# Consultation Document

## Initial Consultation on the revised National Radio Frequency Plan, Spectrum Management, Licensing and Pricing Principles

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# About this document

The Botswana Communications Regulatory Authority (BOCRA) is conducting the first of two consultation exercises in relation to the development of a revised Spectrum Management Strategy for Botswana.

This document is designed to gather Stakeholder views on BOCRAs proposals for a revised National Radio Frequency Plan (NRFP), supporting footnotes as well as draft positions on key agenda items for WRC-19. This document is also seeking initial Stakeholder views across a wide range of spectrum management issues including spectrum assignment, trading, sharing and renewal, as well as licensing and pricing principles. This document contains general commentary on the key issues. The second consultation will present BOCRAôs proposals based on a detailed assessment of the Botswana market and the input of Stakeholders from this initial assessment. The issues addressed in this consultation potentially have relevance for a wide range of spectrum users, including:

- Fixed Wireless Access Systems;
- Mobile Services (voice and data);
- Mobile Radio Services;
- Radio Local Area Networks;
- Broadband Wireless Access Systems;
- Broadband Public Protection and Disaster Relief;
- Fixed Radio Services;
- Fixed Services
- Point-to-Point Radio Systems
- Point-to-Multi-Point Systems;
- Broadcasting Services;
- Public Mobile Access Radio (PAMR) and Private Mobile Radio (PMR);
- Satellite Communications; and
- Short Range Devices.

This document also seeks to understand the potential levels of Stakeholder demand for new spectrum, particularly for International Mobile Telecommunications (IMT) services. In addition, BOCRA is seeking specific Stakeholder feedback in relation to a potential assignment of IMT spectrum in the 800 MHz spectrum range.

In this document, BOCRA describes a range of potential approaches to spectrum management that have been adopted in other markets and seeks Stakeholder views on the relevance and suitability of these approaches in Botswana. Input from Stakeholders will inform BOCRAôs future policy proposals.

# Version Management

| Version | Date | Author | Comments |
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| 001 | 10/08/2018 | Graham Friend | Initial draft |
| 002 | 14/08/2018 | Sarah Johnson | Annex B cover sheet template |
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[Note to BOCRA: The Version Management table above will be deleted when this document is finalised and ready for publication.]

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# Section 1. Executive Summary

## 1.1 Introduction

1.1.1. The Botswana Communications Regulatory Authority (BOCRA) was established through the Communications Regulatory Authority Act, 2012 (CRA Act) and is responsible for managing radio frequency spectrum in the Republic of Botswana. BOCRA is required by the Act to promote efficiency, investment, innovation and competition in the regulated sectors.

1.1.2. The rapid rate of change taking place in the information and communication and technologies (ICT) sector means that BOCRA must periodically review its approach to spectrum management and update its forward-looking Spectrum Management Strategy. BOCRAôs Spectrum Management Strategy covers a period of approximately 10 years. BOCRA is in the process to review and update this Strategy.

1.1.3. BOCRAôs Spectrum Management Strategy includes the National Radio Frequency Plan (NRFP) and accompanying footnotes for Botswana, Spectrum allocation Policy, Spectrum Pricing Policy, Spectrum licensing Policy among others. BOCRA has recently revised and updated the NRFP which is still in draft form awaiting consultation and will develop migration plans where necessary for implementing the updated NRFP. BOCRA is seeking Stakeholder views on the updated draft NRFP and footnotes.

1.1.4. Over and above the NRFP and footnotes, BOCRA is seeking stakeholdersôviews on spectrum assignment, trading, sharing, renewal, licensing and pricing. These initial Stakeholder views will inform future policy proposals which will be subject to further consultation.

1.1.5. A key input into BOCRAôs future policy proposals is an assessment of Stakeholder demand for spectrum for different radiocommunication services including IMT. This consultation document therefore seeks initial input from Stakeholders on their spectrum requirements over the coming years.

## 1.2 National Radio Frequency Plan

1.2.1. Technological developments require a periodic revision of a countryôs National Radio Frequency Plan to ensure that a countryôs valuable spectrum resources are utilised efficiently and generate the greatest socio-economic benefits. Most regulators revise their Plans periodically reflecting the four-yearly cycle of the World Radiocommunications Conference. To ensure that the people of Botswana benefit from access to low-cost user equipment and services arising from global economies of scale, it is important that spectrum use under Botswanaôs NRFP is aligned with the decisions of appropriate international bodies. Such bodies include the International Telecommunications Union (ITU), European Post and Telecommunications (CEPT) as well as regional organisations such as the Southern Africa Development Community (SADC) and Communications Regulators Association of Southern Africa (CRASA).

1.2.2. Following WRC-12 and WRC-15, BOCRA has revised and updated the NRFP and Footnotes and is seeking views from Stakeholders on the revised plan. Following the approval of the final NRFP, BOCRA will develop plans to migrate affected licensees between spectrum frequencies in accordance with the NRFP. This consultation seeks initial input from Stakeholders on how such migration can be best achieved.

## 1.3 Radio Spectrum Management

1.3.1. Radio spectrum management encompasses a wide range of issues. In general, BOCRA intends to implement internationally recognised principles of best practice in Botswana. A key aspect of radio spectrum management is the assignment of the same. BOCRA is seeking Stakeholders inputs on their requirements and demand for additional radio spectrum in the next 10 years.

1.3.2. The demand for additional radio spectrum requires BOCRA to develop appropriate methods for assigning new frequencies. Approaches used in Botswana to date for the assignment of high demand spectrum for exclusive

use include administered approaches such as ñEqual Allocationò and ñInvitations to Applyò a form of ñComparative Assessmentò. Selecting the appropriate method becomes particularly important when there are competing demands for the use of certain frequencies because BOCRA has a legal duty to ensure that the spectrum is used efficiently. BOCRA is therefore seeking Stakeholdersô initial views on what the most appropriate methods could be for assigning radio spectrum for a wide range of uses in Botswana, especially where demand exceeds supply for certain frequency bands.

1.3.3. The issues raised in the approach to radio spectrum licensing (including the form of spectrum licence or permission, its duration, rights of use and renewal to be offered and obligations such as coverage and quality of services required) are closely related to the method of radio spectrum assignment. Radio spectrum pricing is also inherently linked with assignment decisions. BOCRA is seeking initial Stakeholder views on these topics. In addition, BOCRA is seeking input on spectrum trading and sharing. These are all topics relevant to ensuring that spectrum is used efficiently.

1.3.4. Spectrum management encompasses a wide range of spectrum frequencies and a wide range of uses and users. The scope of this consultation encompasses, but is not limited to, the following services:

- Fixed Wireless Access Systems;
- Mobile Services (voice and data);
- Mobile Radio Services;
- Radio Local Area Networks;
- Broadband Wireless Access Systems;
- Broadband Public Protection and Disaster Relief;
- Fixed Radio Services;
- Point-to-Point Radio Systems
- Point-to-Multi-Point Systems;
- Broadcasting Services;
- Public Mobile Access Radio (PAMR) and Private Mobile Radio (PMR);
- Satellite Communications; and
- Short Range Devices.

1.3.5. BOCRA welcomes all current and future users of spectrum as well as other Stakeholders to contribute to this consultation on spectrum management issues in Botswana.

## 1.4 Assignment of 800 MHz Spectrum

1.4.1. The successful migration of broadcasting service from 694 ï 862Mhz on account of digital transmission in ITU Region 1 has freed spectrum in the 700 and 800 MHz range. This band is now allocated to Mobile service on a primary basis and identified for IMT. The 800 MHz is popularly referred to as the first digital dividend and the 700Mhz as the second digital dividend. In Botswana BOCRA is seeking to make 800 MHz spectrum available for mobile telecommunications as soon as possible. However, interference issues with bordering countries, in particular South Africa, which has not yet switched off its analogue transmitters will make the assignment of 800 MHz more challenging. BOCRA is seeking initial input from Stakeholders on potential approaches to making this spectrum available as early as possible.

## 1.5 Next Steps

1.5.1. Stakeholders are invited to provide input into this consultation process by following the procedures explained in the Annex and making use of the templates provided alongside this consultation. In order to provide Stakeholders with sufficient time to consider the issues raised in this consultation, two separate closing dates have been defined. The first closing date relates to Stakeholder comments on the NRFP, Footnotes and Migration Plans. The closing date for these is 5:00pm on 26 October 2018. The second closing date relates to Stakeholder comments on the remaining spectrum management issues and is 5:00pm on 09 November 2018.

Exhibit 1: Provisional Key Dates

| Event | Date |
|---|---|
| Consultation on the NRFP and footnotes | 26th October 2018 |
| Consultation on Spectrum Management Issues closing date | 09th November 2018 |
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| | |
| | |
| | |

Source: BOCRA

# Section 2. Introduction

## 2.1 Consultation Approach

2.1.1. BOCRA is consulting on the updated National Radio Frequency Plan and Footnotes. Following a review of the responses from Stakeholders, the final NRFP and Footnotes will be adopted as Botswana National Frequency Plan.

2.1.2. BOCRA is also seeking initial Stakeholder input on a wide range of spectrum management issues. The views of Stakeholders will be considered in formulating BOCRAôs draft Spectrum Management Strategy. The draft Strategy will then be published for consultation and the views of Stakeholders will be considered before the Spectrum Management Strategy is finalised.

2.1.3. All Stakeholders are invited to contribute to the consultation process by submitting their views by the relevant consultation closing dates. This document contains a series of questions and Stakeholders are invited to provide responses to these specific questions as well as any additional relevant input. Detailed instructions on how to respond are provided in Annex A and supporting templates are provided in the further Appendices.

## 2.2 Structure of the Document

2.2.1. Section 3 explains BOCRAôs legal status and statutory responsibilities as well as its values and approach to regulation. This section also highlights the key objectives of Botswanaôs Vision 2036 which are most relevant from a spectrum management perspective.

2.2.2. Section 4 provides a brief overview of the key changes to the National Radio Frequency Plan arising from WRC-12 and 15.

2.2.3. Section 5 describes the migration plans proposed to realise the spectrum allocations identified in the National Radio Frequency Plan.

2.2.4. Section 6 seeks input from Stakeholders on their future requirements for IMT spectrum bands.

2.2.5. Section 7 discusses a range of licensing issues, including licence duration and indefinite licence terms as well as potential licence obligations such as coverage and quality of service which may be attached to certain frequencies. This Section also explores the approaches to spectrum licence renewal that have been used in other markets, such as administered pricing, auctions and hybrid approaches incorporating elements of both. BOCRA seeks views from Stakeholders on the most appropriate approaches for renewal in Botswana.

2.2.6. Section 8, which is closely related to Section 7, describes a range of approaches to spectrum assignment including some which have been used in Botswana such as ñEqual Allocationòand ñInvitations to Applyò(a form of Comparative Assessment) as well as alternative market-based approaches such as auctions. This Section seeks views on what are the most appropriate approaches for spectrum assignment in Botswana in light of likely relative levels of supply and demand for certain bands and the relative size of Botswana.

2.2.7. Section 9 focuses on spectrum trading and is closely related to licensing policies on licence duration which may include indefinite licence terms. Efficient spectrum management requires that, where spectrum licence terms are indefinite, some form of market-based approach, such as trading, must be employed to establish incentives for ensuring ongoing efficient use of spectrum. This Section seeks the views of Stakeholders on introducing spectrum training in Botswana.

