogue transmission, and which can be used for broadband services after the migration.

4.2 OBJECTIVES OF THE GUIDELINES ON THE HARMONIZED USE OF THE DIGITAL DIVIDEND

1. The guidelines aim to define key policy objectives and set up general regulatory provisions as well as the technical conditions for harmonizing the use and management of the digital dividend at regional and continental levels to ensure equitable access to radio spectrum resources, accommodate the specific needs of Africa, and consolidate the ICT market by enabling economies of scale and fostering the provision of new, affordable ICT services.

2. The objective of this consultancy is therefore: (i) to develop guidelines on policy and regulatory procedures for an optimum and beneficial use of the digital dividend and (ii) to address the growing demand for wireless data services and capacity. The harmonized use of the digital dividend at regional and continental level will contribute to the deployment of high-speed wireless broadband systems, competition, and innovation.

3. These guidelines focus in particular on developing a strategy for the allocation and assignment of the digital dividend bands, including administrative functions and market-based methods such as auctions, authorization and licensing. It also provides guidance and assistance in developing national procedures for establishing relevant spectrum frameworks to ensure an efficient and flexible use of this valuable resource by a wide range of potential applications.

4.3 SCOPE OF THE WORK

There are multiple interpretations of what constitutes the digital dividend. The primary focus of this work is what are popularly known as DD1 and DD2 within the frequency range 694-862 MHz. The applicable use of the resulting dividend to broadcast services is not the main focus of this work.

To develop these guidelines, a desk study of relevant background documents was carried out. A questionnaire was also designed and responses were obtained from Angola, Benin, Botswana, Burkina Faso, Burundi, Congo, Congo Brazzaville, Cote-D'Ivoire, Gambia, Guinea, Guinea Bissau, Lesotho, Madagascar, Mauritania, Nigeria, Senegal, South Africa, South Sudan, and Togo.

5. SPECTRUM PLANNING FOR DIGITAL DIVIDENDS 1 AND 2

In this section, the report examines various spectrum channel plans. It is intended that the best option for harmonization within Africa and with the rest of the world will be identified.

5.1 SELECTION OF OPTIONS

The AUC recognizes the fact that globally harmonized spectrum and channeling arrangements are desirable, as is regional harmonization, which is the key reason for the development of this project. A minimized number of globally harmonized frequency channeling arrangements will reduce the overall cost of networks and terminals by providing economies of scale, and facilitating deployment and cross border coordination. A common base transmit band, in particular, provides the possibility to broadcast to roaming users all information necessary to establish a call, while use of the minimum effective guard bands avoid wasting valuable spectrum.

a) Asymmetry of Traffic

In actual broadband usage scenarios, individual subscriber traffic is expected to be dynamically asymmetric, where the direction of asymmetry can vary rapidly within short (milliseconds) timeframes and over the longer term. In this context, asymmetry means that the basic amount of network traffic may differ between the uplink and the downlink directions. Administrations and operators should therefore consider asymmetric traffic requirements when assigning spectrum or implementing broadband systems. Telecommunications applications may have various degrees of asymmetry, with download-dominant applications including video and audio streaming and e-newspapers, while upload-dominant applications may include, for example, video uploads. Also, the degree of asymmetry of other applications such as high-quality video telephony, mobile multicasting, and videoconference depends on user requirements. Overall, it is important to keep in mind that the amount of resources needed for the downlink may differ from that of the uplink.

It is also the case that radio interfaces currently include two modes of operation – frequency division duplex (FDD) and time division duplex (TDD). It is noted that administrations may implement other frequency arrangements (for example, arrangements which include different duplex schemes, different FDD/TDD boundaries, etc.) to fulfill their requirements. These administrations should consider deployments in neighboring countries as well as matters related to achieving economies of scale, facilitating roaming, and measures to minimize interference. Administrations should take into account the fact that some of the different frequency arrangements in the same band have an overlap of Base Station (BS) transmitter (TX) and Mobile Station (MS) transmitter (Tx) bands. Interference problems may result if different frequency arrangements with such overlaps are implemented by neighboring administrations.

b) Duplex Arrangement and Separation

It is important that systems operating in FDD mode should, as much as is practical, maintain the conventional duplex direction, with mobile terminal transmit within the lower band and base station transmit within the upper band. However, in order to facilitate coexistence with adjacent services, in some instances it may be desirable to reverse the duplex direction, with the mobile terminal transmit within the upper band and base station transmit within the lower band. The conventional duplex direction for FDD terrestrial mobile systems has been used because the system performance is generally constrained by the uplink link budget due to the limited transmit power of terminals.

On duplex separation, the duplexer bandwidth, and the centre gap in an FDD frequency arrangement affects the duplexer performance. In particular, larger duplex separation brings better isolation performance between downlink and uplink. Also, larger duplexer bandwidth reduces the overall duplexer performance, resulting in both worse self-desensitization and higher interference from MS-to-MS or BS-to-BS. Smaller centre gaps may lead to higher interference from MS to MS or BS to BS.

One way to reduce the duplexer's bandwidth in an FDD system, while keeping a larger duplex separation and total bandwidth, is to use a dual duplexer. A fixed overlap between lower and upper duplex arrangement enables the use of common equipment to

meet the operational requirements of deployments. The size of the overlap is likely to be the same for all implementations, and it would be decided in accordance with filter design when establishing the band plan. Due to the two adjacent duplex arrangements, the gap between DL (downlink) and UL (uplink) blocks can be made smaller than the duplex gap in a single duplexer FDD arrangement. Such two duplexer arrangement can be implemented by standard filter technology. This would minimize the cost and complexity of equipment. However, the small gap between UL and DL blocks will put additional filtering requirements on the terminals to avoid MS-MS interference. The BS-BS interference can be handled by additional filtering using conventional technologies.

5.2 OPTIONS FOR HARMONIZATION

There are different options for use of DD1 and DD2 for mobile services, but the most suitable options for Africa should be 2 x 30 MHz in the 700 MHz band, 2 x 30 MHz in the 800 MHz band. This can be additionally harmonized with 2 x 35 MHz in the 900 MHz band. Charts 1 to 11 provide additional information.

To establish and understand the level of digital dividend accruing from digital switchover in the UHF band, it is first necessary to know the incumbent analogue TV channel plan that is in use across the African Union Member States and, where possible, the current occupancy in the band. Since the VHF band is not expected to yield a dividend to other services, such as telecommunications, our focus should be on the UHF band. Chart 1 shows the UHF band analogue TV channel plans that have been used across Africa. In particular, Channels 21 to 69 are shown with corresponding frequencies. Channels 61-69 (corresponding to 790-862 MHz) comprise the first digital dividend identified, while Channels 49-60 (corresponding to 694-790 MHz) comprise the second digital dividend. For countries in the Americas and Asia-Pacific regions, the first digital dividend was the 700 MHz band. During WRC-15, some countries in those regions identified sub-700 MHz bands for mobile broadband services, especially the 600 MHz band, which is being dubbed the second digital dividend, and corresponds to channels 39-48 in Region 1. Further studies on the 600 MHz band are not included in the agenda for WRC-19, but there is some preliminary agreement to have discussions including Region 1 during WRC-23. As mobile technology moves towards lower frequency ranges, with its proven improvements in spectral efficiency, African administrations should pay attention to the developments in the 600 MHz band.

Chart 1 also depicts ranges of potential interference between the European, APT and US 694-960 MHz spectrum plans. When European devices are used in close proximity with countries using the US band plan, it is clear from the chart that there are three zones of major frequency overlap, which may cause interference. In particular, 728-746 MHz is used in the US band plan for downlink as compared to other regions using the same spectrum for uplink. Also, the US band plan's uplink in 776-793 MHz conflicts with European and APT plans that use the same for downlink. Furthermore, all countries occupying the whole 850 MHz band up to 894 MHz, including those in Africa, will experience interference with the European plan between 880 MHz and 894 MHz, where the European uplink conflicts with the CDMA downlink employed across several African countries. However, if the band plan recommended in this report for harmonization across Africa is adopted, the interference with residual CDMA-850 systems will be minimized to a level that countries can manage and resolve internally without need for international coordination. The harmonized plan proposed in this report leaves a reasonably sufficient guard band of 3 MHz from 877-880 MHz that will avoid interference with Europe and the Arab region (the key African neighbours). In addition, devices from Africa will work seamlessly in the APT, Arab, European, and Latin American regions.

Chart 2 provides a simplified picture of the uplink and downlink zones for ITU Region 1 countries, including African Union Member States in the 694-960 MHz range. The chart provides clear options for bands that may be selected for the uplink and downlink, devoid of interference.

