SADC MODEL SPECTRUM POLICY FRAMEWORK

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1. Introduction

1.1 Background

The Southern African Development Community (SADC) coordinates spectrum management and allocation through the common Radio Frequency Spectrum allocation Plan (SADC Radio Frequency Spectrum Allocation Plan [RFSAP]). This approach to management and allocation of radio frequency spectrum ("spectrum") is to encourage innovation in the electronic communications and other sectors as well as to support the mobile and wireless service provision in the region. Harmonisation of spectrum access allows for efficient and effective use of spectrum as well as assuring the interoperability of equipment and communications services. In addition, SADC Member States have agreed to common approaches to usage of spectrum, including; spectrum for use for Public Protection and Disaster Relief (PPDR) services, Short Range Devices (SRDs), Cross Border Private Mobile Radios (PMR) and broadband technologies. SADC has also made recommendations regarding cross-border coordination, licensing of Visitors Amateur Radios and Earth Station in Motion Systems (ESIMs).

It should be recognised that SADC has established its regional priorities such as the SADC Industrialisation Strategy and Roadmap 2015-2063, Revised Regional Indicative Strategic Development Plan (RSIDP) and Regional Infrastructure Development Master Plan for Information and Communications Technologies (ICT) Sector 2012. It is imperative that these regional priorities are translated into strategic policy objectives in relation to spectrum allocation and use. National Spectrum Policies within SADC should facilitate achievement of these regional priorities.

Recognising that modern wireless technologies such as the 5th Generation (IMT 2020) will enable intelligent connectivity that is critical in the 4th Industrial Revolution (4IR), the SADC Spectrum Policy will provide a roadmap to common approaches and strategies towards spectrum management and allocation including spectrum that will be used for IMT 2020 technologies.

1.2 Purpose of the Policy

The objective of this policy is to:

a) achieve effective and efficient use of spectrum in SADC;

b) ensure the availability of spectrum to be used as a tool to develop communication services;

c) facilitate access to ICT infrastructure as a basis for social and economic development in SADC;

d) allow for translation of SADC regional priorities into strategic policy goals for spectrum allocation and use;

e) harmonise the spectrum management policies in SADC;

f) achieve interoperability of equipment and communications services in SADC;

g) promote innovation and competition in SADC;

h) encourage investment in ICTs within the SADC region;

i) avoid harmful interference; and

j) support government use of radio frequency spectrum.

1.3 Structure of the Policy

Section 1: Background and purpose of the policy

Section 2: Principles of radio frequency spectrum management

Section 3: Technology and service neutrality

Section 4: Radio frequency spectrum migration policy

Section 5: Radio frequency spectrum licensing and license exempt spectrum policy

Section 6: Spectrum sharing

Section 7: Pricing of spectrum and spectrum management fees

Section 8: Developing a Spectrum Roadmap

Section 8: Conclusions

1.4 Abbreviations and acronyms

The following abbreviations and acronyms have been used throughout this document:

AIP	-	Administrative incentive pricing
ATU	-	African Telecommunications Union
ASA	-	Authorised Shared Access
BAU	-	Best Alternative Use
CRASA	-	Communications Regulators' Association of Southern Africa
EC	-	European Commission
ECC	-	Electronic Communications Committee

ESIM	-	Earth Stations in Motion
EU	-	European Union
FDD	-	Frequency Division Duplex
GSM	-	Global System for Mobile Communications, a technology standard also referred to as Second Generation (2G)
HAPS	-	High Altitude Platform Systems
ICT	-	Information Communication Technology
IEEE	-	Institute of Electrical and Electronics Engineers
IMT	-	International Mobile Services
IoT	-	Internet of Things
ITU	-	International Telecommunication Union
LSA	-	Licenced Shared Access
LTE	-	Long Term Evolution, a technical standard also referred to as Fourth Generation (4G)
MOCN	-	Multi-Operator Core Network
MNO	-	Mobile Network Operator
NFAP	-	National Frequency Allocation Plan
NRA	-	National Regulatory Authority
ODV	-	Optimised Deprival Value
PMR	-	Private Mobile Radio
PPDR	-	Public Protection and Disaster Relief
RR	-	Radio Regulations of the ITU

SADC	-	Southern African Development Community
SADC RFSAP	-	Southern African Development Community Radio Frequency Spectrum Allocation Plan
SDL	-	Supplementary Downlink
SRD	-	Short Range Devices
TDD	-	Time Division Duplex
WRC	-	World Radiocommunication Conferences
3G	-	Third Generation
4G	-	Fourth Generation
4IR	-	Fourth Industrial Revolution
5G	-	Fifth Generation

2. Principles of Radio Frequency Spectrum Management

Radio frequency spectrum is a scarce resource and hence efficient use of this resource is an overriding policy objective. Efficient use of spectrum has several dimensions:

- Economically: the efficient use of radio frequency spectrum means maximising the value of outputs produced from spectrum including the valuation of public outputs provided by the government or other public authorities. We refer to this as a socio-economic benefit.

- Technically: the efficient use of radio frequency spectrum relates to maximising throughput measured in bits per Hertz and this is achieved by encouraging the deployment of new and appropriate technologies.

Modern wireless technologies such as the IMT 2020 have enabling capabilities for various industries and that's being one of the critical factors in the 4IR. In this case, spectrum is one of a key inputs into enabling the 4th Industrial Revolution and more so that SADC Member States agree on the importance of communications and ICT for the development of member nations as stated in the Spectrum Roadmap: "Efficient and affordable infrastructural services (consisting of transport, communications, ICT, energy and water supply) are critical inputs for reducing transaction costs for industry and trade, as well as for enhancing the economic and social wellbeing of society at large" (SADC Industrialization Strategy and Roadmap 2015 – 2063, Page 9).