2.2.8. Section 10 examines spectrum pricing issues and is closely linked to relative levels of supply and demand for specific spectrum frequency bands and the choice of assignment method. The views of Stakeholders on the most appropriate pricing approaches for high and low demand spectrum bands are sought.

2.2.9. Section 11 looks at sharing spectrum between users to support greater levels of competition and spectrum efficiency. Stakeholdersôviews on spectrum sharing and alternative approaches to it are requested.

2.2.10. Section 12 focuses specifically on the assignment of 800 MHz spectrum and seeks Stakeholdersô views on how cross-border interference issues can be managed, as well as the timing for assignment, the approach to assignment and how the spectrum should be priced.

2.2.11. Details of how to respond to this consultation and supporting forms and tables are provided in the Appendices.

# Section 3. Legal Framework

## 3.1 Legal Framework

3.1.1. The Botswana Communications Regulatory Authority (BOCRA) was established by the Communications Regulatory Authority Act, 2012 (CRA Act) and is responsible for managing radio frequency spectrum in the Republic of Botswana. BOCRA is required by the CRA Act to promote efficiency, investment, innovation and competition, including in relation to radio spectrum management.

3.1.2. BOCRA is responsible for formulating and implementing a Spectrum Management Strategy. The Strategy comprises the National Radio Frequency Plan and frameworks and principles related to spectrum management activities. The National Radio Frequency Plan identifies the use (allocation) of radio spectrum by different classes of user. The frameworks and principles relate to:

- Spectrum licensing;
- Spectrum pricing;
- Spectrum assignment; and
- Other aspects of spectrum management.

## 3.2 BOCRA's Statutory Duties

3.2.1. BOCRA's statutory duties as defined by the CRA Act most relevant to this consultation are:

- Protecting and promoting the interests of consumers;
- Facilitating and encouraging private sector investment and innovation;
- Ensure that technology is aligned with recognised standards so that Botswana can benefit from economies of scale in equipment manufacture and inter-operability;
- Promote efficiency and economic growth in the sector and ensure rational use of radio spectrum;
- Ensure the availability of ICT services to low income groups, rural areas or otherwise disadvantaged groups of consumers; and
- Promote and facilitate the convergence of technologies.

3.2.2. The BOCRA core values describe the manner in which BOCRA should make decisions and also govern the conduct of this consultation process. BOCRA's values include:

- Openness;
- Transparency;
- Accountability;
- Innovation
- People Centred
- Consistency;

- Objectivity; and
- Without undue preference to any person or organisation.

3.2.3. Botswanaôs ñVision 2036,ò which was first published in 2016, provides the overall context for the strategic objectives of BOCRA. The Vision 2036 is based on four pillars:

- Sustainable Economic Development;
- Human and Social Development;
- Sustainable Environment; and
- Governance, Peace and Security.

3.2.4. Vision 2036 is a wide-ranging programme initiative that encompasses a great many industries, markets and consumer groups within Botswana. Increasing broadband access is an important enabler for many aspects of Vision 2036. The Draft National Broadband Strategy was published in December 2017 and plays an important role in shaping BOCRAôs priorities. The National Broadband Strategy identifies two principal goals and a number of objectives.

3.2.5. The overall policy goals of the National Broadband Strategy are to:

- Establish a coordinated approach to ensure that reliable high-speed networks are universally accessible throughout the country; and
- Ensure equitable and affordable access to broadband infrastructure and services by all people over time.

3.2.6. The National Broadband Strategyôs objectives which are most relevant to spectrum management are to:

- Create an enabling environment that:
  - Encourages and ensures increased uptake and usage of broadband services by all citizens;
  - Ensures the integrity and security of the broadband networks to promote confidence and trust in electronic commerce and transactions; and
  - Introduces and promotes flexibility in the use of scarce resources such as spectrum to ensure the broader availability of broadband services.
- Facilitate and encourage economic diversification inter alia by promoting and facilitating:
  - Innovation, research and development.

3.2.7. The National Broadband Strategy also sets out a range of specific targets against which its progress and success will be assessed:

- Ensure broadband connectivity for all, including remote, rural, agriculture, underserved and unserved areas in Botswana;
- Increase broadband access to homes, businesses and government premises;
- Set up public access broadband facilities in communities across Botswana;
- Increase affordability and demand for ICT smart devices;
- Increase affordability and use of advanced broadband-enabled ICT devices for target user groups;
- Create an enabling environment that encourages and ensures increased deployment, uptake and usage of broadband services;

- Create an environment that introduces and promotes flexibility in the use of scarce resources such as spectrum to ensure the broader availability of broadband services; and
- Promote innovation, incubation, research and development in the Botswana's ICT sector.

3.2.8. The BOCRA Spectrum Management Strategy should not only ensure that BOCRA meets its statutory duties but also supports the National Broadband Strategy.

# Section 4. National Radio Frequency Plan

## 4.1 Introduction

4.1.1. BOCRA has updated the Botswana National Radio Frequency Plan and associated footnotes based on the outcomes from WRC-12 and WRC-15.

4.1.2. WRC-12 produced 26 significant resolutions including changes to important footnotes. Notable resolutions included:

- defining the operation of aeronautical and High-Altitude Platform Systems (HAPS);
- a recognition of the requirement for dedicated spectrum for short-range devices;
- identification of spectrum in the 790 MHz to 862 MHz range for IMT / Mobile services;
- identification of fixed services for special attention regarding block-edge mask performance in the 73 GHz to 238 GHz band; and
- passage of five resolutions regarding changes to the maritime, radiolocation and distress services.

4.1.3. WRC-15 produced 20 significant resolutions. Three key themes were:

- A number of additional bands were ratified for Region 1 for wireless broadband services. Spectrum in the 3600 MHz to 3800 MHz range was included for future agenda items during WRC-19. Under footnotes 5.429B and 5.430A, spectrum in the 3300 MHz to 3600 MHz range was identified for IMT in all AMT countries along with all of Regions 1 and 2.
- Significant debate and discussion concerned agenda item 1.3 Broadband Public Protection and Disaster Relief (BPPDR), which was identified as having a high priority status. This item concerned the review and possible revision of the WRC Resolution which documents the scope and regulatory context of Public Protection and Disaster Relief (PPDR) internationally.
- Considerable discussion and negotiation took place in relation to changes required to allow the development of enhanced wireless broadband and mobile services in defined sub-bands between 600 MHz and 38 GHz to support the IMT2020 vision of development worldwide. The conference agreed that "quasi global" could be identified within sub-bands 3300 MHz to 3400 MHz and 1427 MHz to 1518 MHz.

## 4.2 National Radio Frequency Plan

4.2.1. A copy of the revised National Radio Frequency Plan and associated Footnotes is published alongside this consultation document. Stakeholders are invited to share their views on the revised Plan.

| Question 1 - What are your views on the revised National Radio Frequency Plan and Footnotes? |
|---|

# Section 5. Migration Plans

## 5.1 Introduction

5.1.1. Migration of existing uses and users of certain spectrum bands may become necessary under the updated NRFP.

5.1.2. The updated NRFP may require some existing users to vacate some or all of their current spectrum holdings and potentially migrate to new bands. Spectrum bands susceptible to migration for new uses are digital dividend bands (700 / 800 MHz), and potentially bands that are currently used for fixed wireless access services. The upcoming WRC-19 and the licencing of additional spectrum bands for 5G services may lead to further spectrum bands being affected by migration, e.g. in frequency bands above 24 GHz, which are considered for the future development of IMT.

Question 2 - Which spectrum bands do you think must be migrated for new uses and new users?

## 5.2 Migration Plans

5.2.1. Retaining a given spectrum band in its current use until the licence term has expired may result in a loss of economic or social value, slowing the development of the national economy. Enabling new uses of currently occupied spectrum poses various questions, such as how to measure whether new uses are economically more beneficial than existing ones, or how to ensure that new uses produce larger net present social values than the cost of terminating or migrating existing services.

5.2.2. Where possible, BOCRA will seek consensual processes for migration, and limit forced migration to cases where it is necessary to migrate existing services to free frequency bands for other uses and applications.

Question 3 - Which mechanisms should BOCRA apply to migrate existing spectrum to new uses and / or users?

Question 4 - Do you have any suggestions regarding the time frames for migration?

# Section 6. Spectrum Demand

## 6.1 Introduction

6.1.1. Spectrum is a valuable natural resource and in some frequency bands demand from users can exceed the available supply. Where demand exceeds supply, BOCRA must ensure that the spectrum is assigned to those that will use it most efficiently. Efficient assignment of spectrum maximises the socio-economic benefits derived from the use of that spectrum. In determining the most appropriate approach for assigning spectrum BOCRA needs to understand which frequency bands are likely to experience demand exceeding available supply.

## 6.2 Current BOCRA Approach to Assessing Demand

6.2.1. In the current BOCRA spectrum management strategy, if demand exceeds supply, spectrum is assigned through a competitive process, currently based on an Invitation to Apply (a form of comparative assessment). Otherwise, spectrum is assigned through a First Come, First Serve approach. The latter, however, takes into account the number of operators active in a market or planning to enter. Competitive procedures (whether comparative assessment or auctions) are potentially more expensive and time consuming both for BOCRA and potential participants. This suggests that they are most appropriate when demand exceeds supply and obtaining an efficient assignment is a key regulatory objective. In the absence of excess demand, then some form of low cost and fast administered approach is preferable.

6.2.2. In a low-population-density-country like Botswana, excess demand is likely to occur only in a few special cases. Unfortunately, the level of demand cannot be observed directly. In practice, BOCRA needs to know whether demand would exceed supply if the spectrum were offered at some given cost to the applicants. Traditional demand surveys or interviews are generally unreliable because interested parties may have incentives to misrepresent their demand, particularly where no cost is implied. In the current strategy a formal procedure for demand assessment has been used to reveal whether demand for block licences exceeds availability in frequency bands performed.

Question 5 - The above statement is drawn from the current strategy. Should BOCRA maintain the status quo? If not, how should demand for spectrum be assessed?

## 6.3 IMT Spectrum Bands

6.3.1. One area where spectrum demand may exceed supply is in the IMT spectrum bands. In order for BOCRA to develop an initial assessment of potential levels of demand, Stakeholders are invited to indicate their interest in using IMT bands by completing the table to be found in the Appendix and re-produced below for illustration purposes. Stakeholders are also invited to comment on their requirements.

Question 6 - What are your spectrum requirements by spectrum band?

Exhibit 2: IMT Spectrum Bands

| Identifier | Frequency Range | Type | Amount | Quantity Required | When Required |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

Source: BOCRA

# Section 7. Spectrum Licensing

## 7.1 Introduction

7.1.1. A key role performed by BOCRA is the licensing of spectrum in pursuit of its policy objectives. BOCRA solicits the views of Stakeholders on the following key issues:

- Which frequencies should be licensed, and which should be licence exempt?
- For those frequencies that are to be licensed, what licensing approach should be adopted?
- What obligations and rights should be contained within the licences?
- What approach should be adopted for the renewal of licences at the end of the licence term?