Chart 1: The UHF band and analogue channels, interference-sensitive areas with existing 850 MHz networks and other ITU Regions

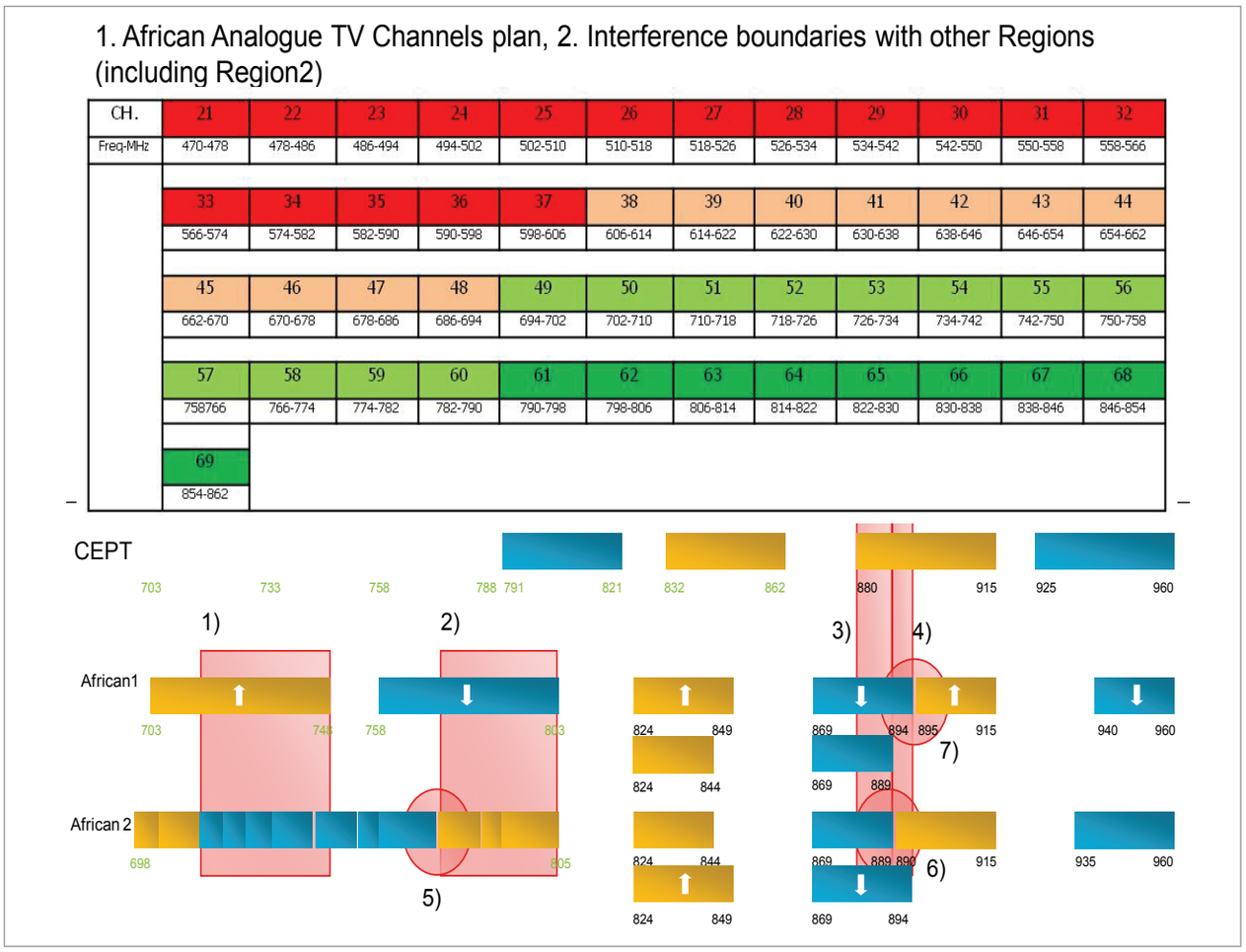


Chart 2: Uplink and downlink boundaries covering DD1 and DD2

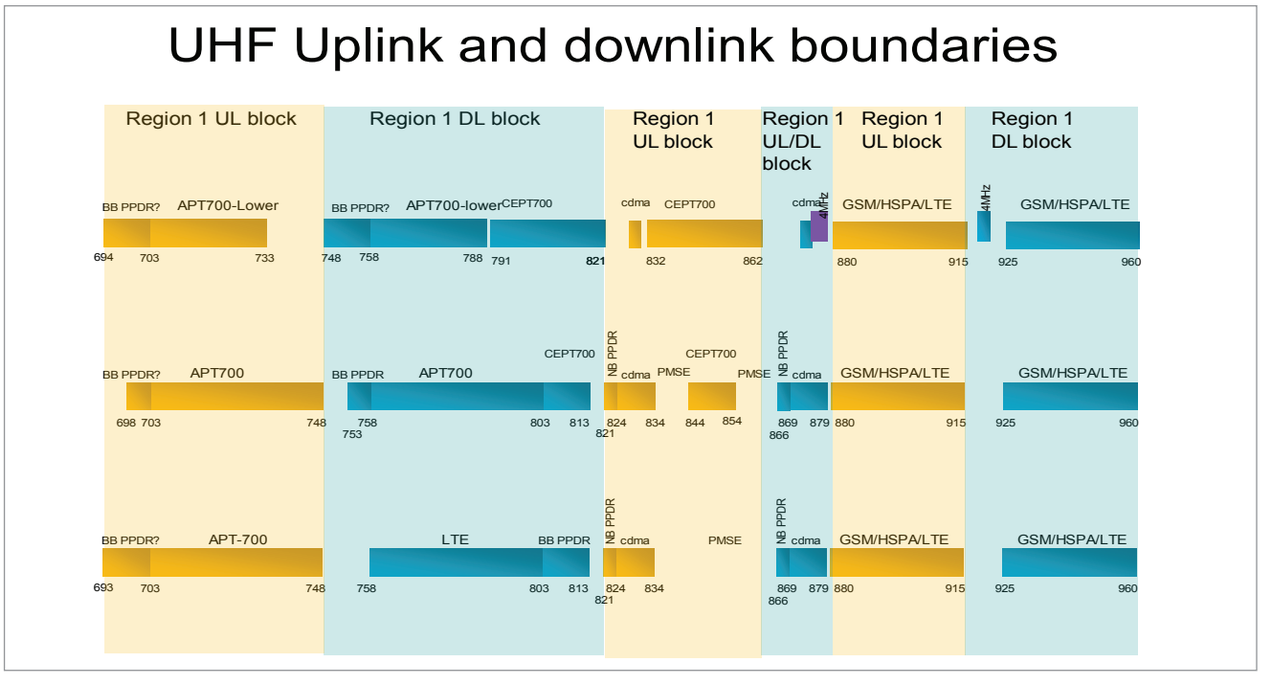


Chart 3 depicts the proposed African band plans, the CEPT band plan, and the APT options. In the three options, there is clearly a greater harmony of the bands, unlike when matched against the US band plan. The only area of potential interference in this case is the boundary between CDMA-850 and the extended primary GSM (900 MHz) band, highlighted in pink. It can be observed from the chart that potential interference occurring around 877-880 MHz has been reduced to a minimal level that can be managed internally by Member States, as a result of the use of guard band and possible filtering.

Chart 4 shows the location of the additional 5 MHz duplex that may result from the proposed harmonized African plan. It is one of the duplex frequencies that are being debated for use by Public Protection and Disaster Relief (PPDR) services. The challenge with that assignment is that police and emergency services are keen to have new emergency networks in a dedicated band, while governments – especially from Africa – are not necessarily interested in investing in a new nationwide network to be used for only emergency services due to competing demand for limited public resources. Furthermore, there are issues with the handset size and cost. Police are demanding smaller and cheaper handsets, but it is quite complicated to produce a small handset that is to operate efficiently in a low frequency. In addition, the proximity to television channel 48 means that to achieve -25dBm out of band (OOB) emission to protect TV services requires complex filtering which will render the mobile station more expensive than anticipated.

Chart 5 shows the location of the 2x30 MHz in the 700 MHz intended for use by mobile networks, i.e., the second digital dividend. One important characteristic of this is band is that it is not reverse duplex, as is the case with 800 MHz. This arrangement matches the lower duplexer of the APT band plan, enabling the use of a wider portfolio of devices (including lower-cost devices enabled by economies of scale), greater interoperability, and roaming with populous countries of Asia-Pacific. Adopting the proposed 2x30 MHz arrangement in the 700 MHz band creates a nearly global band for use by mobile networks.

Chart 3: Channeling options presented by the proponents of the allocation of 700 MHz at WRC-12