Spectrum, ICT infrastructure, applications and other resources are important enablers of development: “Together these are recognised as enablers of social and economic development whose impact cuts across virtually all other sectors”. (SADC Regional Infrastructure Development Master Plan, Information and Communication Technologies (ICT) Sector Plan, August 2012, Page 14).

The “SADC Industrialization Strategy and Roadmap” and the “SADC Regional Infrastructure Development Master Plan” both highlight the importance of spectrum in the development of economies and wider society of SADC member states. It follows that the objective of spectrum management should be to maximise the net socio-economic benefit from the use of spectrum.

At a national level, a national spectrum management agency or National Regulatory Authority (NRA) should be mandated as the agency responsible for spectrum management. The key task of such an entity is to take appropriate measures to ensure efficient and interference-free utilisation of spectrum. Spectrum management should combine the different interests of frequency users, product manufacturers, and end users who depend on services which rely on the use of spectrum. End users in this context include commercial end-users, consumers, public services and government uses.

At international level, ITU-Regional (African Telecommunications Union - ATU) coordination, ITU Global (International Telecommunications Union Radiocommunications Sector - ITU-R), and Sub-Regional Regulatory (CRASA) coordination is essential to achieve efficient and interference-free utilisation of spectrum across whole regions.

To achieve efficient use of spectrum, the national agency responsible for spectrum management should publish a National Frequency Allocation Plan (NFAP).The NAFP must be consistent with the Radio Regulations (RR) of the ITU. The ITU allocates on a worldwide basis frequencies to radio services. The RR is an international agreement which regulates the use of frequency resources for all radio applications, as well as the orbital positions of geostationary and non-geostationary satellites. This agreement is binding for ITU member states, i.e., it is also binding for SADC Member States. The RRs are revised in the World Radiocommunication Conferences (WRC) to adapt the existing framework to evolving spectrum requirements with the aim of refining existing applications and enabling the introduction of new applications. The NFAP should be updated in a timely manner to reflect changes in the RR.

International harmonisation of radio frequency spectrum usage involves the allocations of frequencies to radiocommunication services and results in an entry in the Table of Frequency Allocations for a given frequency band. This allows its use by one or more radiocommunication services and the radio astronomy service under specified conditions. In contrast, the assignment of spectrum to particular users (referred to as radio stations in ITU terminology) is the responsibility of national frequency managers.

Further, the NFAP must, as much as possible, be in harmony with the SADC FAP which provides for a harmonised framework on the allocation of the radio frequency spectrum in SADC. The FAP allocates radio frequency spectrum to the radiocommunication services in line with the ITU RR and the current plan includes the proposals to allocation of spectrum from 8.3KHz to 3000GHz. The FAP is revised every four years after each and every WRC.

SADC Member States' spectrum policy development should consider several key factors which combine to deliver efficient and interference free use of spectrum:

- Harmonisation is a key benefit. Harmonised use consistent with regional and global spectrum allocations means that radio equipment which makes use of various bands is standardised resulting in low equipment costs due to economies of scale. Harmonisation is also an essential element is managing cross-border interference.

- Spectrum which lies fallow does not generate any socio-economic benefit. National spectrum managers should, therefore, ensure that spectrum is assigned as quickly as possible either a) on an exclusive basis to spectrum licences holders; b) in the form of licenced shared access; or c) for general licence exempt use. Exclusive spectrum licence holders include Government and public service users, in addition to private sector service providers and other users.

- To make use of spectrum, in many cases significant investment is required such as in-building mobile communications networks, microwave transmission backbone connectivity, Public Protection and Disaster Relief (PPDR) networks, satellite communications, military communications installations, etc. To ensure efficient investment that will result in low economic costs, spectrum users need to know the long-term plan for the use and licencing of spectrum and require planning certainty with regards to the availability of new spectrum resources and spectrum migration. In order to provide spectrum users and manufacturers with this long-term outlook, national spectrum managers should publish a spectrum strategy covering a period of not less than 5 years. In addition, national spectrum managers should publish a spectrum roadmap which sets out the proposed release of new frequency bands as well as radio frequency spectrum migration for a period of not less than four (4) years.

- National spectrum managers should have a transparent rules-based approach to spectrum management covering all aspects relevant to spectrum management, including the following:

    - technical conditions of spectrum use;

    - spectrum migration from an existing use to a new use;

    - spectrum licensing and license exempt use of spectrum;

    - spectrum sharing;

    - pricing of spectrum licences, license duration and renewal; and

    - spectrum management fees.

From a regional perspective, harmonisation of spectrum is beneficial as it allows for deployment of cross border networks, economies of scale, roaming, management of cross border interference etc... Where there is a choice between a Frequency Division Duplex (FDD) and a Time Division Duplex (TDD) band plan, it is beneficial for member states to agree on either one.

Since spectrum should be allocated to the highest value use or uses with the objective that the maximum socio-economic benefit is realised, mechanisms should be put in place to enable and encourage spectrum to move to its highest value use. Such mechanisms include:

- technology and service neutrality;
- migration of services to other radio frequency spectrum bands;
- spectrum trading; and
- spectrum sharing.

These policies are considered in more detail below.