## 7.2 Licensed and Licence-Exempt Spectrum

7.2.1. For all spectrum, a key initial question is whether it should be licenced for exclusive use or made available to multiple providers and/or users on a licence-exempt basis. In general, spectrum for broadcasting, fixed and mobile services has historically been licensed on an exclusive basis using service and technology-specific licences of 10 years or more. In contrast, spectrum bands identified internationally by WRC for licence-exempt use are normally made available in national markets on a licence-exempt basis. This "mixed" model of exclusive spectrum assignment and licence-exempt use provides a heterogeneous spectrum environment which allows contrasting spectrum uses to be deployed on an efficient basis.

Question 7 - What are your views on BOCRA continuing to adopt a ñmixedò model for assignment spectrum, combing both a licensed and licence-exempt approach?

Question 8 - Which specific frequencies do you believe should be licensed and which do you believe should be licence-exempt and why?

## 7.3 Spectrum Licensing Approach

7.3.1. Where spectrum is subject to licensing, unified licence regimes are progressively being established internationally and are replacing earlier service and technology-specific licensing. Service or technology-specific licensing was characterised by large numbers of different types of licences. Providers' business models and choice of technology typically determined the licences needed. This complex approach has now become redundant.

7.3.2. Driving this change in regulation are advances in technology and new services offered by providers. These mean that the same services can be offered using different technologies and make previous service and technology-specific licence regimes obsolete. In contrast, unified licences are intended to simplify a national licensing regime, ensure providers are treated consistently, and allow greater flexibility in the way providers offer communications facilities and services and the technology they use. See commentary from the World Bank in Exhibit 3 below.

Exhibit 3: World Bank / ITU ICT Regulation Toolkit: Authorisation

*"When competition was first introduced, the original licenses were hefty documents containing specific details regarding the technology to be used and behaviour of a particular licensee. Gradually the legacy of this practice is being superseded by issuing light-touch, general authorisations that apply across all sectors or in a particular sub-sector or "class". […].*

*"Convergence introduces a new set of issues for the authorisation agenda. Authorisation has tended to follow a process that allows applicants to provide specific services with specific technologies. In a converged environment, such distinctions become irrelevant. Although service-specific authorisations remain, multi-service authorisations and unified (or global) authorisations are becoming more prevalent. The unified authorisations are technology- and service- neutral and allow licensees to provide all types of services under a single authorisation, using any type of communications infrastructure and technology capable of delivering the desired service."*

Source: World Bank / ITU

7.3.3. Unified licence models are generally characterised by either: (1) a single licence for all national communications facilities / infrastructure and services or (2) two to four horizontally tiered licences each for separate layers of provision. Botswana has instituted a two-tier ICT licensing regime for communications infrastructure and services which is progressively being adopted. This model consists of: (1) fixed and mobile National Facilities Provider (NFP) licences for facilities / infrastructure and (2) Service and Applications Provider (SAP) licences for services and applications. This model is expected to be continued under the revised Spectrum Management Strategy.

7.3.4. Under the revised Spectrum Management Strategy, where new spectrum is assigned by BOCRA for exclusive use, it proposes that this will be licensed though the mechanism of a separate Spectrum Licence. For example, any provider wishing to offer services on new, exclusive use spectrum will require the relevant ICT NFP and SAP Licences in addition to a new separate Spectrum Licence (and NFP and SAP licences will not include spectrum rights). Where a provider wishes to use multiple new spectrum bands on an exclusive basis, it will require a separate Spectrum Licence for each band. Such a licence should include only the rights and obligations applicable to the use of that spectrum. Other rights and obligations will be contained in the relevant ICT NFP and SAP Licences. Providers using designated Licence Exempt Spectrum are free to do this subject to national rules on interference, range and power limits. Such providers will still normally require the relevant unified licence or licences. This will replace previous service and technology-specific licences which included spectrum for fixed and mobile licence categories and may also apply in the case of new broadcasting licences, subject to further consideration by BOCRA at that time.

Question 9 - What are your views on the proposed licensing approach?

7.3.5. Spectrum for fixed microwave links is currently assigned to users on a link-by-link basis by BOCRA. This allows BOCRA to manage the interference between fixed link users particularly in Gaborone and other urban areas. An alternative approach, which has been introduced in certain other national markets, is to assign users specific fixed-link frequencies on an exclusive national or regional basis. The main benefit of the national-basis approach is administrative efficiency both for the regulator and the user in greatly reducing the burden of the application process, although it may reduce some flexibility on specific links. There may also be questions about managing transition to such an approach where existing equipment may need to be reconfigured (if technologically possible for such equipment) for a new range of fixed-link frequencies.

Question 10 - Do you support continuation of the existing link-by-link management of fixed links by BOCRA?

Question 11 - What are your views on alternative approaches, such as exclusive, national frequency assignments?

## 7.4 Licence Rights and Obligations

### Licence Duration

7.4.1. Licence duration is a key consideration for all Stakeholders. The licence duration should be sufficiently long to ensure that the users of spectrum are able to earn a reasonable return on their investment over the period of the licence. However, BOCRA also needs to ensure that, as technology and spectrum users and requirements change over time, spectrum can be re-assigned to ensure that it continues to be used efficiently.

7.4.2. In the case of mobile services, evidence from many markets suggests that licence duration has affected the success of mobile markets and providers, with longer licence durations providing a more secure basis for investment. For this reason, international practice is tending towards offering providers longer licence terms. International practice is also increasingly using generally applicable conditions of authorisation rather than individual operating licences. Perpetual licences for certain spectrum bands are also increasingly considered.

7.4.3. In Botswana, mobile operators are currently using a mix of 2G, 3G and 4G radio access network technologies. Within the likely life-span of the current National Radio Frequency Plan, BOCRA envisages that operators will deploy 4G radio access network technology on new IMT spectrum assigned and will progressively upgrade 2G and 3G technology across existing frequencies where supported by their business plans. Towards the end of the period, operators may also begin to deploy 5G technology.

7.4.4. Currently, Botswana ICT licences have been offered with a 15-year term. Spectrum Licences for use with Long Term Evolution (LTE) technology in the 1800 MHz spectrum band were assigned in 2015 and for Fixed Wireless Access Spectrum in the 2300-2400 MHz and 3500-3600 MHz band in 2017 for 10-year terms. In principle, BOCRA proposes to offer new Spectrum Licences also with a 15-year term irrespective of services or technology and to provide spectrum licence holders with a presumption of renewal as discussed below in Section 7.5. In contrast, some regulators have assigned spectrum on an indefinite basis (subject to meeting certain requirements such as the terms of the licence). Where regulators in other markets have det a finite licence period, some of those regulators have also indicated a presumption of renewal in favour of the incumbents.

7.4.5. BOCRA believes that longer licence terms are generally to be preferred where requirements for investment are substantial and the period of return is likely to be long, especially where this may extend over the replacement of multiple network technology cycles.

Question 12 - What are your views on spectrum licence duration?

### Coverage and Quality of Service Obligations

7.4.6. The National Broadband Plan describes Botswana's ambitions for the extension of broadband access networks and services nationally. Critical to achieving this plan will be the deployment of wireless broadband coverage and capacity to the fullest practical extent. BOCRA believes that the release of new spectrum for IMT services provides an important opportunity to advance this. BOCRA may consider including coverage obligations as part of the spectrum licensing process. In addition, BOCRA may also consider introducing quality of service obligations.

Question 13 - What are your views on the introduction of coverage and quality of service obligations?

### Other Rights and Obligations

7.4.7. Stakeholders may have a wide range of views regarding the rights and obligations attached to licensed spectrum in Botswana. BOCRA welcomes Stakeholdersôviews on the rights and obligations associated with all potentially licenced spectrum, particularly any borne out of specific experience.

Question 14 - What are your views in relation to licence rights and obligations in relation to any specific frequencies?

## 7.5 Licence Renewal

### Introduction

7.5.1. Licence renewal is important because a poorly managed process can have adverse impacts for consumers and investment. A lack of clarity over the renewal process near the end of an existing licence period could chill ongoing investment in the network. Furthermore, significant disruptions to service continuity and consumer harm could happen if operators do not have sufficient time to adjust in the event that some spectrum changed hands. Today in Botswana, for example, mobile and fixed wireless access spectrum licences may be renewed if requested up to 12 months before the expiry date. BOCRA has the right to refuse renewal for non-payment of fees or if it determines renewal would not be in the best interests of Botswana. In this sub section BOCRA describes the approaches that have been adopted in other markets.

### Approaches

7.5.2. In the case of renewal, regulators have the following choices:

- Administered renewal to existing holders;
- Administered re-assignment (some or all) to new users;
- Auction or other type of competitive process to assign rights to existing or new users; and
- Hybrids.

7.5.3. The choice of approach may vary depending on circumstances. Administered renewal to existing holders may be preferred when:

- There are no problematic imbalances in spectrum holdings or other competition reasons to allow others to use the spectrum;
- Spectrum is deployed and intensely utilised and there are clearly only poor alternative uses;
- The incumbent licensee has invested substantially in new technology that relies specifically on the licensed bands; or
- Customer disruption is likely.

7.5.4. Administered re-assignment (some or all) to new users may be preferred when:

- Necessary to rebalance spectrum holdings to address imbalances in spectrum holdings (where the imbalance cannot be addressed through other bands) that are weakening competition, or to introduce a competitive new entrant;
- Spectrum is not deployed or is under-utilised; or
- Spectrum can be divided and distributed effectively.

However, such re-assignment to new users may depend on it being possible to manage any customer disruption.

7.5.5. The auctioning of rights to existing or new users may be preferred when:

- Spectrum is not deployed or is under-utilised;
- There has been no or limited recent investment in new technology on which users have not had sufficient time in which to earn a reasonable return on that investment;

- There is uncertainty over demand or the most efficient use of the spectrum; or
- There is a desire to avoid making subjective judgements which may be criticised as ñarbitraryò

7.5.6. Approaches to licence renewal vary internationally. In several countries, for example Canada, New Zealand, Sweden (for some bands) and the US, a hybrid approach is used. Licence terms are nominally fixed, but there is a presumption of renewal for existing users. Renewal is not guaranteed and is subject to approval by the regulator. Typically, the rights of existing holders have tended to be renewed under this system.

7.5.7. In contrast, several countries such as Belgium, France, Germany, Ireland and Spain typically set fixed terms for licences and use auctions to re-assign rights to the spectrum. In a few rare cases comparative selection has been used, e.g. in France. Regulators often try to reduce uncertainty over renewal in this approach by making sure that the re-award process takes place well in advance of licence expiry. An incumbent that is currently using the spectrum may succeed in winning a comparative selection approach, particularly if it has already made substantial investments.

Question 15 - What are your views on the most suitable approach to spectrum renewal in Botswana?

# Section 8. Spectrum Assignment

## 8.1 Introduction

8.1.1. There are three main approaches to assigning a spectrum licence:

- Administered;
- Comparative assessments; and
- Market based.

8.1.2. Within these three main categories there are a wide range of alternative options that can be adopted. In the following discussion, the most commonly used options are presented and their main advantages and disadvantages are discussed in light of BOCRA's policy objectives.

## 8.2 Administered procedures

8.2.1. Administered approaches that have been adopted for the assignment of spectrum include:

- lotteries;
- equal administered assignments;
- First Come, First Served; and
- managed assignments.

