Establishment of Harmonized Policies for the ICT Market in the ACP Countries

Cross-Border Frequency Coordination: A Harmonized Calculation Method for Africa (HCM4A)

Southern Africa Assessment Report

HIPSSA

Harmonization of ICT Policies in Sub-Saharan Africa

Establishment of Harmonized Policies for the ICT Market in the ACP Countries

Cross-Border Frequency Coordination: A Harmonized Calculation Method for Africa (HCM4)

Southern Africa Assessment Report

HIPSSA

Harmonization of ICT Policies in Sub-Saharan Africa

Disclaimer

This document has been produced with the financial assistance of the European Union. The views expressed may not necessarily reflect the official opinion of the European Union.

The designations employed and the presentation of material, including maps, do not imply the expression of any opinion whatsoever on the part of ITU concerning the legal status of any country, territory, city or area, or concerning the delimitations of its frontiers or boundaries. The mention of specific companies or of certain products does not imply that they are endorsed or recommended by ITU in preference to others of a similar nature that are not mentioned.

Please consider the environment before printing this report.

Foreword

Information and communication technologies (ICTs) are shaping the process of globalisation. Recognising their potential to accelerate Africa's economic integration and thereby its greater prosperity and social transformation, Ministers responsible for Communication and Information Technologies meeting under the auspices of the African Union (AU) adopted in May 2008 a reference framework for the harmonization of telecommunications/ICT policies and regulations, an initiative that had become especially necessary with the increasingly widespread adoption of policies to liberalise this sector.

Coordination across the region is essential if the policies, legislation, and practices resulting from each country's liberalization are not to be so various as to constitute an impediment to the development of competitive regional markets.

Our project to 'Support for Harmonization of the ICT Policies in Sub-Sahara Africa' (HIPSSA) has sought to address this potential impediment by bringing together and accompanying all Sub-Saharan countries in the Group of African, Caribbean and Pacific States (ACP) as they formulate and adopt harmonized ICT policies, legislation, and regulatory frameworks. Executed by the International Telecommunication Union (ITU), co-chaired by the AU, the project has been undertaken in close cooperation with the Regional Economic Communities (RECs) and regional associations of regulators which are members of the HIPSSA Steering Committee. A global steering committee composed of the representatives of the ACP Secretariat and the Development and Cooperation – EurepeAid (DEVCO, European Commission) oversees the overall implementation of the project.

This project is taking place within the framework of the ACP Information and Telecommunication Technologies (@CP-ICT) programme and is funded under the 9th European Development Fund (EDF), which is the main instrument for providing European aid for development cooperation in the ACP States, and co-financed by the ITU. The @CP-ICT aims to support ACP governments and institutions in the harmonization of their ICT policies in the sector by providing high-quality, globally-benchmarked but locally-relevant policy advice, training and related capacity building.

All projects that bring together multiple stakeholders face the dual challenge of creating a sense of shared ownership and ensuring optimum outcomes for all parties. HIPSSA has given special consideration to this issue from the very beginning of the project in December 2008. Having agreed upon shared priorities, stakeholder working groups were set up to address them. The specific needs of the regions were then identified and likewise potentially successful regional practices, which were then benchmarked against practices and standards established elsewhere.

These detailed assessments, which reflect sub-regional and country-specific particularities, served as the basis for the model policies and legislative texts that offer the prospect of a legislative landscape for which the whole region can be proud. The project is certain to become an example to follow for the stakeholders who seek to harness the catalytic force of ICTs to accelerate economic integration and social and economic development.

I take this opportunity to thank the European Commission and ACP Secretariat for their financial contribution. I also thank the Economic Community of West African States (ECOWAS), West African Economic and Monetary Union (UEMOA), Economic Community of Central African States (ECCAS), Economic and Monetary Community of Central Africa (CEMAC), East African Community (EAC), Common Market for Eastern and Southern Africa (COMESA), Common Market for Eastern and Southern Africa (COMESA), Southern African Development Community (SADC), Intergovernmental Authority on Development (IGAD), Communication Regulators' Association of Southern Africa (CRASA), Telecommunication Regulators' Association of Central Africa (ARTAC), United Nations Economic Commission for Africa (UNECA), and West Africa Telecommunications Regulators' Association (WATRA), for their contribution to this work. Without political will on the part of beneficiary countries, not much would have been achieved. For that, I express my profound thanks to all the ACP governments for their political will which has made this project a resounding success.

Brahima Sanou
BDT, Director

Acknowledgements

The present document represents an achievement of a global activity carried out under the HIPSSA project ("Support to the Harmonization of ICT Policies in Sub-Saharan Africa") officially launched in Addis Ababa in December 2008.

In response to both the challenges and the opportunities of information and communication technologies' (ICTs) contribution to political, social, economic and environmental development, the International Telecommunication Union (ITU) and the European Commission (EC) joined forces and signed an agreement aimed at providing "Support for the Establishment of Harmonized Policies for the ICT market in the ACP", as a component of the Programme "ACP-Information and Communication Technologies (@CP-ICT)" within the framework of the 9th European Development Fund (EDF). i.e., ITU-EC-ACP Project.