3. Technology and Service Neutrality

3.1 Introduction

In practice, regulators licence spectrum for particular radiocommunication services (e.g. mobile, fixed wireless access, broadcasting) and in many cases spectrum licences specify the technology to be used (e.g. GSM, CDMA, 3G, LTE, IMT 2020, WiMAX, etc). A policy of technology and service neutral spectrum licencing aims at moving away from these restrictions in order to increase the efficient use of spectrum. Consequently, "Open market and technology neutral licence availability" has been identified by SADC as policy goal. (SADC Regional Infrastructure Development Master Plan and ICT Sector Plan, August 2012, Page 78).

The issue of technology and service neutrality is most relevant for services that operate in bands identified for International Mobile Telecommunications (IMT) and the following section considers technology and services neutrality in this context.

3.2 Benefits Of Technology And Service Neutrality

Taking a technology and service neutrality approach to spectrum licencing allows licensees, typically telecommunications network operators, to use the spectrum they hold in a manner that is driven by socio-economic and market factors as opposed to technological preferences. The competition that emerges between technologies as a result of this neutrality spurs innovation thereby delivering greater social economic value.

A policy on technology neutral spectrum licensing has several benefits:

- spectral efficiency increases as a result of deploying the latest technologies;

- innovation which is critical for meeting the exponential growth in the demand for data services;

- improving the quality of network and service ; and

- market led deployment of new technologies, provided that there are no charges for amending licenses to remove technology specific restrictions.

Within the context of licences which allow the deployment of any standards-based technology which complies with regulations in the licence frequency band, the adoption of service neutral spectrum licensing also delivers important benefits:

- efficiency in spectrum utilization increases because any type of traffic can be passed through a particular frequency range; and

- it fosters innovation because network operators can introduce new services within the licenced spectrum in response to market demand and technology evolution.

3.3 Efficient Spectrum Uses In A Technology Neutral Context

Technology neutrality is a licencing policy approach that allows the use of any non-interfering technology in a frequency band. Frequency bands are harmonised and identified for services, for example IMT, at a global level at the ITU's WRC. The 3GPP, IEEE and other standardisation bodies then develop technical standards for radio equipment to make use of these harmonised bands. In practice this means that only standardised technology is used by mobile and fixed wireless operators. Therefore, technology neutral spectrum licences can be defined as "licences which allow the deployment of any standards-based technology which complies with regulations in the licensed frequency band". The real focus of technology neutrality is to allow mobile network operators to replace older equipment in a frequency band with equipment of a newer standard to move from 2G to 3G, or 3G to 4G or IMT 2020. This process is also referred to as spectrum refarming.

Spectrum is a scarce resource and from a technical perspective the overriding objective in using spectrum is to achieve the best possible spectral efficiency, i.e. passing more traffic through a given amount of spectrum measured in bits per Hertz. With each generation of radio communications technology, spectral efficiency improves. The latest technology should, therefore, be put into use in wireless networks. This is recognised in the constitution of the ITU: "Members shall endeavour to limit the number of frequencies and the spectrum used to the minimum essential to provide in a satisfactory manner the necessary services. To that end, they shall endeavour to apply the latest technical advances as soon as possible". (Constitution of the ITU, Article 44, Paragraph 1).

There are other areas where technology neutrality matters. For example, the wireless technology to be used for safety-related vehicle communications (i.e. V2X) should not be prescribed by regulators but it should be left to industry to select the technology based on their assessment of market evolution and technology benefits.

It is recommended that SADC members adopt a policy of issuing all new spectrum licences as technology neutral licences and to modify existing technology specific licences to become technology neutral. Neutrality increases efficient use of spectrum, and hence there should be no financial or administrative barriers imposed on the conversion of technology specific licences to technology neutral licences.

3.4 Efficient Spectrum Use In A Service Neutral Context

Historically, some countries issued operating or spectrum licences which restricted the use of spectrum to a particular telecommunications service, for example either fixed wireless access or mobile access but not both type of services. Service neutrality is a policy approach which enables telecommunications network operators with spectrum licences to offer any type of service to end-users according to the national frequency allocation plan. It involves moving away from service specific licenses where an operator must hold separate licenses for each type of service offered.

The telecoms industry is experiencing a trend towards convergence of services which has a particular implication for efficient use of spectrum. Today's wireless communication networks can support a range of communication and media services including, for example, transmission of Television (TV) and radio programmes via Internet Protocol (IP) based networks, broadband access to buildings, Internet of Things (IoT) services, mobile broadband, and other services.

In practice the main restriction hindering efficient use of spectrum is to restrict spectrum to be used for either fixed or mobile services. Such restrictions are inefficient because it does not allow usage to evolve in response to market demand. Service neutrality removes this restriction and therefore results in a more efficient use of spectrum.

It is recommended that SADC Member States consider encouraging the introduction of licensing regimes that are service neutral so as to build on the benefits of technology neutrality. In such instances, it is not envisaged that there be financial or administrative barriers imposed on the conversion of service specific licences to service neutral licences. However, in cases where a spectrum licence restricted to fixed service provision was acquired at a much lower price compared to what it would have been worth had the licence been a mobile services licence, it may be appropriate for the state to capture some of the value created from removing the service restriction.

3.5 Technical Considerations

It is intended that spectrum usage rights be defined in a generic way by means of power emission masks and other such technical parameters. This means that any technology working within these rights is allowable. If the rights do not define the type of system or service e.g. fixed or mobile, then the system type or service can change as long as the new system operates within the defined parameters.

In making spectrum assignments, NRAs are encouraged to make a consideration for different in band or out of band properties or the emissions of the technologies that can be accommodated in the said bands.

The rules that govern the usage of spectrum should not hinder the use or development of technologies in the future.