### Lotteries

8.2.2. Lotteries involve assigning spectrum at random amongst those that submitted applications for the relevant spectrum. The only real advantages of the approach are that it is quick and low cost to implement. The approach makes no attempt to achieve any policy objectives and the outcome is likely to be highly inefficient. Lotteries are not best practice and are seldom if ever used today for the assignment of spectrum.

### First Come, First Served

8.2.3. Under First Come, First Served (FCFS) approach, the first to request the relevant spectrum is assigned some or all of the spectrum. When there is a large supply of spectrum and it is sufficient to meet all the demands of users, then the FCFS approach can be an easy way of assigning spectrum very quickly.

8.2.4. When demand exceeds supply for specific frequencies, the FCFS approach may not lead to an efficient assignment. It may be of course that the user who has the greatest need for the spectrum will be the first to demand it. However, that need may reflect a lack of investment in its network, and a user that has invested more heavily to utilise its existing spectrum may well make more efficient use of any new spectrum. A further complication is that asymmetry of information between the regulator and the users makes it difficult for the regulator to validate and assess the degree of need. While some arguments can be made that the FCFS approach can deliver economic efficiency, alternative approaches may be more likely to deliver an efficient assignment.

8.2.5. The FCFS approach could deliver economic efficiency if it is accompanied by an effective secondary market enabling spectrum trading so that eventually spectrum may be re-allocated to those that value it more highly than the prior user. However, this is akin to the use of lotteries by the FCC at the dawn of the mobile market in the US. Spectrum was acquired by chance by those that may not be the ultimate users of the spectrum and was

then sold on to operators creating personal fortunes for those lucky enough to be assigned spectrum in the lottery. Regulators will want to see spectrum deployed as quickly as possible and any value associated with the sale of a valuable, finite natural resource is probably best appropriated by the government on behalf of society as a whole.

8.2.6. A further potential problem with the FCFS approach is that spectrum may not be allocated efficiently from a technical perspective. Contiguous, wide blocks of spectrum are optimal for cost-effective deployment and to harness the spectral efficiencies of technologies such as LTE. The risk with a FCFS approach is that spectrum becomes fragmented, which damages the efficiency with which it can be deployed from a technical perspective. This also distorts any secondary market in trading, as values will be higher or lower depending on technical limitations introduced through an assignment method that is not geared towards the long term but the immediate user's request. The use of the FCFS approach provides no assurance that spectrum will be used efficiently, especially if there are no well-defined rules relating to spectrum trading.

8.2.7. Relative levels of spectrum holdings of users can play a very significant role in determining the level of competition between them. To ensure a level playing field and competition between users, the regulator will wish to ensure that all users have an appropriately balanced portfolio of spectrum assets. The use of the FCFS approach may result in a high level of spectrum concentration amongst one or a small number of users resulting in a lack of overall competition with adverse consequences for consumers.

8.2.8. Spectrum only creates value for society when operators invest in the deployment of the network that will use it. Users or speculators may seek spectrum on a FCFS basis in order to hoard spectrum to prevent others from utilising it or to create private gains through reselling spectrum to actual users. The FCFS approach could result in spectrum being left idle, which is not efficient or delays its deployment. Furthermore, in the absence of stringent application and enforcement of roll-out and coverage conditions in licences, the policy objective of expanding coverage may also not be met.

8.2.9. The FCFS approach may actually deter investment through its impact on regulatory uncertainty. The more certainty businesses have about the future, the more confident they will be to invest. This is particularly true of mobile operators whose investment decisions involve significant amounts of cash and long pay-back periods. The FCFS approach creates a very high degree of uncertainty for operators as to when spectrum will be available and whether they will be able to acquire it when it is released. This lack of regulatory uncertainty may deter investment.

8.2.10. One of the greatest criticisms of the FCFS approach is its lack of transparency. The experience of India is a good example. In 2008, the then telecom minister A. Raja issued 122 licences on a FCFS basis at low prices to a few players, despite having as many as 40 players interested in the spectrum. Some of the initial licensees quickly sold the licences on to telecommunications operators at a huge profit. These allocations were later cancelled by the Supreme Court on grounds of impropriety and damaged the credibility and investment in the Indian telecoms market for a number of years. The FCFS approach has a high risk of corruption or impropriety. The spectrum will be allocated to those who have the best information as to the timing of the spectrum award and as that information is extremely valuable the risk of a leak or worse is extremely high. A lack of transparency undermines confidence in the regulatory regime in addition to the harm to investment from uncertainty as mentioned above.

8.2.11. In summary, the FCFS approach to spectrum assignment can be an easy way of assigning spectrum when demand is unlikely to exceed supply, and, in such cases, efficient assignment might be achievable if it is accompanied by effective spectrum trading. However, demand is likely to exceed supply for much spectrum designated for mobile use. Consequently, the FCFS approach may suffer from the following disadvantages:

- the allocation of spectrum is likely to be economically and technically inefficient;
- if trading is present then the value of spectrum may be appropriated by private individuals rather than society as a whole;
- the approach creates regulatory uncertainty which does not encourage investment; and
- the process is susceptible to corruption which also tends to discourage investment.

Question 16 - What are your views on the use of FCFS for the assignment of spectrum?

### Administered assignments

8.2.12. In this type of process, the regulator determines, through discussions with the industry and other Stakeholders, and its own analysis of different options, the award of the spectrum to those parties which it believes would most appropriately meet the needs of the economy and consumers in accordance with its policy objectives.

8.2.13. This is the approach that BOCRA has used historically with mobile network operators. It has ensured spectrum is assigned on an equal (or close to equal) basis to active operators in the market. The approach has the advantage of being quick, low cost and simple to implement. The approach also ensures that there is not an excessive concentration of spectrum with one or more operators and therefore may help maintain existing levels of competition. The main disadvantage of this approach is that the assignment may not be efficient if there are disparities in the size of operatorsô customer bases or in the availability of funds with which to invest. In addition, it may in some circumstances constrain the market if an operator whose spectrum demands are higher than others (e.g., due to greater success in attracting more usage of its services, or introduction of higher bandwidth services such as video) cannot obtain the additional spectrum that would be required to deliver them.

8.2.14. A managed spectrum assignment process could have an advantage over other processes in that it could theoretically be completed relatively quickly if all parties agreed to the assignment. However, a significant disadvantage of a managed assignment process is that it may not to lead to an efficient allocation of spectrum. Achieving an efficient assignment of spectrum through a managed spectrum assignment process would require the regulator to identify the most efficient use of spectrum. This would require the regulator to have an accurate understanding of the potential value of the usage rights to each individual operator or new entrant. For example, it would require the regulator to understand the potential revenues, costs and risks associated with all possible services which could be supplied using the spectrum. As the regulator faces an asymmetry of information versus the operators regarding the value of spectrum, there is a considerable chance that the resulting spectrum assignment would not be efficient. In addition to a potential lack of efficiency, if orderly procedures are not followed and inadequate information is published, the approach may also lack transparency and could potentially be subject to corruptive practices.

Question 17 - What are your views on the use of managed spectrum assignments?

### Comparative assessments

8.2.15. Comparative assessments involve the regulator determining a set of criteria against which applications for spectrum are evaluated. The applicants which best meet the criteria are awarded the spectrum licence. Comparative assessments are often referred to as "beauty contests" or "beauty parades". BOCRAôs ñInvitation to Applyò approach can be seen as a form of comparative assessment.

8.2.16. The use of comparative assessments has been historically widespread. However, there has been significant variation between regulators in how effectively the process has been used. In some cases, the process has been very poorly managed resulting in a high degree of confusion for applicants and a significant lack of transparency in the assessment performed by the regulator. In this section we focus on well-managed comparative assessment processes.

8.2.17. In a well-managed comparative assessment, the regulator develops a set of criteria against which it will judge competing bids for the spectrum licence. It publishes these criteria in advance, together with a 'scoring scheme' describing how the regulator would select winning bids. It then invites interested parties to submit bids (often referred to as a ñBid Bookò) for the spectrum, describing how their bid would meet the criteria. Such criteria could cover technical components (e.g., types of services, coverage commitments and track record), financial components (e.g., financial strength of the investor), and sometimes the amount a party is prepared to pay for the spectrum. Where the process also requires a bidder to indicate the amount they are prepared to pay, the process can be seen as a hybrid of both a comparative and some form of competitive assessment.

8.2.18. The main advantage of a comparative assessment is that, when establishing the criteria, the regulator can take into account a broader range of public policy objectives which may not be fully reflected in the private values placed on spectrum by bidders in an auction.

8.2.19. However, as previously discussed, the regulator faces a significant asymmetry of information when reviewing the bid books and may not be able to identify which operator will best meet the public policy objectives. Even in well-managed comparative assessments, the asymmetry of information can result in an outcome which is not economically efficient. A further challenge, even in the case of well-managed comparative assessments, is that a degree of subjectivity in the assessment process may be unavoidable. When a degree of subjectivity is associated with the assessment process, this can potentially result in a lack of transparency.

8.2.20. A further challenge is that comparative assessments can be costly and time-consuming to implement for both the regulator and the bidders if the requirements of the assessment process are extensive.

Question 18 - What are your views on using comparative assessments?

### Market based procedures

8.2.21. A common policy objective is to ensure the most economically efficient use of spectrum. This means allocating the spectrum to those companies that will generate the greatest economic value from it. A well designed and competitive auction ensures that spectrum is allocated on an efficient basis as the companies with the highest spectrum values will outbid their weaker competitors and win the spectrum.

8.2.22. Achieving an efficient allocation of spectrum however, may not be the only public policy objective. Governments often have a range of policy objectives. Two common additional objectives are: i) to provide extensive access to basic communication services, and increasingly broadband services, and ii) to ensure downstream (post auction) competition to maximise consumer choice and welfare. Spectrum auction design has progressed significantly, and modern spectrum auction design is capable of addressing, simultaneously, the multiple policy objectives of coverage requirements, downstream competition and economic efficiency.

8.2.23. Another dimension particularly relevant to auctions concerns generating revenues for the public purse from the assignment of a scarce natural resource. In auctions, maximising economic efficiency and maximising auction revenues are not always aligned. A bidder with the highest spectrum valuation may not necessarily generate the highest economic efficiency if their private valuation includes value associated with weakening a competitor by depriving them of spectrum. However, if the retail market is sufficiently competitive then it is not unreasonable to assume that private values and the value to society overall are closely correlated. In these circumstances, economists regard it as reasonable to presume that if the spectrum is awarded to those that value it most highly then, in doing so, the regulator is maximising both economic efficiency and government revenues.

8.2.24. The benefits to the public purse from auctioning spectrum are not limited to the revenues generated at auction. A well-designed auction often offers a stronger change than other methods of ensuring the spectrum is allocated to the operators which will generate the greatest value or profit from the spectrum. An auction therefore also ensures that the government will maximise tax receipts from the allocation of spectrum.

8.2.25. A well-designed auction will generally be more transparent and objective and significantly less prone to corruption than most alternative assignment methods. A well-designed auction will increase investors' confidence in the regulator and government and will help reduce regulatory uncertainty. Reducing uncertainty should reduce the level of risk the market and thereby encourage investment. An auction may also significantly reduce the risk of legal challenge and a well-executed auction will enhance the reputation and standing of the regulator.