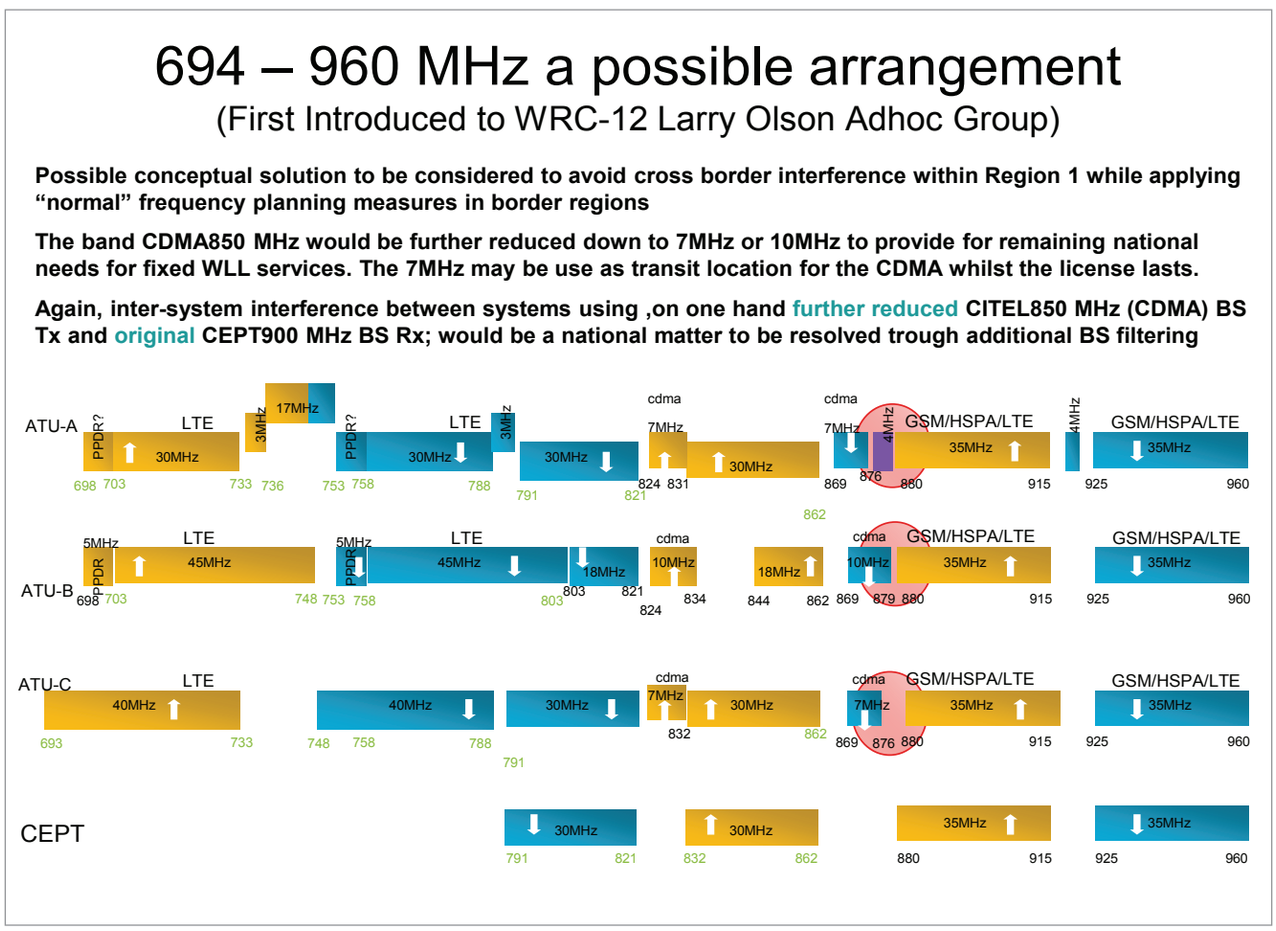


Chart 4: The location of 2 x 5 MHz that can be used for other services

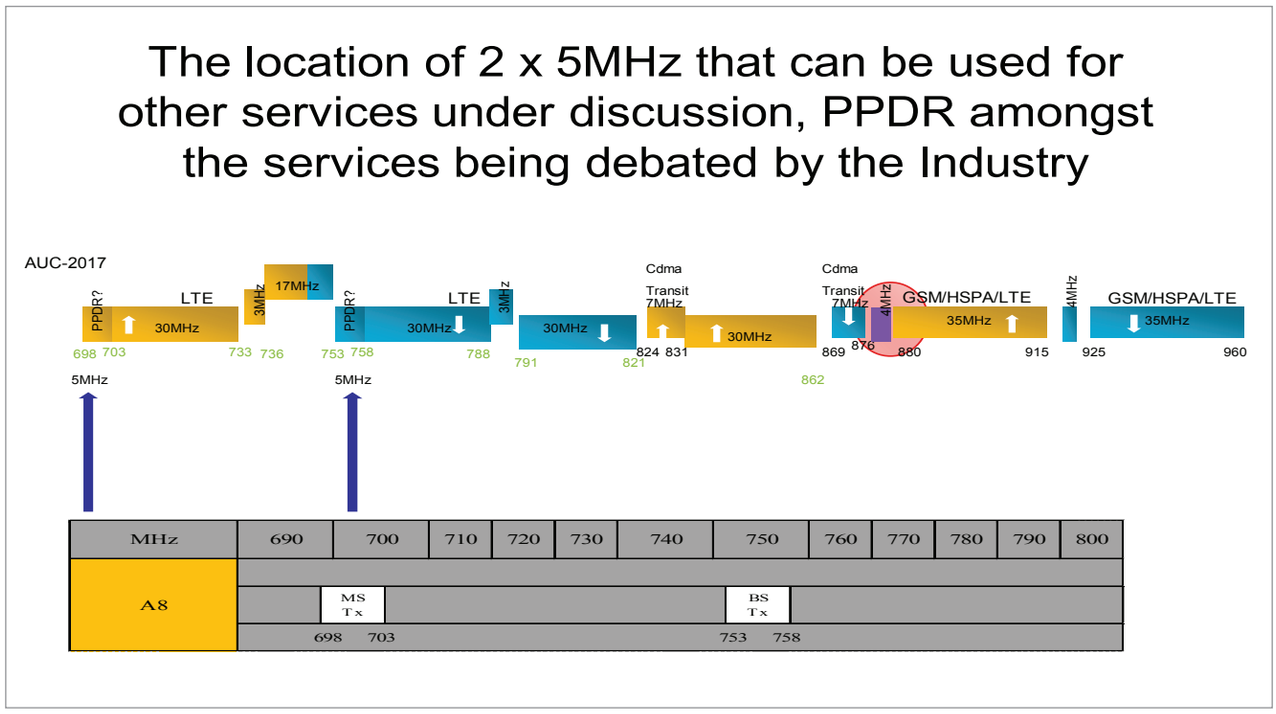


Chart 5: The 2 x 30 MHz in the 700 MHz Band

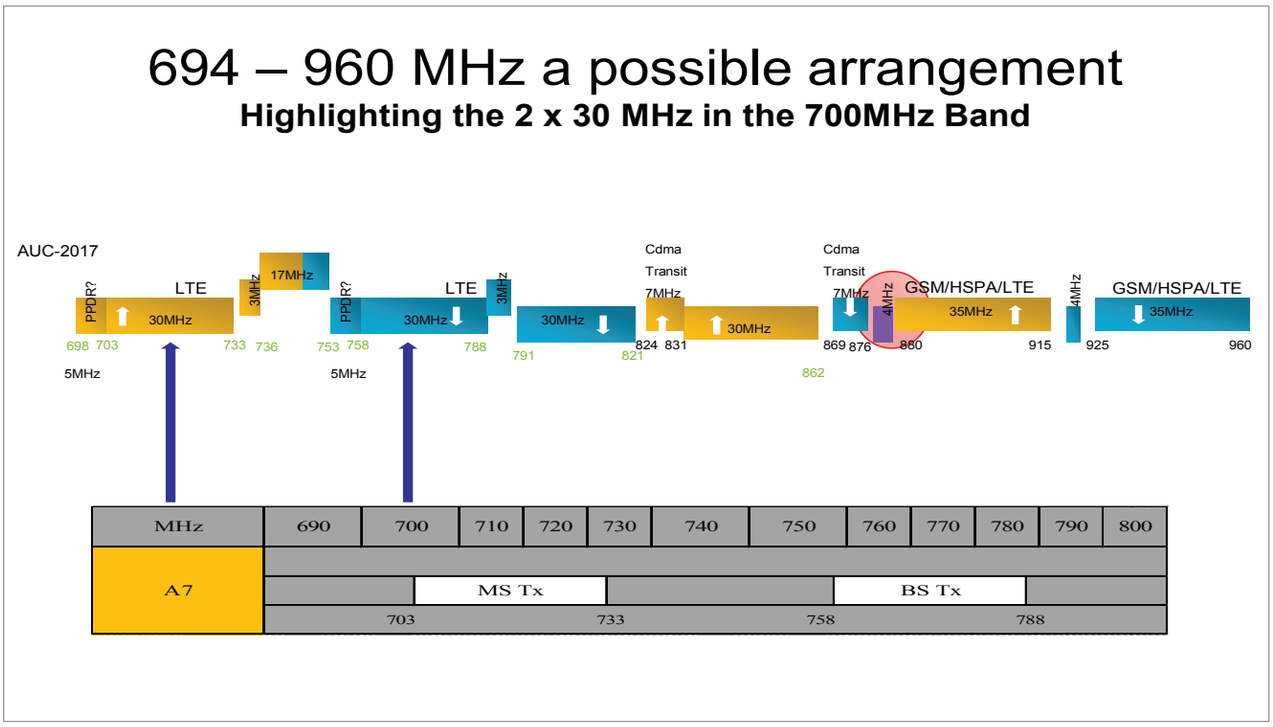


Chart 6 shows the location of the additional 3 MHz duplex that may result from the proposed harmonized Africa plan. Similar to the information presented in Chart 4, it shows one of the duplex frequencies being debated for use by PPDR services. The challenge with this spectrum is that to provide protection to the 3 MHz duplex might requires losing a sizeable proportion of the centre gap that is being considered for other applications.

Chart 7 shows the location of the 2x30 MHz in the 800 MHz intended for use by mobile networks, i.e., the first digital dividend. One important characteristic of this band is that it is reverse duplex, with the downlink frequency lower than the uplink. This reversal ensures minimal interference with TV networks and terminals.

In **Chart 8**, it can be seen that the CDMA was deployed as 2x25MHz that consists of 824-849MHz (uplink) paired with 869-894MHz (downlink) referred to as the 850MHz band in a number of African countries. However, we believe that CDMA system currently in use may still offer its current level of coverage and service on a 2x7MHz spectrum without adversely affecting the recommended harmonized 700/800/900MHz band-plans. That said, it is important to state here that we envisaged that the 2x7MHz will only be transitional home of the CDMA-850 whilst the license tenure subsists. On expiration of the Licenses it is likely that other services such as short-range devices, GSM-R and PPDR will compete for the space.

It is noted that around the uplink leg of the CDMA-850, there are ongoing studies to establish whether or not the 821-824MHz (3MHz gap) can provide sufficient protection as a guard-band for the downlink leg of the 800MHz, whereas near the downlink leg of the CDMA-850, there are proposals for the use of various short-range devices in the range 863-870MHz in some jurisdictions. In particular, 863-870MHz has been proposed to be segmented as 863-865MHz, 865-868MHz and 868-870MHz for use of wireless microphones/Assistive listening devices, RFIDs, and Alarms/Telemetry/Remote controllers etc respectively.