4. Spectrum Migration Policy

4.1 Introduction

Spectrum migration refers to the movement of users or uses of radio frequency spectrum from their existing radio frequency spectrum band within the same band or to another band. Spectrum migration may be initiated when a change in use of the frequency band is necessary. Advancement in technology, introduction of new services, efficient utilisation of the radio frequency spectrum, mitigation of harmful interference and national requirements are the key drivers initiating changes in the use of spectrum. The new technologies come with the benefits of providing better services to consumers and efficient use of spectrum. The outcomes and decisions of WRC trigger the need for migration.

The purpose of this section is to establish a framework by which NRA's within SADC may migrate users or uses of the radio frequency spectrum under their National Frequency Allocation Plan (NFAP).

4.2 Principles

The process of radio frequency migration should be guided by the following principles:

- radio frequency spectrum migration must be consistent with the NFAP;
- assignments of radio frequency spectrum that are no longer in accordance with the NFAP shall be migrated;
- the cost of migration should be minimized by considering, among other things, the duration of the license and the economic lifetime of the equipment; and
- NRAs will determine whether the users to be migrated shall be compensated or not.

4.3 Reasons for radio frequency migration

The process of radio frequency migration will be initiated in the following circumstances:

a) Where a change in the use of a radio frequency band is required to bring the National FAP in line with ITU RR;

b) Where a change in the use of a radio frequency band is required to ensure harmonisation of the National FAP with SADC RFSAP;

c) Where SADC has determined that a change in use of the frequency is necessary for efficient utilisation of the radio frequency spectrum;

d) Where the NRA has determined that a change in a radio frequency spectrum licence holder's assignment within a radio frequency band is required to enable more efficient use of the radio frequency spectrum (in-band migration);

e) Where the NRA has determined that a change of frequency is necessary to mitigate harmful interference; and

f) When NRA has determined a need for cross border frequency coordination

g) Where any other NRA-specific requirement must be accommodated.

4.4 Frequency Migration process

The process of radio frequency migration can be as follows:

a) In consultation with relevant stakeholders, prepare a frequency migration plan which:

- lists frequency bands that will be impacted;
- lists Radiocommunications services that will be impacted;
- identifies users that will be impacted;
- identifies new frequency bands for affected users to move to;
- identify a plan for e-waste disposal; and
- determines the technical and financial requirements including timelines to implement the migration.

b) In consultation with relevant stakeholders, design rules for use of the band:

- develop a channel assignment plan (TDD, FDD, SDL - Supplementary Downlink, simplex, …);
- determine technical parameters (Transmission power, OOBE limits, …) ;
- determine operational rules;
- indicate frequency coordination requirements (cross-border, international, in-band, …); and
- stipulate the licence assignment mechanism for the band (auction, administrative assignment, …).

c) Implement the migration plan and follow up with assignment or licensing of the spectrum to new users.

5. License Exempt Spectrum And Spectrum Licensing Policy

5.1 Introduction

Spectrum use is defined along the dimensions of frequency code, space and time. At one end the use of certain devices in specific bands (e.g. Wi-Fi) is not subject to any licences. Although compliance with the stipulated technical and operational rules are mandatory, at the other end, an exclusive spectrum licence confers to a licensee an interference free right of use within a defined licence area for a specified duration.

In between these two ends there are some alternative methods of managing spectrum usage which are primarily intended to ensure a more efficient and flexible use of spectrum. Licenced Shared Access (LSA) is a method which takes advantage of technology to enable dynamic changes in spectrum use. Spectrum unused by an incumbent user or application at any given time and place can be utilised in a shared, interference-free manner by LSA licences users.

Both exclusive spectrum licences and LSA require spectrum managers to put in place a mechanism to assign such spectrum licences to licensees.

5.2 Licence Exempt Spectrum

Some radio frequencies are designated for specific types of use without the need for users to obtain a spectrum or apparatus licence. This is referred to as licence exempt spectrum. The term “unlicensed spectrum” is also used. There is no need for a user to obtain an individual licence from the regulator as long as the devices used meet certain technical and operational standards which are designed to minimise interference. The most notable examples are Wi-Fi, Bluetooth and cordless phone standards, but there are several others such as radio microphones, baby monitors, car key fobs, garage door openers, and many more. A licence is not required because the technologies used must operate generally at low-power levels, meaning they can only cover short distances. Since every user has an equal right to use these bands, it is not possible to guarantee a particular quality of service.

Licence exempt spectrum is becoming increasingly important for consumer and industrial applications. The success of these applications depends on the availability of low-cost devices that comply with global standards. Globally standardised devices result in economies of scale which bring down the cost of such devices. Standards also ensure that devices can circulate freely around the globe such as WIFI devices and Radio Frequency Identification (RFID) devices.

5.3 SPECTRUM LICENCES

5.3.1 THE RATIONALE FOR SPECTRUM LICENCES

A spectrum licence guarantees the licensee the use of a defined frequency range, protected against interference in a specific geographic area for the duration of the licence period. In essence a licensee has an exclusive right to use the spectrum. Exclusive spectrum licences are an essential tool of spectrum management and are relevant where substantial investment is required to make use of spectrum. Exclusive licences have been the key element in the wide-spread deployment of mobile networks and as a result mobile services are the main means of communications for the majority of the population and businesses in SADC countries.