This global ITU-EC-ACP project is being implemented through three separate sub-projects customized to the specific needs of each region: Sub-Saharan Africa (HIPSSA), the Caribbean (HIPCAR), and the Pacific Island Countries (ICB4PAC).

As members of the HIPSSA Steering Committee co-chaired by the African Union's Commission (AUC) and the ITU, the African Union's Commission (AUC) and the African Telecommunication's Secretariat (ATU) provided guidance and support to the team of consultants who prepared the draft document: Mr Shola Taylor from Kemilinks International for the Assessment Report for Sub-Saharan Africa, Mr Hilaire Mbega for Central Africa, Mr Andrew Kisaka for East Africa, Mr Carlos Alais for Southern Africa, Mr Ahmed Boreau for West Africa and Mr Zoltan Zsuffa on HCM Europe. This draft document is to be reviewed, discussed and validated by broad consensus by participants of a workshop to be organised in collaboration with AUC and ATU.

ITU would like to thank the focal point delegates from the member states ICT and telecommunications ministries and regulators, from regional organisations' commissions and secretariats and regulators associations among them the Association of Regulators of Information and Communications Service of Eastern and Southern Africa (ARICEA), Association of African Telecommunications Regulators (ARTAC), Communication Regulators' Association of Southern Africa (CRASA), East African Community (EAC), East Africa Communications Organizations (EACO), Economic Community of Central African States (ECCAS), Economic Community of West African Countries (ECOWAS), Southern African Development Community (SADC), and West Africa Telecommunications Regulatory Assembly (WATRA), for their hard work and commitment in contributing to the data collection efforts of this unprecedented study. The contributions from the AUC and ATU are gratefully acknowledged.

Without the active involvement of all of these stakeholders, it would have been impossible to produce a document such as this, reflecting the overall requirements and conditions of the SADC region while also representing international best practice.

The activities have been implemented by Ms Ida Jallow, responsible for the coordination of the activities in Sub-Saharan Africa (HIPSSA Senior Project Coordinator), and Mr Sandro Bazzanella, responsible for the management of the whole project covering Sub-Saharan Africa, Caribbean and the Pacific (ITU-EC-ACP Project Manager) with the overall support of Ms Hiwot Mulugeta, HIPSSA Project Assistant, and of Ms Silvia Villar, ITU-EC-ACP Project Assistant. The work was carried out under the overall direction of Mr Cosmas Zavazava, Chief, Project Support and Knowledge Management (PKM) Department. The document was developed under the direct supervision of the then HIPSSA Senior Project Coordinator, Mr Jean-François Le Bihan, and has further benefited from the comments of the ITU Telecommunication Development Bureau's (BDT) Technology and Network Development (TND) and ITU Radiocommunication Bureau (BR). Support was provided by Mr Andrew Rugege, Regional Director, ITU Regional Office for Africa Region. The team at ITU's Publication Composition Service was responsible for its publication..

Summary

Executive Summary

The project for the Harmonization of ICT Policies in Sub-Saharan Africa abbreviated as HIPSSA is a joint project common to the ITU and European Union that aims at the "Establishemnt of Harmonized ICT Policies in Sub-Sahara Africa".

As part of such programme HIPSSA decided to carry out an assessment and feasibility analysis to see if it is possible to implement a Harmonised Calculation Method (HCM) to facilitate cross-border frequency coordination among all countries in Africa.

HIPSSA based this project on a HCM carried out in 2008 among 17 countries in Europe (HCM2008) and called the Harmonised Calculation Method for Africa, abbreviated as HCM4A.

This report as part of the above mentioned HIPSSA project presents the outcome of a survey carried out in Southern Africa to determine if in this region in particular, as part of Sub-Saharan Africa, it would be possible to implement the HCM4A.

As in the case of Southern Africa other regional experts have addressed the other components of the sub-Saharan Africa, West; East and Central Africa.

This report covers only the first assessment phase of the project analyzing the frequency coordination situation across borders in the following 10 countries in Southern Africa:

Angola	Lesotho	Mozambique	South Africa	Zambia
Botswana	Malawi	Namibia	Swaziland	Zimbabwe

Part 1 of the document presents the regional report of Southern Africa, considering the current regional initiatives towards harmonized cross-border frequency coordination and provides a comparative analysis of the regional survey ending with conclusions and recommendations.

The Part 2 of the document presents the report of each country including a general profile of each of them from the geographical, economic and telecommunications point of view. It presents as well the spectrum management framework for every country and investigates the national table of frequency allocations.

It analyzes the frequency coordination status of the countries under consideration, particularly with regard to the existing bilateral and multilateral agreements. Consequently the frequency coordination agreements required to be implemented in the HCM4A are indicated for every country.