The duplex of 873-876/918-921MHz or the adjoining duplex of 876-880/921-925MHz on the other hand have also been proposed for GSM-R Railway Radiocommunication Systems between Train and Trackside (RSTT) services. All these applications clearly indicate that CDMA-850 may only be in the 2x7MHz band for the transit period before full decommissioning.

Chart 6: The location of 2 x 3 MHz that can be used for other services

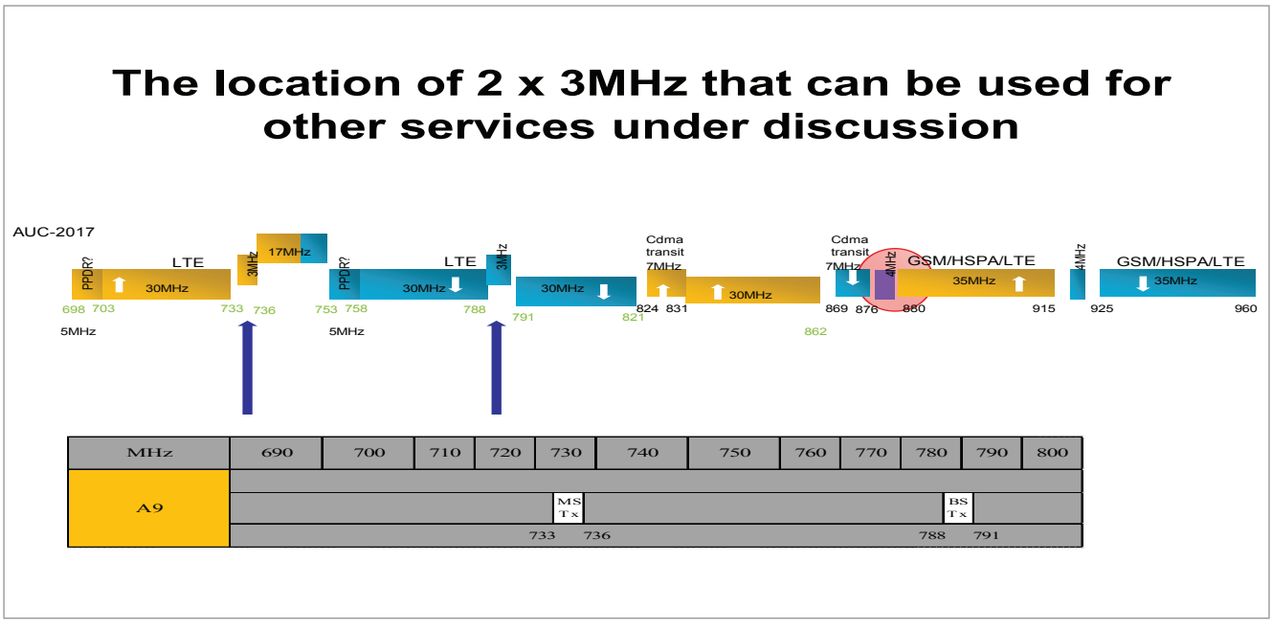


Chart 7: The 2 x 30 MHz in the 800 MHz Band (a key recommendation)

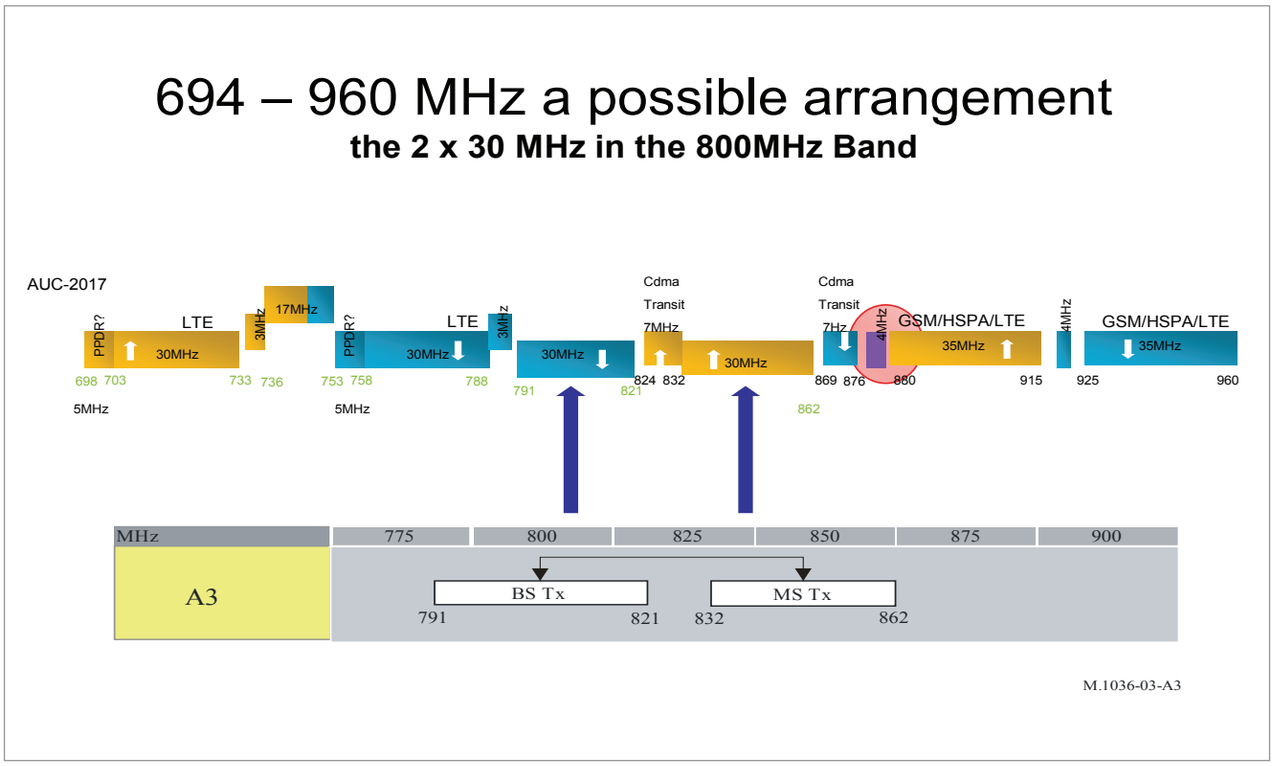
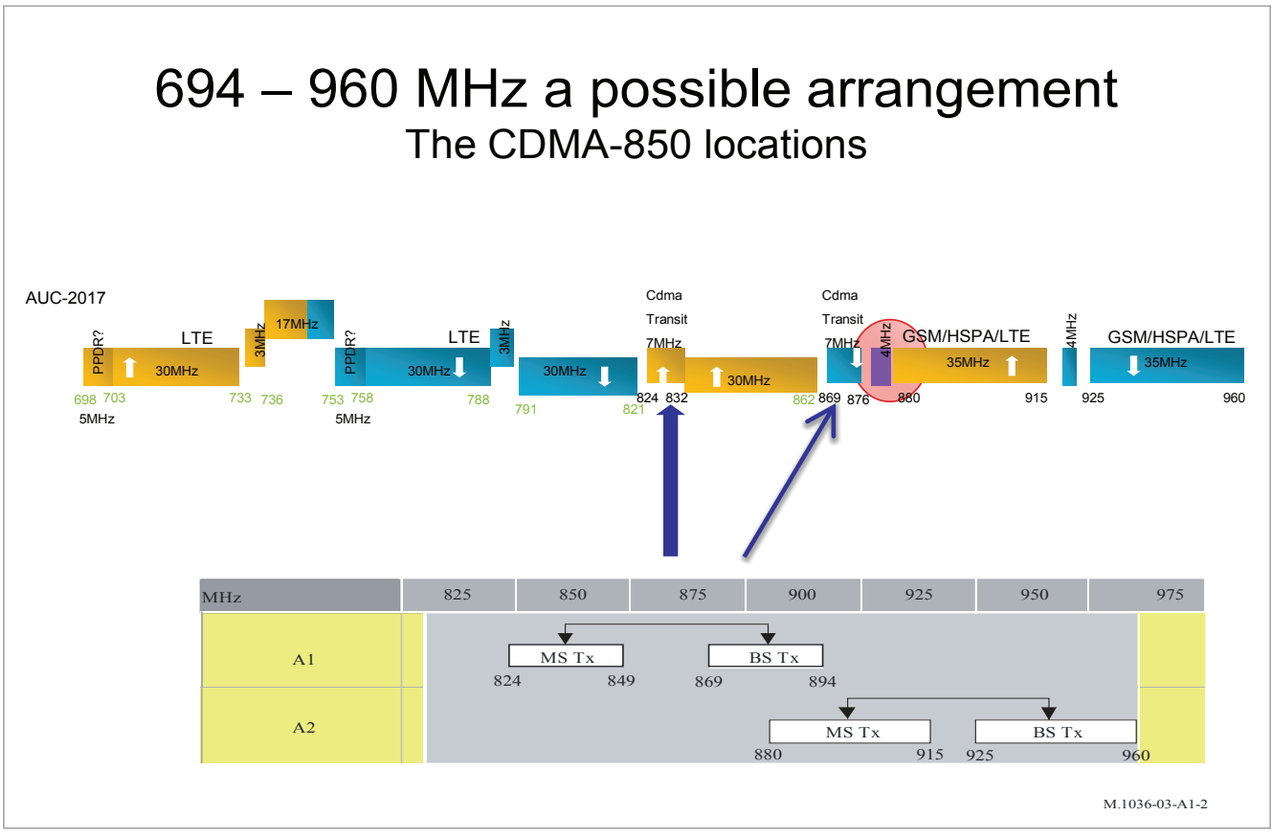


Chart 8: The locations of the 2x25 MHz CDMA-850 and the new location of residual 2x8 MHz in the same band



In **Chart 9**, it can be seen that with the lower A1 arrangement, the primary GSM band was and could only be deployed as 2x25 MHz that consists of 890-915 MHz (uplink) paired with 835-860 MHz (downlink). However, with the new proposed plan in line with A2, African countries are to gain an additional 2x10 MHz in the 900 MHz band. The harmonized plan will lead to the adoption of a 2x35 MHz band plan that consists of 880-915 MHz (uplink) paired with 925-960 MHz (downlink) in the 900 MHz band. This harmonization and the introduction of a 3 MHz guard-band have resolved the long-standing incompatibility between the deployment of CDMA-850 and GSM networks.