Exclusive spectrum licenses are a critical element in attracting the large investment required to build mobile networks, to enhance network coverage, improve quality of services, and continually invest in the latest technology. These investments have long pay-back periods and there is considerable demand and technology uncertainty over the return on investment. To counteract the demand and technology uncertainty and in order to promote investment in mobile communications networks infrastructure, spectrum policy should aim to provide investors, notably network operators, with certainty in relation to spectrum licences, including the following aspects:

- certainty of tenure and stability of licence terms;
- a predictable and transparent process to renew existing spectrum licences; and
- access to additional spectrum resources that may be required to keep pace with the evolution of demand and technology.

Exclusive spectrum licences are also an important policy tool to bring telecommunications services to geographic regions where such services would otherwise not attract investment. This is because regulators typically attach obligations to spectrum licences, notably a deployment or coverage obligation which mandate investments beyond what would be commercially viable.

Given the importance of exclusive spectrum licences, assigning exclusive licences through appropriate market-based licensing mechanism is likely to continue to deliver high socio-economic benefits. Exclusive spectrum licences should, therefore, remain the main regulatory approach for IMT spectrum, spectrum used for transmission systems, broadcasting and other uses where socio-economic benefit is delivered as a result of investment.

5.3.2 Spectrum Licence Assignment Mechanisms

Since spectrum licences confer an exclusive right to use on the licence holder, a mechanism must be put in place to assign spectrum licences in a transparent manner consistent with the efficiency objective of spectrum management.

If demand for spectrum does not exceed supply and is not to likely to exceed supply in the medium term, a “first come first served” approach is a simple solution to assign spectrum licences to users. This method does not require significant administrative effort and may be appropriate for certain uses, for example point-to-point microwave links.

In most cases demand for spectrum exceeds supply. This particularly true at WRC level where different uses such as satellite, IMT, terrestrial broadcasting, High Altitude Platform Systems (HAPS) and other uses compete for the scarce resource that is radio frequency spectrum. Demand for spectrum is driven by technology development which enables new systems to be deployed across radio frequency bands ranging from 400 MHz into the GHz range. When, within a country, demand for spectrum exceeds supply, it is important to consider national policy objectives in assigning spectrum to different Governmental, public, or private users. .

Where all other national policy objectives have been considered, spectrum licences are assigned following a transparent rules-based approach with objective criteria. The two main approaches used are a) spectrum auctions and b) comparative tenders (also referred to as beauty contests).

In spectrum auctions, participants bid for spectrum licences, and the highest bidders obtain a licence to use a particular frequency range within a frequency band. This means the licence fee for particular spectrum is determined by the market. Spectrum auctions have been adopted world-wide.

- A spectrum auction should be designed that it supports national policy objective.

- A spectrum auction is the mechanism most likely to deliver the spectrum policy objectives because spectrum is assigned to those who value it the most. By implication this means spectrum is assigned to those users who produce the greatest socio-economic benefit. It must be understood that the primary goal of a spectrum auction is to identify those users. Raising cash for the state is a by-product of an efficient spectrum auction.

- Spectrum auctions assist spectrum managers to determine the market value of spectrum.

- The advantage of spectrum auctions is that the spectrum licence fee is determined by the market. It does not require spectrum managers to estimate the value of spectrum.

- A spectrum auction has the advantage of transparency and objectivity and is thus most likely to deliver the policy objective of efficient use of spectrum.

- Aside from technical conditions, most spectrum licences include obligations, for example to provide coverage in sparsely populated areas or to deploy IMT 2020 technology. With appropriate licence obligations, spectrum auctions can deliver the socio-economic development goals of spectrum policy.

Spectrum licence assignment by comparative tender assigns spectrum to those who score highest against a set of selection criteria. Such tenders are now rarely used due to the drawbacks of this approach when compared to spectrum licence assignment using an auction, as follows:

- spectrum assignment by comparative tender is opaque if the award is based on judgement concerning the quality of the bid. Spectrum will be assigned to operators who promise the most with no assurance of delivery; and

- since the spectrum licence fee is not a selection criteria, the value of the licence to the licensee is not identified.

To mitigate these drawbacks, a comparative tender process should have the following characteristics:

- it must be a transparent process using a predefined set of selection criteria;

- the selection criteria should be translated into scores which lead to an objective selection of the winning tenders; and

- a spectrum licence fee, if any, should be stated in the tender document. The spectrum licence fee should not be a selection criteria.

Regardless of which mechanism is selected to assign spectrum licences, SADC members should adopt the following guidelines when designing a spectrum licence assignment process:

- focus on the overall policy goal of efficient use of spectrum;

- assign all spectrum that is available to avoid having spectrum lay fallow;

- adopt a process that is transparent and objective; and

- consider wider policy objectives, including competition, bringing access to unserved communities, quality of service, innovation, avoiding unnecessary producer costs, and affordability.

5.4 Spectrum Trading

The trading of spectrum licenses can contribute to efficient use of spectrum because it introduces flexibility in the use of spectrum. Spectrum trading enables unused or lightly used spectrum to be transferred to a user who will make better use of it. The socio-economic benefit of spectrum trading is that it can support higher service volumes, lower cost and better-quality services. Spectrum trading should, therefore, not be discouraged by imposing fees or charges which may render spectrum trading uneconomic.

Given its role in improving efficiency in spectrum use, spectrum trading should be allowed in principle subject to competition law and ex-ante competition assessment.

6. Spectrum Sharing

6.1 Introduction

Sharing spectrum between different users and uses is a means of using a given amount of spectrum more efficiently compared to a non-shared use. Sharing spectrum can also reduce costs. Spectrum sharing takes several forms:

- licence exempt spectrum allows all users with standards-based equipment to share spectrum in a designated frequency range. This is dealt with under heading 5.2, above;

- LSA gives licensees individual rights to access a shared spectrum band;

- spectrum pooling is a means for two or more entities who hold licenced spectrum to pool their spectrum and share the spectrum; and

- sub-ordinate spectrum licences in geographic regions where spectrum is not used by the licensee.