8.2.26. A well-designed auction can be executed quickly, which reduces risk and uncertainty leading to potentially greater auction revenues.

8.2.27. For the reasons described above, auctions are widely regarded as best practice for assigning spectrum where demand exceeds available supply and when an effectively competitive auction can be designed and

implemented. Auctions can also have disadvantages. They depend on correct decisions by the regulator about key issues, such as the reserve price, spectrum lots being auctioned and spectrum caps. A competitive auction requires scarcity of licences or spectrum such that there is excess demand for the lots being auctioned. If an auction is not sufficiently competitive then it may fail to deliver economically efficient outcomes. Indeed if prior to the start of the auction demand equals or is less than supply then the auction will conclude after the first round of bidding and lots will be sold at their reserve prices. The auction effectively becomes an administered approach and the determination of the appropriate reserve prices becomes critical. In practice therefore, auctions can be used where:

- An appropriate auction design can be formulated that incorporates key public policy objectives;
- There is excess demand for the lots to be awarded;
- The monetary value of the license is relatively high, justifying what can be a complex assignment procedure; and
- The process can be well-understood by participants.

Question 19 - What are your views on the use of auctions for assigning spectrum when there is excess demand?

# Section 9. Spectrum Trading

## 9.1 Introduction and overview

9.1.1. A spectrum trade is a transfer of the rights to use a specified set of frequencies from one person to another. It can either be the transfer of all the frequencies associated with a licence or it can be a partial transfer in terms of frequency, geography and even by time.

9.1.2. Spectrum trading establishes a secondary market for spectrum. This means that it would provide a secondary means to access spectrum alongside the primary means of assigning spectrum through an auction or administrative assignment.

9.1.3. The advantage of a secondary spectrum market is that, if it is well functioning, then like any market it should lead to spectrum flowing towards those who value it the most. A well-functioning market should have a degree of competition for buyers and sellers and a degree of transparency over the ownership, quality and legal rights or obligations associated with the goods or services. Current and potential spectrum users should also be able to access information on existing spectrum assignments, which should be kept up-to-date.

9.1.4. Hence, spectrum trading incentivises efficient spectrum use for spectrum that is already in the market, including any that was previously awarded on a FCFS basis. Spectrum trading provides on-going incentives for efficient spectrum use in response to changing market conditions. Trading may accomplish this faster than the regulator having to terminate and re-assign the spectrum. Users which no longer need spectrum will have an incentive to release rather than hoard it because they can realise value from the trade. In economic terms, the holder has an opportunity cost and should sell the licence if the value it can generate from using it falls below the value it could receive by selling it. Finally, and importantly, the ability to trade spectrum is also likely to increase spectrum value with the aforementioned benefits for investment, particularly in the context of a fixed term licence where the incumbent is given an expectation of renewal.

9.1.5. The potential downsides to trading also have to be considered. Spectrum transfers could lead to concentration of spectrum holdings, resulting in a distortion of competition. Regulators in other jurisdictions have addressed this in a number of ways, e.g. a full competition assessment on a case by case basis, a two-stage process where trades are only reviewed if pre-published conditions are met, and spectrum caps.

9.1.6. Currently in Botswana, there is no negative prohibition on spectrum trading, but there is no framework in place to promote a well-functioning secondary market in spectrum either. Individual licences contain provisions prohibiting licensees from transferring rights, interests, or obligations to another person without the prior written consent of the Authority.

Question 20 - What are your views on spectrum trading in Botswana?

# Section 10. Spectrum Pricing

## 10.1 Introduction

10.1.1. This section discusses the pricing of spectrum. It is directly related, of course, to the prior discussion of methods of spectrum assignment, as these also have a direct bearing on pricing, particularly where the very means of assignment is centred on the price (as in an auction) or is a significant component of a comparative assessment (as price may be one of several factors to be considered). The issues raised by spectrum pricing thus cannot be separated from issues raised by assignment methods. Nevertheless, we focus here on particular dimensions raised by pricing.

10.1.2. The ITU published a set of guidelines[1] for spectrum pricing which provide a good summary of best practice pricing principles based on the approaches adopted by leading regulators. These principles are:

- Spectrum prices should enable and encourage spectrum to move to its highest value use and discourage spectrum hoarding to ensure economic efficiency;
- Where appropriate, spectrum prices should also be set to support the attainment of wider public policy objectives such as promoting social and cultural benefits;
- To the extent possible, regulators and spectrum managers need to promote both regulatory certainty and flexibility in how spectrum is used and priced;
- Fairness and objectivity require that spectrum prices are based on objective factors and all licence holders in a given frequency band should be treated on an equitable basis;
- The prices charged for spectrum should be sufficient to ensure that the costs of spectrum management can be recovered from those that benefit from the use of the spectrum;
- Transparency requires that the basis on which prices are calculated should be made clear in a published document resulting from consultation with Stakeholders and that all prices should be set based on a published schedule;
- The administrative costs of implementing the spectrum pricing approach should be as low as possible which leads towards a preference for simple pricing models (however, simple models, such as flat fees, may not always be consistent with the attainment of other policy goals such as efficiency);
- Administrative simplicity needs to be balanced against the requirement to encourage efficiency of spectrum use if fees are set taking account of parameters such as bandwidth, frequency band or coverage; and
- The approach to pricing and pricing levels should be reviewed periodically to ensure that the pricing regime reflects the developments within the market.

10.1.3. The choice of spectrum prices must also reflect the political climate. Spectrum is a valuable, scarce natural resource and governments often wish to ensure that the pricing of spectrum generates significant revenues for wider government use.

## 10.2 The Challenges in Spectrum Pricing

10.2.1. This section discusses a range of challenges associated with spectrum pricing:

- Investment and innovation;
- Competition and consumer welfare;

1 Guidelines for the Review of Spectrum Pricing Methodologies and the Preparation of Spectrum Fees Schedules, 2016

- Rapid and unpredictable change; and
- Asymmetry of information in relation to value.

### Investment and Innovation

10.2.2. The socio-economic benefits of access to broadband services are widely recognised. Increasing broadband services to rural areas and under-served communities is a key objective for many regulators. Investment in coverage and service, as well as in research and development for innovation, requires spectrum users to anticipate a reasonable return on their investment. If spectrum is priced too highly, it will reduce the incentives for such investment.

### Competition and Consumer Welfare

10.2.3. Many telecommunication markets are characterised by one or two strong players with significant market share and a number of smaller operators. If spectrum prices are set too high for the smaller players but low enough for the larger players, then the result can be a concentration of spectrum in the hands of the large operators which only reinforces their market power. Spectrum prices must therefore take account of the structure of the market, the ability of operators to pay, and the need to promote and enhance competition to deliver benefits to consumers. This applies to all methods of spectrum assignment, which means that market-based methods may have to be structured to prevent results that unfairly favour those with greater access to financing or a leadership or incumbency advantage.

### Rapid and Unpredictable Change

10.2.4. Communication markets that rely on spectrum are often subject to rapid and unpredictable change. The value of spectrum to its user can be heavily influenced by technological change as well as changes to industry standards and harmonisation of frequency bands. The value of spectrum will change over time, sometimes rapidly and significantly. What may once have been an appropriate price may no longer reflect the value of spectrum.

### Asymmetry of Information in Relation to Value

10.2.5. There is an asymmetry of information between regulators and the users of spectrum regarding the value of spectrum. The holders of spectrum rights have a much better understanding of the value of their spectrum assets than regulators. Furthermore, spectrum rights holders have an incentive to misrepresent the value of spectrum to the regulator in order to influence the regulator in favour of setting lower spectrum prices. These factors provide regulators with significant challenges when determining spectrum prices.

## 10.3 Overview of Spectrum Pricing Approaches

10.3.1. Regulators use a variety of definitions for different types of spectrum prices. For the purposes of this proposal, we will make the distinction between Spectrum Usage Fees and Spectrum Access Fees.

- Spectrum Access Fees: These are the prices for gaining access to the rights of spectrum use and are usually a one-off charge, although they can also be spread over time. They may be set to reflect the market value or opportunity cost of spectrum. They may be determined by some form of market-based mechanism (e.g., an auction) or they may be determined administratively based on an approach (e.g., Administered Incentive Pricing).
- Spectrum Usage Fees: These are typically annual charges and usually relate to the recovery of the costs of spectrum management incurred by the regulator.

10.3.2. The approaches to spectrum pricing can be broadly categorised into two groups.

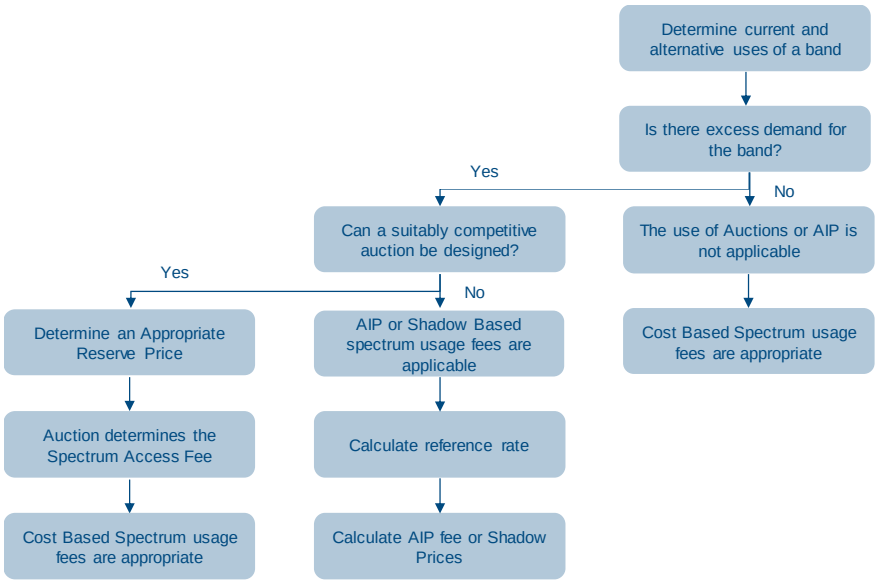
- Market Based Approaches: The most common market-based approach is a spectrum auction where relative levels of supply and demand determine the market clearing price or value of the spectrum.

- Administered Approaches: These are methodologies which rely on the regulator to determine the price for spectrum. Administered approaches may seek to mimic the outcome of a market-based approach (for example Administered Incentive Pricing). They may also focus on seeking to recover the costs of managing spectrum or they may have one or more alternative objectives.

10.3.3. Regulators worldwide predominantly use administered approaches for establishing spectrum fees for most bands and services. However, in the case of IMT bands, the use of market-based approaches is more common. Regulators therefore often adopt a combination of both administered and market-based approaches to price the wide range of spectrum frequencies for which they are responsible.

10.3.4. The Exhibit below sets out a Decision Tree which could provide the basis for determining the appropriate spectrum pricing approach.

Exhibit 3: Spectrum Pricing Decision Tree




Source: Adapted from Ofcom, 2010

Question 21 - What are your views on this decision tree for determining the appropriate pricing model for spectrum in Botswana?