Chart 10 shows the location of the 2x45 MHz intended for use by mobile networks in the so-called APT plan. It can be seen that option has paved the way for maintaining CDMA-850 in its incumbent location. This could further complicate the interference potential around 877-880 MHz.

Chart 11 shows the location of the 2x45 MHz intended for use by mobile networks in the APT band plan. It also shows the two different duplexer arrangements: one option is for the whole band to be covered by a single large bandwidth (45 MHz) duplexer, and the other is for dual 30 MHz duplexers that have a 15 MHz overlap, which enables the use of common equipment.

The large duplexer bandwidth (45 MHz), and/or smaller centre-gap (10 MHz) and a duplex separation of 55 MHz makes the single duplexer less efficient because of potential MS-to-MS or BS-to-BS interference. In the case of the smaller centre gap, MS-to-MS will require additional complex filtering, but the related BS-to-BS interference can be mitigated using standard technology.

Whereas for a dual 30 MHz duplexer arrangement and a larger centre gap of 25 MHz, while maintaining the same 55 MHz duplex separation, the efficiency is better because it offers less potential interference for both the MS-to-MS or BS-to-BS cases.

The 30 MHz duplexer matches the 2x30 MHz CEPT arrangement, enabling a wider portfolio of devices that are interoperable and mass produced with roaming capability across most parts of the world.

Chart 9: The location of 2 x 35 MHz new 900 MHz band plan

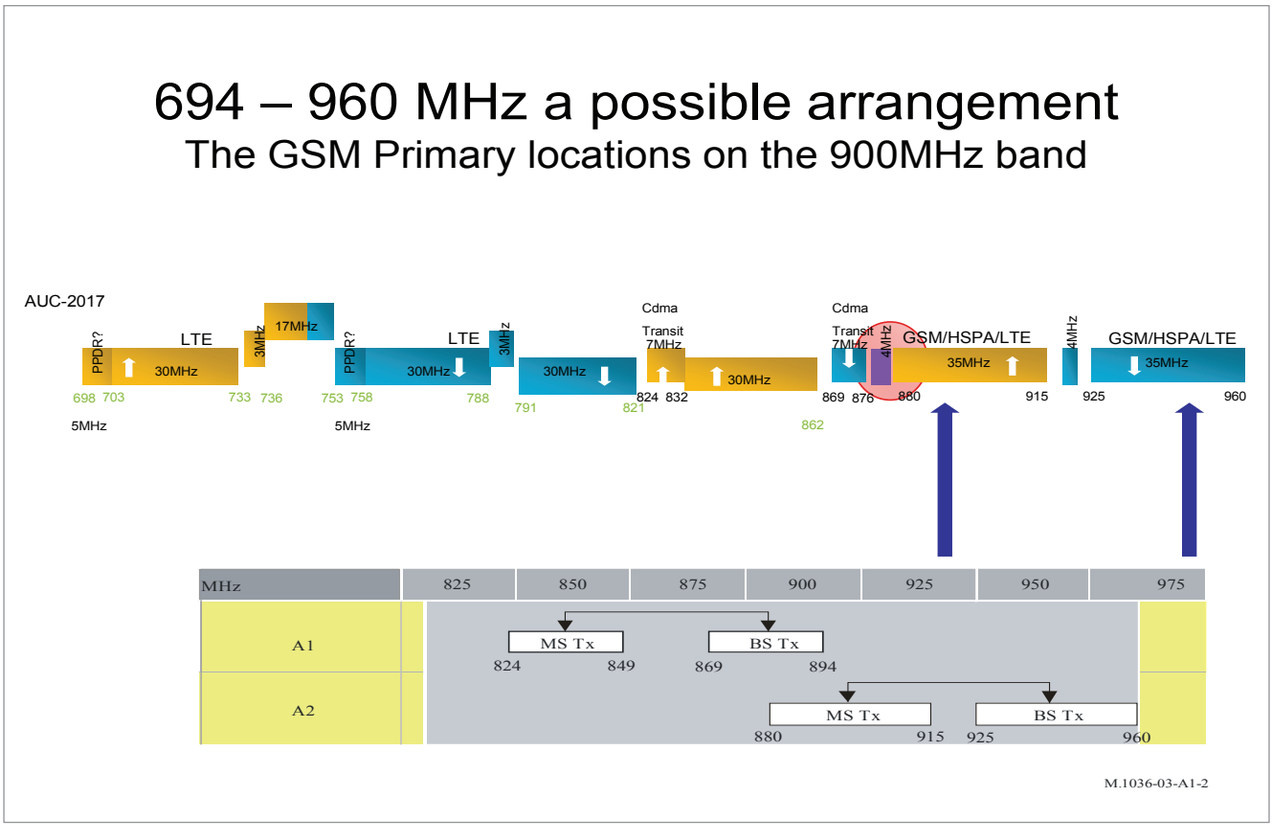


Chart 10: The location of 2 x 45 MHz in the 700 MHz band

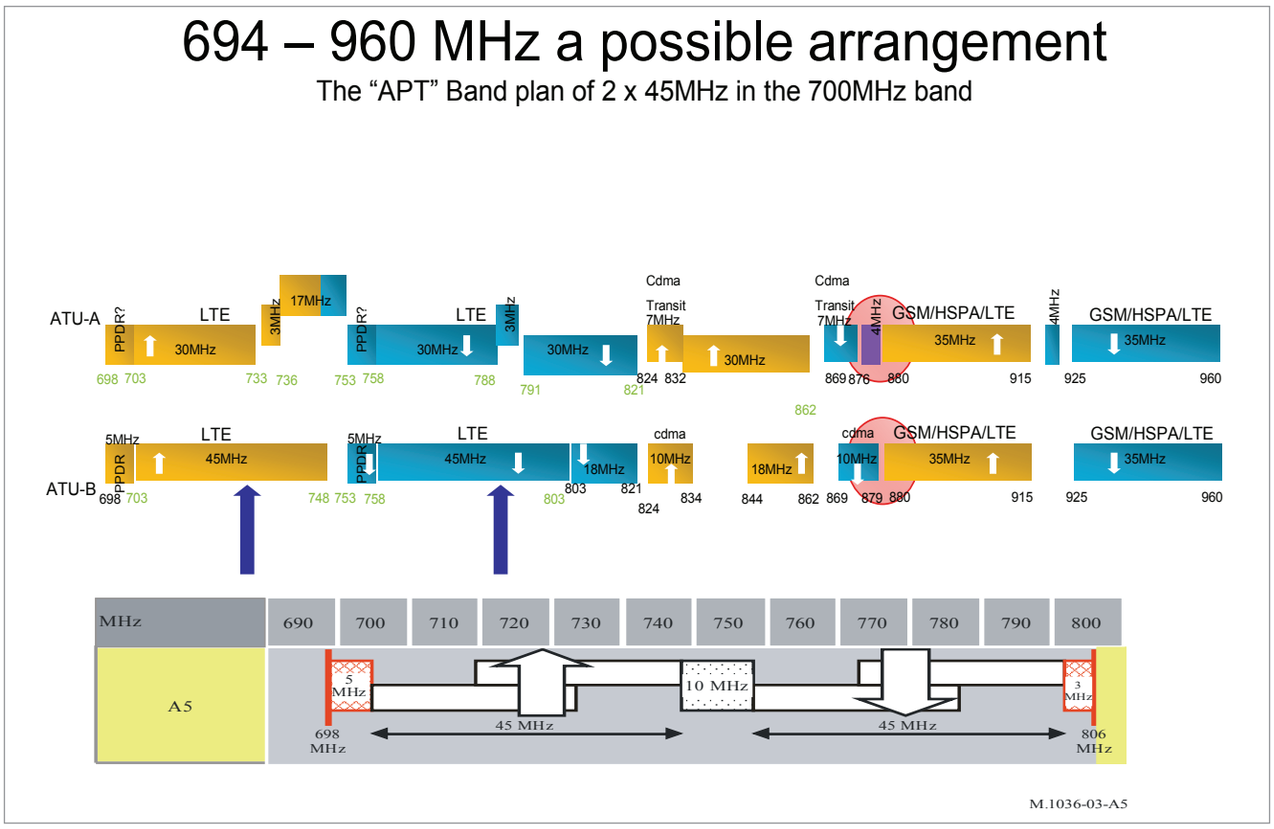
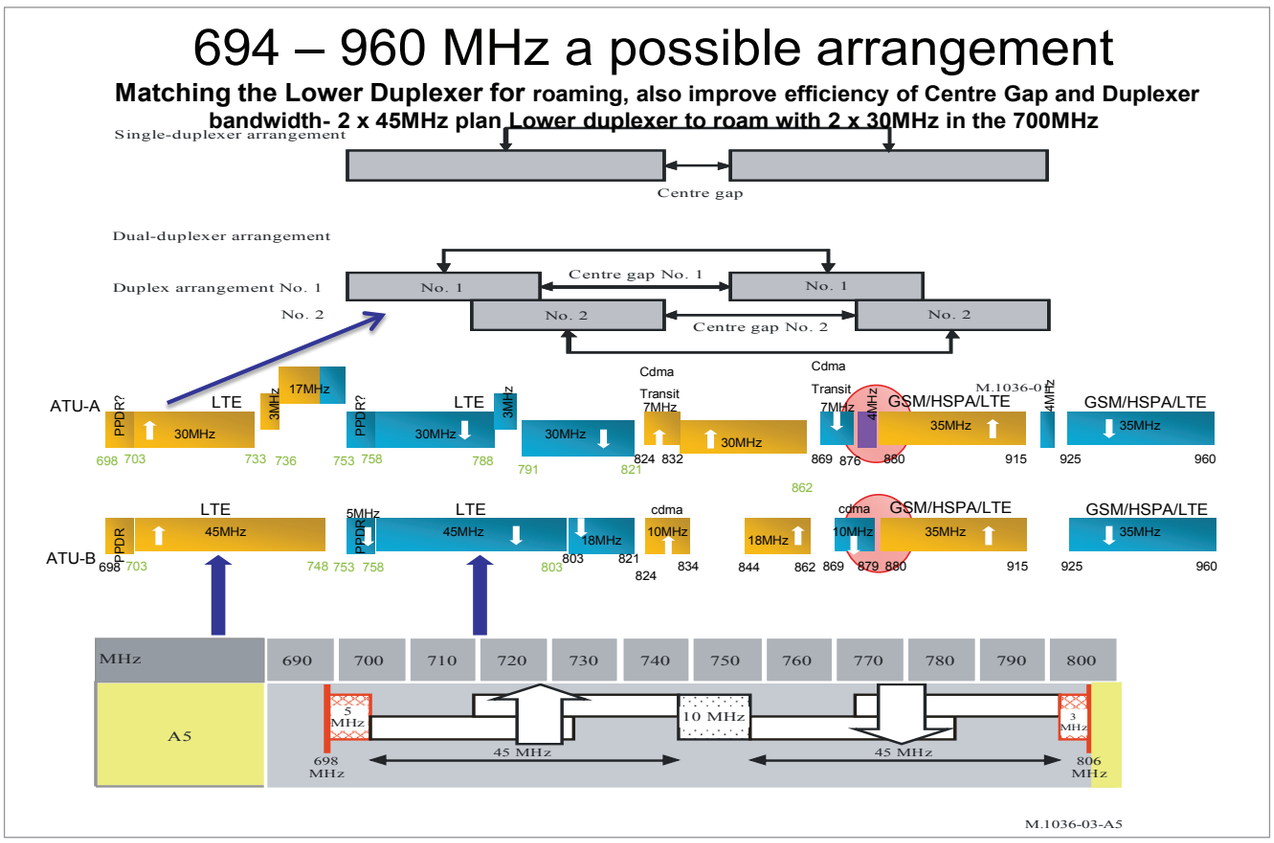