In principle spectrum policy should encourage spectrum sharing precisely because it is likely to lead to more efficient use of spectrum. This is particularly true in situations where a particular frequency is not used fully by a single user, for example it is not used all the time or not in all locations within a country.

6.2 Licenced Shared Access

Licenced Shared Access (LSA), sometimes also referred to as Authorised Shared Access (ASA) is a technological solution which allows sharing agreements by time, frequency or geography. Technologies has been developed which allow several users to share a frequency band without causing interference. LSA was developed to guarantee LSA licensees a predictable quality of service and exclusive access to shared spectrum resources. LSA is “licenced” access which means licensees have the same right of use, as defined in the LSA rules, as is the case with spectrum licences which are not shared.

From a spectrum policy perspective, LSA is a complementary method of guaranteeing access to spectrum - in addition to exclusive spectrum licences and license-exempt spectrum - which enables the sharing of spectrum between a limited number of licensed users.

LSA can help to accommodate increasing demand for radio spectrum, notably for mobile broadband. Spectrum policy should, therefore, aim to provide economic incentives and legal certainty for users to develop and deploy spectrum-sharing technologies, for example based on sharing contracts.

6.3 Spectrum Pooling

Spectrum pooling is defined as an approach where licensees who hold exclusive spectrum licences make an agreement to jointly use their spectrum. This concept is mainly applicable to mobile networks. Technology Multi-Operator Core Network (MOCN) is available that allows a network operator to provide access to a single radio access network by other operators. Each operator operates its own core network, including one or more independent nodes.

Spectrum pooling in mobile networks can lead to more efficient use of spectrum because it increases the total bandwidth available to users in a cell and therefore improves the probability of a higher throughput being available to users.

Given its role in improving efficiency in spectrum use, spectrum pooling in the form of MOCN or some other technical solution should be encouraged where it can help in achieving national policy objectives. However, spectrum pooling agreements should not be prohibited or hindered by administrative or financial disincentives and should be subject to competition law and ex-ante competition assessment.

6.4 Sub-Ordinated Spectrum Licences

Often spectrum licences cover an entire country, but the licensee may not have a need for the licenced spectrum in all locations. This presents an opportunity for a licensee to sub-ordinate spectrum to a local operator or other user who would make use of the spectrum in that area thereby ensuring that spectrum that would otherwise be used is put to use and will generate local socio-economic benefits.

Subordinated spectrum licences or “sub-licensing” has been identified by SADC as one of the key actions required for addressing gaps in “Policy and Regulatory Harmonisation of the ICT sector” (paragraph 3, page 78). SADC Member States national spectrum policy should, therefore, encourage sub-licensing and development of applicable regulatory framework.

7. Pricing Of Spectrum Licences And Spectrum Management Fees

7.1 Introduction

There are two (2) types of fees that are levied on the users of spectrum:

- Spectrum licence fees: Where spectrum is licenced to an entity, for use by that entity, it is appropriate to charge a licence fee for the benefit of the right to protected exclusive use. This is referred to as a “spectrum licence fee”.

- Spectrum management fees: Spectrum management authorities incur a cost in monitoring the use of spectrum. This cost should be recovered from spectrum users in form of a “spectrum management fee”.

7.2 Spectrum Licence Fees

7.2.1 Principles And Rationale For Spectrum Licence Fees

Spectrum is a scarce resource and hence it should be used in a manner which generates the greatest socio-economic benefit for a country. Spectrum licence fees and assignment mechanisms should be designed to ensure that spectrum is licenced to those users who can generate the highest socio-economic value from it. Maximising socio-economic benefits to society, by promoting efficient use of spectrum, should always be the main focus when establishing the level of fee for spectrum licences. A well-designed spectrum pricing policy enables the delivery of affordable, universally accessible and high-quality wireless services thereby enabling the digital economy.

Generally, a spectrum licence guarantees the licensee exclusive use for the licenced spectrum for the duration of the licence period. This exclusivity has been the key element in the wide-spread deployment of mobile broadband networks, microwave transmission networks, satellite communications, terrestrial TV and radio transmission networks, and other applications. Exclusive spectrum licences for a duration of 15 or 20 years are key to attracting investment in building wireless communications networks and other telecoms infrastructure.

By definition, exclusively licenced spectrum cannot be used by other users and hence the licensee must use the spectrum efficiently, i.e. in a manner that creates value which is greater than the value that might be created by an alternative use or user. Spectrum licence fees are a key element in ensuring this:

- a cost is placed on the spectrum and hence a spectrum licence fee encourages the user to put the spectrum to economic use rather than letting it lie fallow; and

- a spectrum licence fee can be a tool to ensure that spectrum is licenced to those who value the spectrum the most, i.e. who create the most value from the scarce resource. This is the rationale for assigning spectrum licences by means of an auction. The highest bidder in an auction is the one who is most likely to make the best economic use of the spectrum.