## 10.4 Market Based Approaches

10.4.1. As discussed above in relation to methods of spectrum assignment, spectrum auctions are the most common market-based approach and are widely recognised as best practice for determining the price of spectrum as a competitive auction should result in an economically efficient allocation of spectrum. Under a market-based approach to spectrum pricing, the regulator designs an auction where competitive bidding by operators determines a market-based spectrum access fee. In an auction, the rights and obligations (e.g. a coverage obligation) associated with the spectrum are clearly defined. The obligations may include the requirement to pay a low, ongoing annual spectrum usage fee to promote ongoing efficiency in the use of spectrum, to deter hoarding and to cover the costs of ongoing spectrum management. However, the greatest proportion of the price charged for spectrum is typically determined by the auction.

10.4.2. As also mentioned above, the critical requirement is that there is excess demand for the spectrum being auctioned such that there is competitive bidding. Auctions will only deliver an efficient allocation of spectrum if

the auction is competitive. Regulators may decide not to use an auction because they believe there will be insufficient competition to generate an efficient outcome or the cost and time associated with implementing an auction may be prohibitive.

10.4.3. The regulator will need to determine a Reserve Price (i.e., the minimum bid price) and design an appropriate auction structure. Spectrum auction designs can become extremely complex, especially when multiple spectrum bands are auctioned simultaneously, and as discussed above in relation to spectrum assignment, it is vital that participants understand the process well for it to be effective.

10.4.4. Regulators face significant challenges in setting the Reserve Price. If they set the price too high they risk multiple policy failures which may include:

- Failure of the assignment process and embarrassment for the regulator's political masters;
- Failure to generate important revenues upon which the government may have been relying in its budgetary plans;
- Spectrum left unsold that does not yield the economic benefits that accrue when mobile broadband increases;
- Inability of the mobile industry to invest in new spectrum and the accompanying technology;
- Distortions to competition if only part of the spectrum is sold; and
- The challenge to the regulator of what to do with the unsold spectrum.

10.4.5. However, if a regulator sets the price of spectrum "too low," it also faces the risk of policy failure:

- Spectrum may be acquired by inefficient users leading to a loss of economic benefits; and
- The regulator's political masters and the media may accuse the regulator of failing to realise the full value of an important, national natural resource.

10.4.6. In light of the more material risks of setting the Reserve Price too high, regulators often adopt the strategy of setting a low, but non-trivial Reserve Price to deter frivolous bidding.

Question 22 - What are your views on the use of market-based mechanisms such as auctions to determine the price of spectrum for which there is excess demand?

Question 23 - What are you views in relation to the level of Reserve Prices where auctions are used to price spectrum?

## 10.5 Administered Approaches

10.5.1. The three most common administered approaches are cost based, Administered Incentive Pricing (AIP) and some form of Shadow Pricing which is based on a range of formulae.

Question 24 - What are your views generally on the use of administered approaches for determining the price of spectrum?

### Cost Based Approaches

10.5.2. Cost based approaches seek to charge spectrum users for the administrative costs associated with managing spectrum. The costs of spectrum management include the costs of issuing spectrum, spectrum monitoring and

enforcing individual licence obligations. Some costs (direct costs) are directly related to a specific band (such as band planning) or to a group of bands. Some costs, such as management overheads (indirect costs), will straddle all licensed bands.

10.5.3. Typical direct and indirect costs include:

- Salaries for the employees of the regulator (including monitoring and enforcement teams) and administrative spectrum management staff;
- Investments in ICT's and databases (e.g., spectrum management tools, national frequency allocation tables, spectrum users' databases and monitoring system and equipment such as fixed and mobile monitoring stations and their upgrades / calibrations);
- Office space and services for utilities;
- Research activities and costs associated with consultations and publications;
- Interference coordination / mitigation activities;
- Participation in ITU and other international meetings;
- Management overheads; and
- Legal fees of enforcement actions.

10.5.4. Some regulators have developed cost models that seek to allocate costs based on the various lines of activity within the regulator. This approach however is not common due to the complexity and costs of developing an appropriately robust cost allocation model. The more common approach is to develop a set of usage fees which are related to a cost driver such as the number of devices or, more commonly, the amount of MHz allocated.

10.5.5. There are advantages to having a clear separation between spectrum usage fees designed to recover the costs of spectrum management and spectrum access fees designed to provide incentives for efficient spectrum use. Separation improves transparency and accountability as it makes it easier to identify the charges related to cost recovery. Equally important is the improvement in overall effectiveness of the spectrum access fees. Efficient use of spectrum can only be achieved when spectrum users are able to respond to the incentive factors incorporated in spectrum access fees (e.g. band and bandwidth, geography, time, coverage density, etc.).

10.5.6. The regulator will also need to decide on the level of cost recovery and be duly authorised to use fees to raise funds for its administrative purposes. Cost recovery may be partial or full, or fees may be in excess of costs leading to a surplus to either support other regulatory functions or provide a revenue stream to government.

Question 25 - What are your views on the use of cost-based approaches to price spectrum?

Question 26 - If a cost base approach were to be adopted, on what basis should the prices be determined?

### Administered Incentive Pricing

10.5.7. Administered Incentive Pricing (AIP) refers to prices set by the regulator to mirror prices that would be achieved if the spectrum were priced using market-based approaches. A range of AIP approaches can be adopted, although generally they focus on estimating the ñopportunity costòof spectrum. However, they may also include other considerations such as commercial value and option values. AIP approaches are designed to provide incentives to encourage the efficient use of spectrum.

10.5.8. There are a number of approaches to determining Administered Incentive Prices and two common approaches are Best Alternative Use (BAU) and Optimal Deprival Value (ODV). Both approaches seek to identify the

opportunity cost imposed by a particular user of the spectrum and are explained further below. The opportunity cost created by a particular user of the spectrum can be seen as the value that could have been generated by an alternative user of the spectrum. In the case of Best Alternative Use the price for spectrum is determined by the price that could have been realised by assigning it to another use. For example, in the case of the spectrum now assigned for mobile telephony services under Digital Dividends I and II, the next best alternative use was probably broadcasting services and the price charged to mobile operators represents the value the spectrum would have generated from the use in broadcasting services.

10.5.9. Continuing the example of Digital Dividend, now that the spectrum has been assigned for mobile telecommunication services, the next best alternative to use by a given mobile operator is therefore use by another mobile operator. Therefore, a more common approach for calculating Administered Incentive Prices is to estimate the costs imposed on a mobile operator had the spectrum been assigned to another operator. This is the basis for the calculation of AIP based on the Optimal Deprival Value. ODV seeks to estimate the incremental network operating costs and capital expenditures that a mobile operator would incur if it did not have access to the spectrum.

10.5.10. To estimate ODV the regulator will need to perform a detailed bottom-up modelling exercise. The modelling exercise entails developing two business cases, one where the operator has access to the spectrum subject to AIP and another where the operator is denied access to the spectrum. The difference between the network operating costs and capital expenditure under the two scenarios represents the opportunity cost of the spectrum.

10.5.11. The modelling exercise will entail forecasting future levels of demand (i.e. customer usage) for network capacity and then modelling an operator's network. In modelling the network, the regulator will need to take account of the current network of sites which have been deployed as well how the operatorsôexisting spectrum holdings would be optimally employed to maximise available capacity including potential re-farming. The modelling exercise would need to take into account the diffusion rates of suitably enabled mobile devices as well as the costs of network equipment, along with a range of technical assumptions related to throughput and signal propagation. Further complications may include having to take into account network sharing agreements and spectrum sharing.

10.5.12. A business modelling approach takes into account commercial sources of spectrum value. The modelling approach described above mirrors the approach that mobile operators follow when seeking to value spectrum. However, mobile operators also consider the potential sources of competitive advantage that additional spectrum may offer. For example, the superior propagation characteristics of 700 and 800 MHz spectrum may mean that an operator which secures this spectrum may be able to claim greater mobile broadband coverage compared to operators that do not hold these or similar spectrum bands. Whilst ODV only takes account the opportunity cost from a network cost perspective, the business modelling approach also considers the commercial benefits of the spectrum. This can be material.

10.5.13. There are a number of challenges associated with estimating AIP based on ODV or business modelling approaches. The first is that while some assumptions contained within the regulators model can be estimated with a reasonable degree of confidence, other variables, such as future usage, will be subject to significant error. Indeed, mobile operators themselves find making suitable assumptions challenging and so regulators will face even greater uncertainty.

10.5.14. The second major challenge is that when adopting a business modelling approach, assumptions must be made about how changes in competitive advantage resulting from the loss spectrum translate into changes in commercial variables such as market share and Average Revenue Per User (ARPU). Even very small changes in commercial variables can lead to very significant estimates of the value of spectrum. Estimating the commercial impact of spectrum is a highly subjective exercise and the risk for a regulator is that they make significant errors in estimating these effects.

10.5.15. The third challenge is that the opportunity cost of spectrum will vary from operator to operator depending on the size of their existing network, the other spectrum assets they have access to, and the level of current network capacity and potential congestion. As a result, estimates will need to be made for the different operators and the costs can vary significantly between a small and large operator.

10.5.16. A further challenge is that the resources and costs required to complete such a modelling exercise are too high for many smaller regulators operating in much smaller and lower value markets. The high costs of estimating AIP prices explain why many regulators adopt an alternative approach such as Shadow Pricing.

Question 27 - What are your views on the use of Administered Incentive Pricing for determining spectrum prices?

Question 28 - What are your views on the most appropriate approach to calculating prices under an AIP approach?

### Shadow Pricing

10.5.17. A common approach adopted by regulators is to use formulae to determine the prices to be charged for spectrum. The South African regulator ICASA, for example, adopts a range of different formulae depending on the type of service being deployed and considers four classes of service. BOCRA currently uses a model that considers a range of parameters to determine spectrum prices.

10.5.18. A wide range of factors are often included with the formulae which seek to reflect the value associated with different frequency bands. The most commonly used factors are:

- Market value;
- Bandwidth;
- Frequency Band;
- Area Sterilised;
- Geographical Area;
- Exclusive Rights or Sharing;
- Supply and Demand;
- Duration; and
- A Service Factor.

### Market Value

10.5.19. Shadow prices are often used to provide a proxy for market values. As a result, the formulae usually incorporate some reference to a market-based spectrum value. The market-based spectrum value is often established through some form of benchmarking exercise. Benchmarking establishes a market value by observing the prices paid in spectrum auctions for similar frequencies in other countries and then making adjustments to the auction prices to adjust for differences between markets. Typical adjustments usually include:

- Adjustments for relative differences in wealth, typically measured by PPP adjusted GDP / Capita;
- The duration of the licence; and
- Inflation and timing effects.

### Bandwidth

10.5.20. Charges vary according to the amount of bandwidth used. International practice varies from increasing the price per KHz of bandwidth with the volume used, to applying an effective discount per KHz with the volume used.

### Frequency Band / Frequency Factor

10.5.21. Charges typically vary with the specific frequency band (spectrum location). As spectrum prices are designed to encourage efficient use of the spectrum, the relative pricing of frequency bands will encourage spectrum users to use the most cost-efficient spectrum location. All other things being equal, the lower the frequency band, the higher the value due to better propagation and scarcity. Some approaches make higher charges for spectrum designated for certain types of service. For example, spectrum for mobile applications such as 2G, 3G and 4G service are priced higher than lower frequency bands due to their commercial value.

### Area Sterilised / Power Output

10.5.22. Charges often increase according to the area 'sterilised' (i.e. the geographical area denied to other users as a consequence of the assignment). It is frequently the practice to use the power output of the transmitter as a proxy for the area sterilised, but this is less efficient than using an area sterilized or area factor as it does not take into account the topography of the country.