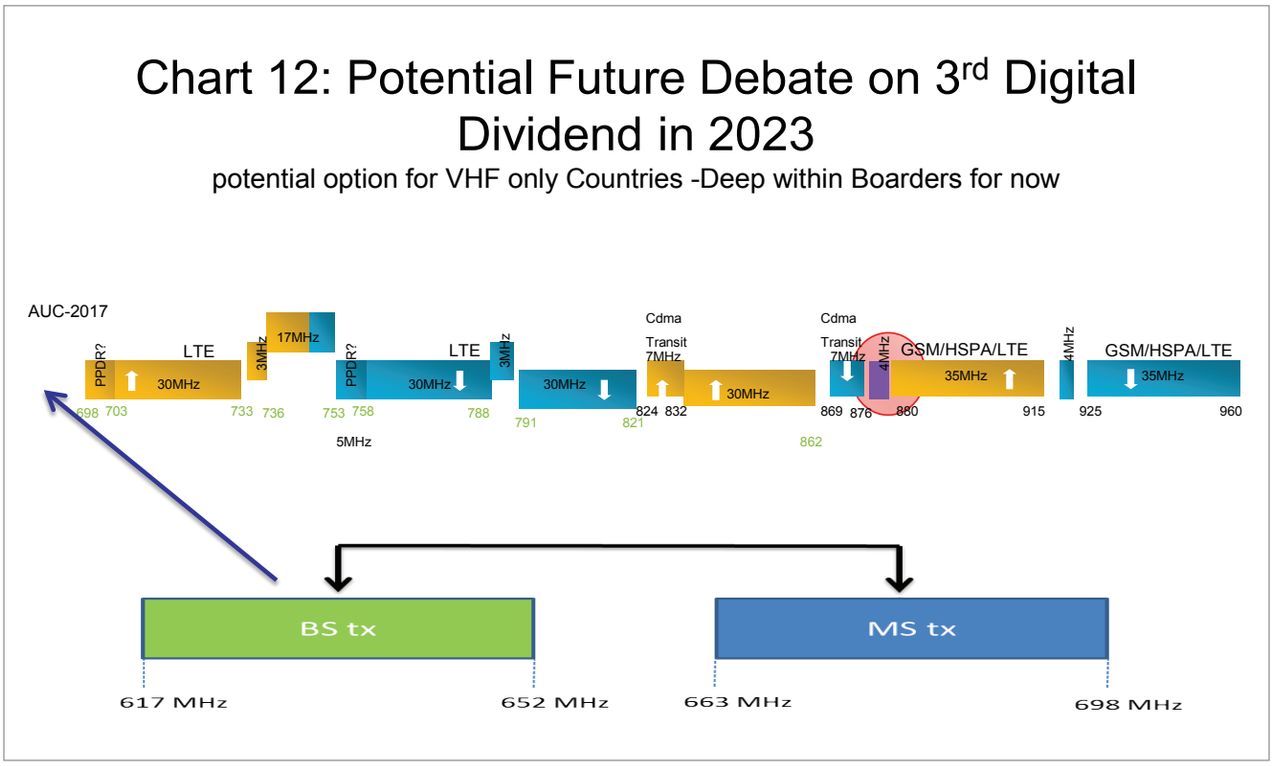
Chart 11: Matching the Lower Duplexer of 2 x 45 MHz for roaming, also improve efficiency of Centre Gap in the 700 MHz



5.3 OPTIONS FOR VHF COUNTRIES

Countries that have not assigned UHF to analogue TV services, such as Cote d'Ivoire, should take note of the discussion occurring in the Americas region regarding the potential to reverse auction the 600 MHz band, and forward auction 2 x 35 MHz of it between 614 and 694 MHz shown in **Chart 12**, such as the incentive auction conducted in the United States. This debate may take place in relation to WRC-2023 in Region 1 and thus, it is advisable not to make any DTT deployment in the band 606-694 MHz (Channels 38-48) highlighted in orange in Chart 1, since the UHF band is already empty. In other words, such countries may limit their planned DTT deployment in the UHF to Channel 21-37 to avoid rigours of any potential transition

Chart 12: The future dividend debate and potential option for VHF-only countries, deep within borders



5.4 SUMMARY OF OPTIONS

694 – 960 MHz Paired Frequency arrangements in the band 694-960 MHz
Summary of Optimum Choices in TEXT

Frequency arrangements	Paired arrangements					Un-paired arrangements (e.g. for TDD) (MHz)
	Mobile station transmitter (MHz)	Centre gap (MHz)	Base station transmitter (MHz)	Duplex separation (MHz)		
A2	880-915	10	925-960	45	2 x 35MHz In 900MHz band	None
A3	832-862	11	791-821	41	2 x 30MHz In 800MHz band	None
A5	703-748	10	758-803	55	2 x 45MHz In 700MHz band	None
A7	703-733	25	758-788	55	2 x 30MHz In 700MHz band	None
A8	698-703	50	753-758	55	2 x 5MHz In 700MHz band	None
A9	733-736	52	788-791	55	2 x 3MHz In700MHz band	None

5.5 AFRICA-WIDE CHANNEL PLAN FOR DD1 AND DD2

The options A2, A3, and A7 (shown in green in the table above) are, in the opinion of the consultant, the best choices for harmonization within Africa and with rest of the world. This approach is harmonized with CEPT's use of the digital dividend and with the lower duplexer of the APT700 band plan, thus creating a band that is harmonized across not only Africa, but Europe, the Asia-Pacific region, and the parts of Latin America that have adopted the APT band plan.

We also recommend the implementation of a technology-neutral regime that will allow operators to deploy new technology using the same spectrum on a non-interference basis.

Specifically, our recommendation for all nations of Africa is to adopt the approach illustrated in **Chart 13**, showing a 2x30 MHz band plan that consists of 703-733 MHz (uplink) paired with 758–788 MHz (downlink) as the preferred plan for 700 MHz band.

Furthermore, we recommend adoption of a 2x30 MHz band plan that consists of 832-862 MHz (uplink) paired with 791-821 MHz (downlink) in the 800 MHz band.

In addition, we further recommend the adoption of a 2x35 MHz band plan for the 900 MHz band that consists of 880-915 MHz (uplink) paired with 925-960 MHz (downlink), creating an extension of 2x10 MHz in the 900 MHz band.

It is further recommended that African nations should not rush to license the spectrum band 2x5 MHz that consists of 698-703 MHz (uplink) paired with 753-758 MHz (downlink), and the 2x3 MHz band that consisting of 733-736 MHz (uplink) paired with 788-791 MHz (downlink). African countries may wish to delay assignment of these additional smaller blocks until there is more clarity on the evolution of African use of the digital dividends as well as the evolution of the related technology.