If spectrum licence fees are determined by auction, prices paid are set by the market unless reserve prices (opening bids) are a factor. When setting reserve prices in an auction or setting prices administratively, the overriding objective of achieving efficient use of spectrum needs to be balanced with other policy objectives, notably:

- ensure that there is a business case to make the investment in the infrastructure which makes use of the spectrum. This implies that investors must be able to generate an appropriate return on investment;

- promote investment in telecommunication infrastructure for coverage, quality of service and new technology;

- consider the cost of fulfilling licence obligations, for example an obligation to provide services in remote areas for which there is no viable business case;

- consider the impact on competition because competition tends to deliver better outcomes for consumers in terms of affordability, coverage, quality of service and innovation;

- ensure technical efficiency and economies of scale in infrastructure-based service provision which cannot be delivered effectively in an excessively fragmented market; and

- ensure that the state generates a reasonable return from assigning exclusive spectrum rights.

Among the key policy bottlenecks, SADC Member States identified high spectrum licence fees as the most important issue that needs to be addressed:"Access to broadband radio spectrum and use of TV white space for broadband – Reduce the high cost of radio spectrum licences and ensure availability of optimal frequencies for broadband" (SADC Regional Infrastructure Development Master Plan, Information and Communication Technologies (ICT) Sector Plan, August 2012, page 12). The Plan identifies it as one of the measure of progress in the key ICT strategies, policies and regulations "Progressive spectrum allocation policy and low-cost, efficient licensing" (Page 87).

7.2.2 Methods To Determine The Level Of Spectrum Licence Fees

There are three main methodologies to determine the level of spectrum licence fees:

a) Market Based Pricing

- Generally, applies to spectrum that is used for commercial purposes and where the demand for the spectrum exceeds supply. The spectrum price is determined by the market, typically through a spectrum auction. An auction has the benefit of transparency in spectrum assignment.

- A market-based spectrum assignment mechanism, such as an auction, is most likely to deliver the objective of assigning spectrum to those who generate the greatest socio-economic value from the spectrum because the winning bidders in an auction are those who assign the highest value to spectrum.

b) Administrative Incentive Pricing (AIP)

- The term "administered" indicates that prices are set by the regulator reflecting the opportunity cost of spectrum while incorporating potential "incentive" properties. Prices are thereby set at a level to encourage efficient use, reflecting spectrum scarcity. Because a price is put on spectrum, i.e. there is a cost to the spectrum licence holder, the spectrum licence holder has an incentive not to hold spectrum which is not needed and also to use spectrum as efficiently as possible.

- The level of licence fee can be calculated using different methodologies. The main methodologies are:

- Optimised Deprival Value (ODV): Deprival value is a cost-based valuation approach that answers the question: "What is the least cost system or bundle of assets needed to provide customers with the existing level and quality of services, should a certain existing asset be removed?" This approach can be applied to valuing spectrum rights by addressing the following: "If an operator was deprived of incremental spectrum rights, what incremental costs would be incurred to replicate the existing level and quantity of services using the remaining spectrum rights?" These costs are "avoided" by owning the incremental spectrum rights and so represent the value of those rights. The rights holder should be prepared to pay up to the value of the incremental costs to avoid being deprived of its spectrum rights, so long as the incremental costs are less than the present value of the free cash flows generated from the spectrum services. ODV calculates this price on the basis of the "deprival value" of a marginal block of spectrum (typically 2x5MHz), for an average reference operator:

- Best Alternative Use (BAU): BAU considers the value placed on an incremental block of spectrum by alternative users or uses, such as broadcasting instead of mobile communications, a new use, or competitors.

- Migration Cost Recovery: Where incumbent spectrum users have to vacate spectrum in order for the spectrum to be allocated to a new use and assigned to new users by means of an exclusive licence, there may be a cost associated with the migration. The price for spectrum licences for this migrated spectrum can be set so as to recover the cost of moving the incumbent users out of the spectrum.

7.2.3 Spectrum Licence Fee Payments

Spectrum licence fees can be paid in a single up-front payment to cover the entire duration of the license. Alternatively, payments can be made in instalments or the licence fee can be an annual payment. Combinations are also possible. Whichever method is chosen, the spectrum licence fee should be fixed at the start of the licence term. If the spectrum licence fee is paid each year and may increase, then the method whereby the increase is calculated should be fixed at the start of the licence, for example in line with the inflation rate for the currency in which the licence fee is denominated. This provides investors with certainty over the cost of the licence during the entire term of the licence and therefore helps to the licensee to make positive investment decisions.

A spectrum licence fee payment is a fee related to the amount of spectrum licenced. Often other regulatory fees are levied on spectrum users. Such other fees, for example fees related to revenue generated from the use of spectrum, the number of base stations deployed, or any other variable not linked to the amount of spectrum held are not spectrum licence fees.

Linking spectrum fees to revenue is not recommended, because licensees who generate the most value from spectrum, i.e. who use spectrum more efficiently, will pay more than licensees who use spectrum less efficiently. Given that the aim of spectrum policy is efficient use of spectrum, such an approach conflicts with this basic principle of spectrum management.

7.2.4 Spectrum Licence Duration And Renewal

The duration or term of a spectrum licence should be set consistent with the nature of the investment required to make use of the spectrum. In cases where such investments are large and require a long time to recover costs, the licence duration should be consistent with the investment horizon of the licensee. For example, licence durations of 15 to 20 years or perpetual licences typical and appropriate for MNOs.

Spectrum licences with a finite term should include the presumption of licence renewal for the existing licence holder. Authorities should follow a predictable, timely and open licence renewal process. Ideally the terms and conditions for licence renewal should be written into the licence at the time of granting the licence. If this is not the case, then terms and conditions for licence renewal should be agreed at least three (3) years prior to licence expiry so as to reduce the risk of investment being reduced or postponed. Exceptions to the presumption of renewal should only apply if there has been a serious breach of licence conditions.