### Geographical Area

10.5.23. The value of spectrum depends very significantly on the population density of the geographic area for which a user has the rights of spectrum access. Where spectrum is assigned on a regional basis, regulators often apply higher charges for densely populated urban areas compared to less densely populated rural areas. Where spectrum is assigned nationally then the distinction between different areas is no longer required.

### Minimum Hop Length

10.5.24. A factor applied to point to point links and penalises licensees who make undue use of low frequency bands for links with relatively short hop lengths.

### Exclusive Rights or Sharing

10.5.25. The spectrum charge varies according to whether the spectrum is used on an exclusive or shared basis.

### Supply and Demand

10.5.26. The spectrum charge reflects the demand for the frequency band. In administrative pricing, market demand is often reflected in a congestion charge which is applied when a spectrum band is fully assigned. Where it is known in advance that a radio frequency band will be in high demand, i.e. that demand will exceed supply, it is better to assign the band by a competitive process, such as an auction.

### Duration

10.5.27. The spectrum charge varies according to the length of time in which the licence is in force. In the case of annual spectrum fees, common practice is to give a discount where the annual fee is paid in advance.

### Service Factor

10.5.28. In some cases, a service factor might be applied to adjust the charge, for example, to:

- Reflect the perceived value of the services that use the spectrum, i.e. for mobile services (which may command a premium due to commercial value or a discount due to the public benefit of making the services available); and

- Reflect the use by government (i.e. the public sector) of what is already a public asset, where the spectrum fee may be lower or waived altogether, although certain administrations such as the United Kingdom require that all spectrum users pay.

  In some countries, rather than use a service factor, 'non-commercial' services are not required to pay spectrum fees.

Question 29 - What are your views on the use of shadow pricing for determining spectrum prices?

Question 30 - What are your views on the current pricing models used in Botswana?

# Section 11. Spectrum Sharing

## 11.1 Introduction

11.1.1. As the demand for mobile broadband capacity and other spectrum uses grows in the future, particularly with the advent of 5G and M2M technologies, sharing spectrum may become increasingly important, both as a way of using scarce spectrum resources more efficiently and a way of providing services more cheaply (depending on the type of sharing).

11.1.2. Broadly speaking, there are two distinct types of sharing: shared access and spectrum pooling. Both lead to more efficient spectrum use but have very different implications for regulation.

11.1.3. Shared access approaches such as Dynamic Shared Access (DSA) and Licensed Shared Access (LSA) allow independent third-party users to access frequencies at a particular time and/or location when the spectrum is not being used by other users, one or more of whom may be an incumbent with rights to be protected from harmful interference. Typically, there is no relationship between the incumbent spectrum holder and the sharer. This type of sharing should raise few competition concerns since the sharers do not coordinate over the provision of the downstream services. However, the technical rules for accessing and transmitting over the frequencies need to be established to limit harmful interference.

11.1.4. The second type of sharing, spectrum pooling, entails the cooperative sharing of spectrum by two or more parties and the combined operation of the access and core network, but with retail services provided separately by the companies sharing spectrum. Hence, the sharers manage any technical issues within the band themselves. However, significant competition questions may arise because the collaboration at the wholesale level by the companies creates the potential for coordination or even collusion in providing services to end-users.

## 11.2 Shared access

11.2.1. As new competing demands for spectrum emerge, new types of shared access are emerging due to advances in technology that have the potential to enable effective interference management between incumbent users and new sharers. Where re-purposing of spectrum is not feasible, sharing may still offer opportunities to utilise spectrum more intensively and more efficiently.

11.2.2. "White space" frequencies are those that are not being used by existing licensees at all times or at all locations. A white space device (WSD) can make efficient use of these frequencies, provided that the risk of harmful interference to the licensed users of the spectrum can be managed appropriately. Location-aware wireless devices assisted by "geo-location" databases, providing information on white space availability and taking other existing licensed use into account (e.g. PMSE use) offer one new way of sharing spectrum.

11.2.3. Further technology advances could open up future opportunities for more sophisticated forms of sharing across a wide set of applications. These include:

- Improvements in robust transmission and reception protocols that would enable wireless devices accessing shared spectrum resources to tolerate greater interference;
- The evolution of radio frequency components capable of operating over wider frequency bands. As components become less frequency-specific, devices would be able to exploit underutilised spectrum available over a wider set of frequency ranges;
- The emergence of smart antennas and the evolution of "beam forming" techniques that could allow devices to better manage interference by focusing the spatial distribution of wireless transmissions;
- The growing use of software defined radios, software solutions and general-purpose computing processors to implement radio transmissions functions traditionally associated with specific hardware components. Software-defined radios can provide significant cost advantages in the production of low

power devices by replicating transmission techniques that are normally associated with higher cost and higher power devices;

- The development of carrier aggregation techniques, through which devices can dynamically combine small bands of spectrum into a single, virtual broadband pipe;
- Increasingly sophisticated white-space devices and geo-location data base with functionalities extending towards more active spectrum management. For example, it will be possible to reflect devices' quality of service requirements through tailored assignment and management approaches. This could facilitate a tiered approach to sharing, with access to spectrum and protection from interference optimised for each device or user type; and
- The development of sensing techniques, through which devices can independently detect and access available unused spectrum without the need to communicate with a database. Technical barriers to implementing cost-effective spectrum sensing in consumer equipment may mean that sensing can only become viable in the longer term.

11.2.4. These types of sharing opportunities may be very useful in spectrum bands used by the public sector. There may be an opportunity to use these frequencies more efficiently. However, any developments should be handled sensitively and in consultation with public sector users. LSA and related approaches may free up public sector spectrum more quickly than other market mechanisms since public sector users would retain their longer-term rights to the spectrum and might receive income for allowing others access.

11.2.5. As a first stage in assessing the opportunity for shared access of public sector bands, many regulators perform a spectrum audit to gain more clarity on the extent to which the bands are used.

Question 31 - What are your views on opportunities for shared spectrum access in Botswana?

Question 32 - What are your views on potential regulatory policies in relation to ñwhite spacesò?

## 11.3 Cooperative or collaborative sharing

11.3.1. The 3GPP standards accommodate the ability for operators to share spectrum. The standards provide the necessary functionality options for network infrastructure and user devices to operate in a way that partitions the network traffic, quality of service and core network routing, but share radio spectrum and radio access network resources.

11.3.2. An example of this type of sharing is Multi-Operator Core Network Sharing (MOCN). MOCN functionality allows several operators to jointly operate some elements of the radio access network. Unlike the basic level of active sharing, known as Multi-Operator Radio Access Network (MORAN) sharing, with MOCN the operators will be using shared carriers, as opposed to using only their own separate licenced spectrum carriers.

11.3.3. One of key benefits of MOCN is that operators can jointly use part of their bandwidth to create a much wider overall bandwidth, making it possible to offer much higher data rates for individual users. Additionally, trunking gain can be achieved as the usage of a single larger band is more effective in terms of throughput. Signalling overheads can also be less onerous with wider bandwidth allocations.

11.3.4. MOCN network and spectrum sharing is flexible in that it can be limited to specific areas or access nodes in the network. MOCN can also be an enabler for operators to provide a better quality of coverage to the widest possible service footprint due to economies of scale and cost sharing achieved through combining spectrum and network resources.

11.3.5. Hence, there are significant benefits to industry in terms of cost sharing and increased economies of scale which should be at least partially passed on to consumers. These benefits need to be set against the potential consumer harm that could result from a reduction of competitive intensity due to the closer cooperation that spectrum pooling brings. It is also important to consider whether competition concerns can be mitigated by the

administrative arrangements for managing spectrum pooling and operating shared infrastructure, e.g. contracting out the management to a third party.

Question 33 - What are your views on the current framework for passive sharing?

Question 34 - What are your views on the introduction of active network sharing in Botswana?

Question 35 - What are your views on spectrum sharing?

# Section 12. Assignment of 800 MHz

## 12.1 Introduction

12.1.1. The transition to digital broadcasting has made spectrum available in the 800 MHz frequency range. The details of the spectrum available for potential assignment are shown in the Exhibit below. The frequencies are from 791MHz - 821 MHz (downlink) and 832Mhz - 862 MHz (Down Link) which is a total of 30MHz x 2.

Exhibit 4: 800 MHz Channel Arrangements

| Frequency arrangements | Paired Arrangements | | | | Un-paired arrangements (MHz) |
|---|---|---|---|---|---|
| | Mobile Station Transmitter (MHz) | Centre gap (MHz) | Base Station Transmitter (MHz) | Duplex Separation (MHz) | |
| A3 | 832-862 | 11 | 791-821 | 41 | None |

Source: BOCRA

## 12.2 Interference Issues

12.2.1. An important consideration in relation to the award of the spectrum is potential border interference issues, most notably with South Africa. Interference reduces the usability of the spectrum in affected border regions. In light of the border interference issues the following approaches could be adopted:

- Option 1: Assign all the spectrum nationally as soon as practically possible even though the interference issues may not have been resolved by the time the spectrum is licensed, and work expeditiously with ICASA of South Africa to reduce interference problems, including establishing coordination among providers operating on both sides of the border;
- Option 2: Assign all the spectrum nationally as soon as practically possible but with the date at which successful applicants receive the spectrum specified as a date in the future when the interference issues can be reasonably expected to have been resolved. This approach will provide immediate certainty over future spectrum holdings;
- Option 3: Wait until all interference issues have been resolved and then award the spectrum nationally; and
- Option 4: Auction the spectrum geographically with those areas not impacted by interference assigned as soon as practically possible and the remaining spectrum assigned once the interference issues have been resolved.

Question 36- Which is your preferred option for assignment?

Question 37 - Are there alternative options that you would prefer?

## 12.3 Licence Conditions

12.3.1. The assignment of 700 and 800 MHz spectrum in many markets has been implemented with the inclusion of coverage obligations to promote increased coverage for mobile broadband.

Question 38 - What are your views in relation to the inclusion of a coverage obligation for the assignment of 800 MHz?

Question 39 - If BOCRA were minded to include coverage obligations, what is your view on the appropriate level (geographic or population) and timing for such an obligation?

## 12.4 Assignment Approach

12.4.1. The relatively limited amount of available spectrum and its attractive properties in terms of wide geographic area propagation and ability to provide good indoor coverage is likely to result in the demand for this spectrum exceeding supply.

Question 40 - What are your views on the most appropriate approach for the assignment of 800 MHz spectrum?

Question 41 - What are your views on the basis by which the price for the 800 MHz spectrum should be set?

Question 42 - Is rural coverage an important consideration for the assignment of 800 MHz?

## 12.5 Promoting competition in the award of 800 MHz

12.5.1. Where there is a limited number of service providers in a market, as there is in the mobile communications market in Botswana, it is common to consider whether competition concerns should be taken into account in awarding spectrum to the players in that market. A small number of providers, e.g. four or less, does not necessarily mean that markets are not competitive. But a small number of operators may indicate the risk that distortions to competition may occur and that measures to promote competition should be considered. Such measures may be used both in administrative assignment and auctions.