As noted in the discussion of **Chart 8**, Code Division Multiple Access (CDMA) 850 (CDMA-850) technology was deployed as 2x25 MHz that consists of 824-849MHz (uplink) paired with 869-894 MHz (downlink) referred to as the 850MHz band in a number of African countries. In particular such service may still subsists in a few countries such as Nigeria, Madagascar, Mauritania, Congo, Congo Brazzaville, Burkina Faso, Benin, Lesotho, Nigeria, Gambia, Togo, and Senegal. However, we believe that CDMA system currently in use may still offer its current level of coverage and service on a 2x8 MHz spectrum without adversely affecting the recommended harmonized band-plan.

It is therefore recommended that African nations that have CDMA-based networks operating on the 850 MHz band to re-assign such licensees some spectrum within the 2x8 MHz band that consists of 824-832 MHz (uplink) paired with 869-877 MHz (downlink) on the 850 MHz band.

Chart 13: Final Recommended Harmonized DD1 and DD2 Band plan for Africa

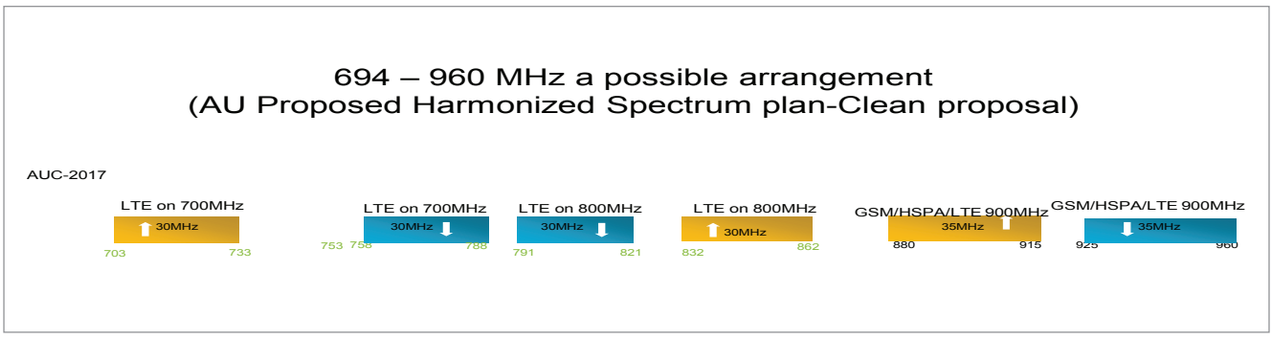
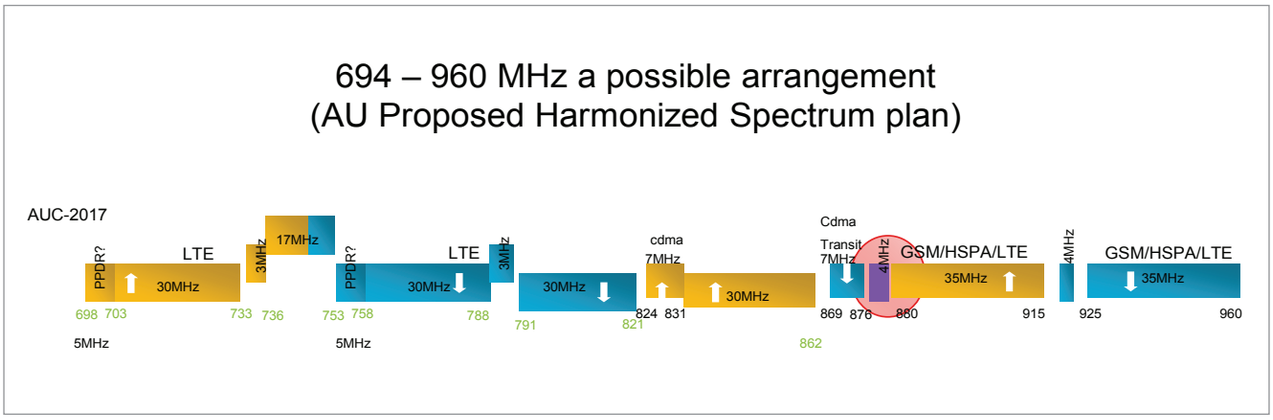


Chart 14: The Harmonized DD1 and DD2 Band plan for Africa



6. LICENSING OF DD1 AND DD2

The licensing procedure to be adopted depends on the objective of the government and the country's relevant legal frameworks. Governments must balance priorities that include deriving the maximum possible revenue from the award process and ensuring access and affordability. While it is important to keep in mind competing government priorities, it is most beneficial to implement a licensing approach that results in licensing fees that allow the government or regulator to recover the administrative costs of the tender and management of the licenses, while enabling competition among licensees that are able to direct the largest possible portion of their resources to robust network deployment. Such an approach fosters faster deployments and competition, leading to increased innovation in services and pricing.

As always, in a liberalized market, promotion of competition that will lead to sustained provision of quality of service and experience, and the provision of innovative, accessible, and affordable services should be the guiding principles. Considerations must include the potential for the availability of digital dividend spectrum to encourage new entry into the market and for incumbents to add to their existing spectrum holdings, and how these options align with government priorities for the sector and the economy as a whole.

While it is often beneficial to ensure competition in the sale of scarce publicly owned resources such as spectrum, governments should also strive for cheaper and more efficient spectrum assignment processes. Hence, a simple procedure should be adopted to guide the award whenever possible. Except if competitive bidding or rather auction is the only procedure enshrined in the law, the decision to select a spectrum award procedure should be guided by the established demand level.

1. If the number of requests or bidders is less than or equal to the number of blocks, then a simple administrative first-come-first served assignment procedure is recommended where each operator/or investor gets a single block. Such an administrative procedure has low costs for operators because each interested party obtains the required slot/block at the administrative price.

2. If the demand slightly outstrips the supply in a situation where non-serious bidders can easily be discerned through a reasonably fair administrative process, then a beauty contest is recommended. The beauty contest should take into account a number of criteria, such as proven competence, experience, and financial capacity to rapidly deploy networks, along with any government priorities

related to encouraging new entrants or otherwise increasing competition among qualified operators. In this case, a clear scoring rubric and set of rules should be used in order to ensure transparency and a level playing field, and to ensure that the same criteria are applied to all interested parties.

3. If demand greatly exceeds supply, i.e., the number of interested parties is significantly higher than the number of blocks available (as is often the case when the spectrum to be awarded has already been standardized by 3GPP), then a competitive bid process (auction) should be adopted. It is recommended that any auction design should avoid opportunities for undue advantage or collusion, and ensure a level playing field with minimal reserve prices. The auction should be designed in such a way as to leave successful bidders with reasonable resources for network deployment while the spectrum is awarded to those that place the highest value on it.

Regulators and governments should be mindful of the fact that auction proceeds and network investments are impacted either positively or negatively by other economic conditions, such as expected GDP growth rate, harmonization of the spectrum, wage levels, exchange rates, new technology and device diffusion, taxation, interest rates, inflation rates, commission levels, the presence of other disruptive services, and more importantly, the clarity of the legal framework, independence of the regulator, and political climate. Thus, even though assignment mechanisms can be controlled, a number of other economic factors will be taken into account by potential bidders.

It is recommended that the auction of the 700 MHz, 800 MHz, and 900 MHz bands should be designed with a carrier size and block size of not less than 2x5 MHz. Further, such auctions should be designed in such a way that will ensure that new participating operators will bid for not less than 2x10 MHz in either the 700 MHz or the 800 MHz bands whereas existing holders of other spectrum are able to bid for a minimum of 2x5MHz. Furthermore, since it is well-known that 1800MHz is generally combined with the 900MHz, then 2x5MHz block size should suffice in the 900MHz band. The rationale for such an approach is to avoid the case where an operator obtains too little spectrum to benefit from the lower relative costs of deployment enjoyed by competitors with larger spectrum holdings.

7. OPTIONS FOR THE CENTRE GAP AND ADDITIONAL DUPLEX PAIRS IN THE PROPOSED AFRICAN 700 MHZ BAND PLAN

There are various options to be presented on the possible use of the centre gap and the two guard bands described above in the 700 MHz band. There is an ongoing industry debate on the use of the guard band 698-703 MHz (5 MHz) and the centre-gap 733-758 MHz (25 MHz) as well as the 788-791 MHz band.

ITU-R Recommendation M.1036-5, which among others, addresses paired frequency arrangements in the band 694-960 MHz, provides useful guidance for the potential use of these bands, though it is important to note that not all of these approaches can be employed simultaneously. In summary, potential approaches to the centre gap and additional spectrum made available by the proposed 700 MHz band plan include:

- The 698-703 MHz band (uplink) can be paired with upper part of the centre gap (753-758 MHz, downlink) to form an additional 2 x 5 MHz (known as arrangement A8);

- The lower part of the centre gap (733-736 MHz) can be used for uplink and paired with the 788-791 MHz band (downlink) to form an additional 2 x 3 MHz (known as arrangement A9); and

- A portion of the centre gap can be used as supplemental downlink (compatible with arrangement A10, which uses 733-758 MHz as downlink).

As noted above, the duplexes of 2x5 MHz and 2x3 MHz are the subject of debate for potential use by PPDR services. The proximity of uplink and downlink for different types of technology and the potential need for additional costly filtering makes it difficult to ensure relevant segregation whilst gaining smaller and cheaper terminal devices. It is recommended that such bands not be assigned until there is more clarity on the evolution of the related technology. Furthermore, the use of these smaller blocks should not delay nor create technical limitations on the use of the bands for mobile broadband.

8. POLICY GUIDELINES

To benefit from the digital dividend, African countries must institute proper policy frameworks and create an enabling environment to facilitate the implementation of the necessary services and networks using the anticipated freed-up spectrum.