7.3 Spectrum Management Fees

A spectrum management fee is distinct from a spectrum licence fee. It is a fee paid for the cost incurred by the spectrum manager for managing spectrum. Spectrum management tasks include monitoring what frequencies are used by whom and in which location, maintain a register of spectrum users, monitor interference, and other spectrum management tasks. The cost associated with these tasks, such as staff costs and purchasing monitoring equipment, needs to be recovered from spectrum users by means of a spectrum management fee.

Such spectrum management fees should be set in a transparent manner. Spectrum management fees should be based on the cost incurred by the spectrum management authority for managing the spectrum and not any other variable. Typically, a spectrum management fee is paid annually with reference to actual spectrum management costs incurred.

The Priority List of Projects and Resource Requirements of the Regional Infrastructure Development Master Plan Information and Communications Technologies (ICT) Sector Plan 2012 as part of policy actions in relation to spectrum management explicitly recommends “cost-based spectrum fees” (Page 78). Costs related to other functions carried out by NRA should not be recovered through the spectrum management fee. For the avoidance of doubt, a spectrum management fee is not a spectrum licence fee.

8. Developing A Spectrum Roadmap

A Spectrum Roadmap focuses on the future release of spectrum. It usually provides a five-year outlook to enable planning. The purpose of a Spectrum Roadmap is to provide information to all stakeholders about when and how frequency bands will be allocated for which use and, if spectrum is to be licenced, the method of assigning it to users. A Spectrum Roadmap should be developed consistent with the Principles of Spectrum Management. These principles are informed by policy objectives.

A Spectrum Roadmap would contain or refer to:

- An inventory of the status quo in the form of the NFAP. The NFAP is updated regularly, but at least every four years to accommodate WRC decisions. NFAP also serve as an input into developing a Spectrum Roadmap. Spectrum has a great variety of uses and users which are identified in a NFAP. Therefore, a complete NFAP identifies for each MHz of radio spectrum from 8.3 kHz to 3,000 GHz the following:
    - the Regional Allocation (ITU Regions 1, 2, 3),
    - the allocation in the country,
    - band plan and existing utilisation, and
    - additional remarks.
- Current technological developments demand for spectrum and latest WRC decisions.
- A timetable for the review of the FAP and where applicable, assignment of spectrum to operators, i.e. licencing.
- The work-programme, i.e. actions and decisions required to achieve the stated timeline.

The purpose of a Spectrum Roadmap is to inform a work programme, decision making and actions with a focus on where the allocation and assignment of new spectrum or changes are required. The most dynamic area of spectrum management is the use of spectrum for IMT. With this focus on IMT, a Spectrum Roadmap shall be designed to ensure there is enough spectrum assigned to meet the rapid increase in demand for wireless broadband services. The key issue for NRA's is that the fast pace of technology developments requires constant effort to provide clarity and predictability and this requires adaptability in spectrum management.

Incumbent users and new users require planning certainty. This means regulators have to review spectrum for new uses in advance of the technology becoming available so that incumbents and new users can optimise investment decisions. With this in mind, the benefits of a Spectrum Roadmap can be summarised as follows:

- Documents a common understanding of the issues and trends so as to allow a regulator to formulate its work-programme, i.e. what needs to be done when, and also secure political backing.

- Provides industry with certainty about the future assignment and renewal of spectrum licences.

- Informs incumbent and adjacent spectrum users about the latest technology developments and how changes may affect them.

Many regulators have adopted an evidence-based approach to drawing up regulations and to decision making. The Spectrum Roadmap should present the evidence which informs the proposed programme and decisions. Evidence is also required to demonstrate where decisions are made that involve a trade-off with a view to increasing the total welfare of a country. Evidence is gathered through studies and also from stakeholder inputs.

It is best practice to follow a consultative approach in drawing up a Spectrum Roadmap. Stakeholders should have the opportunity to provide information and comments. If stakeholder views are considered, it is much more likely that the spectrum release and assignment plan contained in the Spectrum Roadmap can be delivered given that:

- All evidence relevant to the decisions will have been gathered which means decisions are well-informed.

- Potential technical and legal issues can be identified and addressed.

- Commercial interests will have been examined and considered.

- Security and wider societal aspects are brought into the decision-making process.

- It is less likely to meet with resistance in its implementation.

A Spectrum Roadmap is not only for information. The purpose of a Spectrum Roadmap is to take actions which deliver outcomes consistent with the principles of spectrum management, notably what spectrum will be released when and how the spectrum will be assigned. The actionable elements of a Spectrum Roadmap are set out below:

- Work programme and timing
    - Spectrum allocation plan with dates
    - Spectrum migration plan with dates
    - Incumbent migration plan with dates
    - Spectrum assignment (licencing) plan and procedures with dates
    - Spectrum licence renewal with dates.

- Assignment method, if to be licenced, for example market based (auction) or administrative assignment.

- Licence conditions.

The actionable items constitute the work-plan for the regulatory authority and are a commitment by the regulatory authority to all stakeholders notably the operators and their customers.

9. Conclusions

It is concluded that:

(i) Harmonisation of national RF spectrum policies and regulatory frameworks allow for efficient and effective use of RF spectrum, the interoperability of equipment and communications services and creation of economies of scale; and

(ii) That an aligned regional approach to RF spectrum management will promote innovation and timeous release of RF spectrum resources for building and enhancing digital services to support socio-economic development in SADC.

SADC Member States are urged to consider the principles set out in this Policy and aim to incorporate as such into their national RF spectrum strategies, roadmaps and regulatory frameworks.