12.5.2. It is possible that holding more spectrum of a certain type - typically low frequency spectrum such as 800 MHz is highly prized for its superior propagation characteristics and reach - could give a service provider an advantage over its competitors. If this is the case, it may be appropriate to limit (often referred to as ñspectrum capsò) the proportion of spectrum that any one company can acquire either as a proportion of the band itself or of a group of bands e.g. sub 1 GHz spectrum.

12.5.3. However, while restricting the amount of spectrum that firms can acquire may benefit consumers by preventing distortions of competition, it may also harm consumers and service providers by reducing the efficient use of spectrum. Hence, best practice is to consider both these effects and to impose the least onerous restrictions on service providers necessary to safeguard competition.

Question 43 - What are your views on competition measures in relation to 800 MHz such as spectrum caps?

# Annexes

# Annex A. How to respond

## A.1. How to respond

A.1.1. BOCRA invites all Stakeholders to provide written views and comments on the issues raised in this document and answers to the specific questions raised be made by

- 5pm on 26th October 2018 in relation to questions on the NRFP and Footnotes.
- 5pm on 09th November 2018 in relation to the remaining questions on Spectrum Management.

A.1.2. Stakeholders should use the form in Appendix C to respond to the specific questions. This allows BOCRA to process the responses quickly and efficiently so as not to delay the development of the Spectrum Management Strategy. If Stakeholders wish to provide additional written comment, then they are free to do so. However, every response should be accompanied by a suitably completed Cover Sheet (see Appendix B) which ensures that respondentsôconfidentiality issues can be respected.

A.1.3. Consultation responses should be sent in an editable Word document to mosinyi@bocra.org.bw.

A.1.4. BOCRA will acknowledge receipt of responses if they received at the above email address.

A.1.5. It would be appreciated by BOCRA if your response could include direct answers to the questions asked in this document, which are listed together in Appendix D and E. It would also be helpful if you can explain why you hold your views and how the alternative proposals or approaches would impact on you. This greatly increases BOCRAôs ability to take your views into account as it develops its Spectrum Management Strategy and other ongoing spectrum-related work.

## A.2. Further information

A.2.1. If you want to discuss the issues and questions raised in this consultation, or need advice on the appropriate form of response, please contact Ms Basebi Mosinyi on telephone number 3685567 or on email mosinyi@bocra.org.bw.

## A.3. Confidentiality

A.3.1. In accordance with BOCRAôs values of openness and transparency, BOCRA believes that it is important for all Stakeholders and interested parties to see the views of all those who provide input into the consultation process. BOCRA will therefore usually publish all responses on its website, www.bocra.org.bw.

A.3.2. If you believe that parts of your response should be kept confidential then please indicate which parts and why. Please provide reasons relating to the commercially sensitive nature of the information, the applicability of non-disclosure obligations to the information, concerns about reprisals from other market participants, or other genuine reasons. Blanket and unjustified requests will not be accepted. In addition, those elements that you wish to remain confidential should be placed in a separate document and clearly identified as confidential.

A.3.3. If a Stakeholder requests that part or all of a response should be confidential, then BOCRA will give this request due consideration and will endeavour to respect it. However, sometimes BOCRA will have to publish all responses, including those that are marked as confidential, in order to meet its legal obligations. Stakeholders should keep this in mind when preparing their responses.

A.3.4. Please be aware that copyright and all other intellectual property contained within the responses will be assumed to be licensed to BOCRA to use as it sees fit.

## A.4. BOCRA's consultation processes

A.4.1. BOCRA is always seeking to improve the manner in which it communicates and engages with Stakeholders. If you have any comments or suggestions on how this process can be improved, then please e-mail BOCRA at info@bocra.org.bw.

A.4.2. If you would like to discuss these issues or BOCRA's consultation processes more generally you can contact Mr A. Nyelesi on email nyelesi@bocra.org.bw or by phone on 3685549.

# Annex B. Consultation Response Cover Sheet

## Initial Consultation on Spectrum Management, Licensing and Pricing

## Consultation Response Cover Sheet

Your title _____

Your name _____

Name of the company you represent _____

Your telephone number _____

Your email address _____

**Confidentiality**

Do you wish for some or all of your response to be kept confidential? YES ☐ NO ☐

If YES, please indicate below which part of your response is confidential and give your reasons:

**Declaration**

I confirm that the information I have submitted with this cover sheet is a formal response to the Initial Consultation on Spectrum Management, Licensing and Pricing and that BOCRA can publish all responses. I understand that BOCRA will respect any request for confidentiality indicated above except where it has to publish information in order to meet legal obligations. If I am submitting my response by email, BOCRA can disregard any standard email clause regarding disclosure of email contents and attachments.

BOCRA will publish all responses as and when they are received. However, if you prefer BOCRA to withold your non-confidential response until the consultation period has ended, please tick this box. ☐

**Signed:** _____ **Name:** _____

# Annex C. Consultation Response Form

C.1.1. Please use the form marked ñPart 1òto respond to questions on NRFP, footnotes and migration.

C.1.2. Please use the form marked ñPart 2òto respond to questions 5 to 43.

# Initial Consultation on Spectrum Management, Licensing and Pricing

## Consultation Response Form – Part 1

## Questions 1 - 4

Please complete this form in full and return in Word format via email to mosinyi@bocra.org.bw .

Your title _____ Your telephone number _____

Your name _____ Your email address _____

Please use the following table to provide your responses to the questions raised in the consultation document. For each question, please indicate whether you would prefer your response to be kept confidential. Any responses which are marked neither ñyesòor ñnoòto confidentiality will be taken as non-confidential.

| Question ID | Question | Your Response | Confidential? |
|---|---|---|---|
| | | | Yes / No |
| | | | Yes / No |
| | | | Yes / No |
| | | | Yes / No |
| | | | Yes / No |

# Initial Consultation on Spectrum Management, Licensing and Pricing

## Consultation Response Form – Part 2

## Questions 5 - 43

Please complete this form in full and return in Word format via email to mosinyi@bocra.org.bw .

Your title _____ Your telephone number _____

Your name _____ Your email address _____

Please use the following table to provide your responses to the questions raised in the consultation document. For each question, please indicate whether you would prefer your response to be kept confidential. Any responses which are marked neither ñyesòor ñnoòto confidentiality will be taken as non-confidential. Additional rows can be inserted by using the tab button on your keyboard at the end of each row.

| Question ID | Question | Your Response | Confidential? |
|---|---|---|---|
| | | | Yes / No |
| | | | Yes / No |
| | | | Yes / No |
| | | | Yes / No |
| | | | Yes / No |
| | | | Yes / No |

# Annex D. Summary of Questions ï Part 1

| Page no. | Section | Question no. | Question |
|---|---|---|---|
| 15 | 4.2 | 1 | What are your views on the revised National Radio Frequency Plan and Footnotes? |
| 16 | 5.1 | 2 | Which spectrum bands do you consider must be migrated for new uses and new users? |
| 16 | 5.2 | 3 | Which mechanisms should BOCRA apply to migrate existing spectrum to new uses and / or users? |
| 16 | 5.2 | 4 | Do you have any suggestions regarding the time frames for migration? |

# Annex E. Summary of Questions ï Part 2

| Page no. | Section | Question no. | Question |
|---|---|---|---|
| 17 | 6.2 | 5 | The above statement is drawn from the current strategy. Should BOCRA maintain the status quo? If not, how should demand for spectrum be assessed? |
| 17 | 6.3 | 6 | What are your spectrum requirements by spectrum band? |
| 18 | 7.2 | 7 | What are your views on BOCRA continuing to adopt a ñmixedòmodel for assignment spectrum, combing both a licensed and licence-exempt approach? |
| 18 | 7.2 | 8 | Which specific frequencies do you believe should be licensed and which do you believe should be licence-exempt and why? |
| 19 | 7.3 | 9 | What are your views on the proposed licensing approach? |
| 19 | 7.3 | 10 | Do you support continuation of the existing link-by-link management of fixed links by BOCRA? |
| 19 | 7.3 | 11 | What are your views on alternative approaches, such as exclusive, national frequency assignments? |
| 20 | 7.4 | 12 | What are your views on spectrum licence duration? |
| 20 | 7.4 | 13 | What are your views on the introduction of coverage and quality of service obligations? |
| 21 | 7.4 | 14 | What are your views in relation to licence rights and obligations in relation to any specific frequencies? |
| 22 | 7.5 | 15 | What are your views on the most suitable approach to spectrum renewal in Botswana? |
| 24 | 8.2 | 16 | What are your views on the use of FCFS for the assignment of spectrum? |
| 25 | 8.2 | 17 | What are your views on the use of managed spectrum assignments? |
| 26 | 8.2 | 18 | What are your views on using comparative assessments? |
| 27 | 8.2 | 19 | What are your views on the use of auctions for assigning spectrum when there is excess demand? |
| 28 | 9.1 | 20 | What are your views on spectrum trading in Botswana? |
| 31 | 10.3 | 21 | What are your views on this decision tree for determining the appropriate pricing model for spectrum in Botswana? |
| 32 | 10.4 | 22 | What are your views on the use of market-based mechanisms such as auctions to determine the price of spectrum for which there is excess demand? |
| 32 | 10.4 | 23 | What are you views in relation to the level of Reserve Prices where auctions are used to price spectrum? |
| 32 | 10.5 | 24 | What are your views generally on the use of administered approaches for determining the price of spectrum? |
| 33 | 10.5 | 25 | What are your views on the use of cost-based approaches to price spectrum? |
| 33 | 10.5 | 26 | If a cost base approach were to be adopted, on what basis should the prices be determined? |
| 34 | 10.5 | 27 | What are your views on the use of Administered Incentive Pricing for determining spectrum prices? |
| 34 | 10.5 | 28 | What are your views on the most appropriate approach to calculating prices under an AIP approach? |
| 37 | 10.5 | 29 | What are your views on the use of shadow pricing for determining spectrum prices? |
| 37 | 10.5 | 30 | What are your views on the current pricing models used in Botswana? |
| 39 | 11.2 | 31 | What are your views on opportunities for shared spectrum access in Botswana? |

| | | | |
|---|---|---|---|
| 39 | 11.2 | 32 | What are your views on potential regulatory policies in relation to ñwhite spacesò? |
| 39 | 11.3 | 33 | What are your views on the current framework for passive sharing? |
| 39 | 11.3 | 34 | What are your views on the introduction of active network sharing in Botswana? |
| 40 | 11.3 | 35 | What are your views on spectrum sharing? |
| 41 | 12.2 | 36 | Which is your preferred option for assignment? |
| 41 | 12.2 | 37 | Are there alternative options that you would prefer? |
| 41 | 12.3 | 38 | What are your views in relation to the inclusion of a coverage obligation for the assignment of 800 MHz? |
| 41 | 12.3 | 39 | If BOCRA were minded to include coverage obligations, what is your view on the appropriate level (geographic or population) and timing for such an obligation? |
| 42 | 12.4 | 40 | What are your views on the most appropriate approach for the assignment of 800 MHz spectrum? |
| 42 | 12.4 | 41 | What are your views on the basis by which the price for the 800 MHz spectrum should be set? |
| 42 | 12.4 | 42 | Is rural coverage an important consideration for the assignment of 800 MHz? |
| 42 | 12.5 | 43 | What are your views on competition measures in relation to 800 MHz such as spectrum caps? |