This section provides guidance on the overarching issues that African countries need to address and the governing policy that should be developed. The recommended objectives of such a policy are:

1. To define **key policy objectives** for harmonizing the use and management of the digital dividend at regional and continental levels so as to ensure equitable access to radio spectrum resources, accommodate the specific need of Africa in relation to consolidating the ICT market by enabling economies of scale and fostering the provision of new affordable ICT services in Africa.
2. To develop and implement **regulatory procedures** for an optimized and beneficial use of harmonized digital dividend spectrum in Africa. The policy provides guidance in developing national procedures for establishing relevant spectrum framework to ensure an efficient and flexible use of this valuable resource by a wide range of potential applications.
3. To **address the growing demand for wireless data traffic**. The harmonized use of the digital dividend at the regional and continental levels will contribute to the deployment of high-speed wireless broadband systems, competition and innovation.

The following sections flow from these overall policy recommendations, presenting guidelines on specific aspects of digital dividend use.

9. CONTINENTAL POLICY ON THE HARMONIZED USE OF THE DIGITAL DIVIDEND

a) Methodology for licensing digital dividend spectrum

African governments should license the freed-up spectrum in a judicious manner so as not to lose out on its benefits to their economies. The freed-up spectrum is in the very desirable sub-1 GHz band, which is valued for its excellent propagation and penetration characteristics. These benefits should be exploited to the greatest extent possible, both through ensuring use of the band to provide valuable services to users, and through ensuring that it is used efficiently. African governments must therefore determine the most suitable method for licensing this spectrum in order to balance the political, economic and social interests of their own countries and the continent as a whole.

As noted in Section 6, the appropriate approach to licensing digital dividend spectrum in each country should be determined by considering the amount of spectrum available and the level of demand for such spectrum. The most viable proposition in this regard will be the approach that keeping license fees at a level that allows recovery of the administrative costs of licensing while, in the case of demand that exceeds supply, enabling access to spectrum by qualified parties that value it most.

Therefore, it will be essential that Member States establish a uniform regulatory framework in order to harmonize the use of the digital dividend spectrum in Africa. In this regard, the following framework approach is recommended:

1. Determination of the digital dividend frequency plan, and incorporation of the same into Member States' National Table of Frequency Allocations (NTOFA). This will, in turn, greatly influence the number of operators to be licensed, taking into account international trends and best practices, and may influence the potential for consolidation or fragmentation of the market.

2. Arising from (i) above, make NTOFAs publicly available if not already so. In situations where the NTOFA does not exist, it should be developed as a matter of priority. It is recommended that the African Union, through appropriate departments, make the necessary interventions where any Member State would require assistance in this regard.

3. Determination of the appropriate mechanism for assignment of the digital dividend spectrum, including consideration of the ideal number of total mobile broadband providers and the timing for release of each digital dividend.

4. Determination of the initial fee payable, duration of the licence, and mechanisms of licence renewal. An adequate economic balance should be established so as not to make license fees a barrier to market entry.

5. Determine if this fee will be remitted to the national government, or retained by the operator to fund its operations.

6. Identify any potential government/public uses for the digital dividend.

7. Ensure a well-drafted licence document that stipulates technology and service neutrality and includes, inter alia, the initial licence fees, annual operating fees, the methodology for determining and charging any annual spectrum fees, as well as quality of service and universal service obligations.

b) Regulatory consideration for the Use of Digital Dividend

In order to ensure uniformity in licensing the digital dividend in Africa and ensure ease in deployment of these services in border regions, the following guidelines are hereby proposed. These guidelines are intended to help reduce both network deployment and consumer costs:

1. After the selection of operators to deploy services using the digital dividend spectrum, Member States will then issue the requisite service / operating licence and the associated spectrum licence, prior to commencement of the rollout of these services. These licences will provide the necessary certainty for investments and ensure continuity of services.

2. Licences must be kept in force by regular payment of the prescribed annual operating fees and the associated spectrum fees.

3. Licenses must stipulate technology and service neutrality so as to ensure flexibility to respond to market demands and timely adjustment to technological advances.

4. The methodology for determination of spectrum fees should be clearly defined, and preferably in a separate document. Proper incentives should be awarded for efficient use of spectrum, with inefficient use sanctioned though pre-determined severe penalties

5. The methodology for charging annual operating fees should be determined and made publicly available.

6. These licenses should have a provision to safeguard consumer interests and protect against anti-competitive behavior by dominant operators.

10. LEVERAGING THE DIGITAL DIVIDEND AND BROADBAND TO CREATE OPPORTUNITIES FOR AFRICA

Following the realization of the digital dividends, there will be a great opportunity for African countries to enhance the low level of broadband penetration. In taking advantage of this opportunity, governments will gain the potential to unlock economic development and foster more efficient public services, both driven by ICT- and Internet-based services. At the same time, the availability of wireless broadband is considered as a mean to increase connectivity within African countries that may significantly contribute to the digital transformation of the continent.

Therefore, full and inclusive access to ICT services has the potential to generate economic growth and wider social benefits, such as more competitive economies, socially inclusive growth and more equitable development. Improving ICT accessibility through wireless broadband is especially critical for remote and rural societies, making up an important share of the African population, who would benefit through the ability to access to new digital services such as e-education, e-health and the delivery of e-government services.

African governments must therefore create an enabling environment for their institutions to take advantage of the wireless broadband to offer new services to their citizens.

The following guidelines are recommended in this regard:

1. Develop policy and regulatory frameworks for broadband at the national level and support their harmonization at regional and continental levels to lay the foundations for a truly integrated market for ICT services across Africa.

2. Bring the matter of e-services opportunities to the attention of key institutions and develop additional ICT centers of excellence to offer e-learning opportunities.

3. Promote the mainstreaming of ICT policies in other sectors at the national, regional and continental levels and create an enabling environment for institutions/governments to offer training/services through enhanced digital platforms.

4. Popularize the usage of ICTs and encourage the deployment and utilization of ICTs across all socio-economic sectors in Africa; especially in priority areas, such as e-government, e-education, e-commerce, e-health, and e-agriculture.

11. ICT SKILLS TO SUPPORT EFFECTIVE USE OF THE DIGITAL DIVIDEND IN AFRICA

The full transition to DTT and the use of the digital dividend by African countries will provide opportunities for human capacity development in various sectors in Africa. This will require a large number of staff with adequate skills in diverse areas such as spectrum management, development of wireless networks, development of e-services and e-applications, and research and innovation.

Regulators must also build their own capacity in order to employ the appropriate spectrum assignment mechanisms, potentially including auctions, for the expected freed-up spectrum. Similarly, regulators must ensure that they have appropriate staffing levels to address the expected increase in consumer and competition issues that will arise due to an expanded ICT market.

Finally, in a much wider context, Africa must train people notably youth and women in sufficient numbers to fill the ICT skills gap and transform Africa into a digital economy. The expanded digital market and need for new skills in the regulatory sector will create opportunities for governments and educational institutions to work together to develop the human capital to meet new sector needs.

African countries need to create an enabling environment by developing policies that will encourage the following:

1. Establishment of ICT centres of excellence to train sufficient professionals to optimize the use of the digital dividend and contribute to the socio-economic development of the continent.

2. Training of the essential human capital for the restructured broadcasting market, which will require a large number of staff with adequate skills in diverse areas such as studio and transmission engineering, production, translation and interpretation, sign language, and consumer issues.

3. Building of African ICT regulators' capacity to conduct spectrum assignment processes for the expected freed-up spectrum, as well as consumer and competition issues.

4. Building capacities in spectrum management and monitoring for an efficient and effective use of the digital dividend.

12. MONITORING, EVALUATION, AND INFORMATION EXCHANGE

In order to ensure effective implementation of the guidelines on the harmonized use of the digital dividend in Africa, it is important to put in place mechanisms to monitor and evaluate progress by collecting data from Member States and developing reports to be submitted to appropriate AU organs. The AU should, in consultation with Member States and other stakeholders, develop a clearly defined monitoring and reporting mechanism that allows for transparency, information exchange, and highlighting of best practices.

While data provided by Member States will represent the key input to such a monitoring mechanism, the AU should also consider inclusion of an avenue for other stakeholders to provide not only deployment data, for example, but also updates on, for example, technology development both inside and outside Africa and best practices in other regions. Such information could be structured as updates or follow-up to the consultative processes implemented at the early stages of an Africa-wide digital dividend planning process.

13. NORMATIVE REFERENCES

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13. ITU-R M Series Recommandations 1036.

14. LIST OF ABBREVIATIONS

The following abbreviations have been used in this document:

APT	Asia Pacific Telecomm unity
ASMG	Arab Spectrum Management Group
ASO	Analogue switch off
ATU	African telecommunications Union
AU	African Union
AUB	African Union of Broadcasters
AUC	African Union Commission
CEPT	European Conference of Postal and Telecommunications Administrations
CITEL	Inter-American Telecommunications Commission
DD	Digital Dividend
DD1	Digital Dividend spectrum in 800 MHz band
DD2	Digital Dividend spectrum in 700 MHz band
DTT	Digital Terrestrial Television
EACO	East African Communications Organizations
EU	European Union
ITU	International telecommunications Union
NTOFA	National Table of Frequency Allocations
PPDR	Public protection and disaster relief
PPP	Public-Private Partnership
RCC	Regional Commonwealth in the field of Telecommunications (read Countries formerly part of the Soviet Union).
RECs	Regional Economic Communities
RRC	Regional Commonwealth in the field of Telecommunications comprising of the countries of Azerbaijan Republic, Republic of Armenia, Republic of Belarus, Republic of Kazakhstan, Kyrgyz Republic, Republic of Moldova, Russian Federation, Republic of Tajikistan, Turkmenistan, Republic of Uzbekistan, Ukraine
RRC-06	ITU 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 (RRC-06)
STB	Set-Top Box
ToRs	Terms of Reference

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