The fundamental conclusion of the report is that it is feasible to implement HMC4A in Southern Africa with some amendments of the HCM2008, particularly with regard to some portions of the spectrum considered in the original document.

It was also found that there is not only interest for establishing a Harmonized Calculation Method to carry out cross-border frequency coordination for the land mobile service and the fixed service but there is also interest to extend the HCM2008 to cover the broadcasting spectrum as well.

Glossary

AFS	ITU country abbreviation for South Africa
AGL	ITU country abbreviation for Angola
AM	Amplitude Modulation
ATDI	Software company specialised on spectrum management tools
BAZ	Broadcasting Authority of Zimbabwe
BOT	ITU acronym for Botswana
BRIFIC	International Frequency Information Circular from the ITU Radiocommunications Office
BS	Broadcasting Service
BT	Broadcasting Television service
BTA	Botswana Telecommunications Authority
CD	Compact Disk
COD	ITU country abbreviation for the Democratic Republic of Congo
CRA	Communications Regulatory Authority of Swaziland
CRAN	Communications Regulatory Authority of Namibia
CRASA	Communications Regulators' Association of Southern Africa
DTM	Digital Terrain Model
DVD	Digital Video Disc
DRC	Democratic Republic of Congo
EIRP	Equivalent Isotropically Radiated Power
FAP	Frequency Allocation Plan
FM	Frequency Modulation
FS	Fixed Service
FTP	File Transfer protocol
FWA	Fixed Wireless Access
GDP	Gross Domestic Product
GE-06	ITU Agreement covering the whole VHF/UHF digital television broadcasting bands in Europe and Africa.
GE-84	ITU Agreement covering the sound VHF FM broadcasting bands in Europe and Africa.

Glossary

GE-89	ITU Agreement covering the whole VHF/UHF television broadcasting bands in African Broadcasting Area and neighbouring countries.
GHz	Gigahertz
GSM	Global System for Mobile Communications
HCM 2008	Harmonised Calculation Method implemented in Europe in 2008 on which the whole project is based.
HD	High Definition
HF	High Frequency
HMC4A	Harmonized Calculation Method for Africa
HP	Hewlett Packard
ICASA	Independent Communications Authority of South Africa
ICT	Information and Communication Technology
IMF	International Monetary Fund
IMT	International Mobile Telecommunications
INACOM	Instituto Angolano das Comunicações (Angolan Institute for Communications) Regulator
INCM	Institu National das Comunicaçôes de Moçambique (National Institute for Communications from Mozambique)
IRIS	Spectrum Monitoring and Management System
ISP	Internet Service provider
ITU	International Telecommunications Union
ITU-R	Radiocommunication Sector of the ITU
LCA	Lesotho Communications Authority
LMS	Land Mobile service
LS or L&S	Land Mobile service
LSO	ITU country abbreviation for Lesotho
MACRA	Malawi Communications Regulatory Authority
MBC	Malawi Broadcasting company
MHz	Megahertz
MNFAP	Malawi National Frequency Allocation Plan
MoU	Memorandum of Understanding

Glossary

MOZ	ITU country abbreviation for Mozambique
MS	Mobile service
MTN	South Africa-based multinational mobile telecommunications company,
MWI	ITU country abbreviation for Malawi
NCC	Namibian communications Commission
NMB	ITU country abbreviation for Namibia
P	Propagation, Used in front of certain ITU-R Recommendations on the matter
PNAF	Plano Nacional de Atribuição de Frequências (Mozambique's National Frequency Allocation Plan)
POTRAZ	Postal and Telecommunications Regulatory Authority of Zimbabwe
RR	Radio Regulations
SA	Southern Africa
SABC	South Africa Broadcasting Corporation
SADC	Southern Africa Development Community
SATA	Southern Africa Telecommunications Association
SATFA	South Africa Table of Frequency Allocations
SHF	Super High Frequency
SMMS	Spectrum Monitoring and Management System
SMS4DC	Spectrum Management System for Developing Countries (ITU software tool)
SPTC	Swaziland Post and Telecommunications Corporation
SRTM	Shuttle Radar Topography Mission NASA mission to obtain elevation data for most of the world.
SWZ	ITU country abbreviation for Swaziland
TADIRAN	Telecommunications company supplier of equipment and software tools
TCI	Company specialised on spectrum monitoring, radiolocation and spectrum management tools
TCL	Telecom Lesotho
TerRaSys	**Ter**restrial **Ra**diocommunication **Sys**tem ITU software tool
TETRA	Terrestrial Trunked Radio for mobile communications
TV	Television
TZA	ITU country abbreviation for Tanzania

Glossary

UHF	Ultra High Frequency
VCL	Vodacom Lesotho
VHF	Very High Frequency
WACS	West African Cable System. Submarine cable between South Africa and UK landing in many West African countries
WGS84	World Geodesic System adopted in 1984
WISFAT	Web Interface for Submission of Frequency Assignments/allotments (Terrestrial Services) ITU Internet Tool
WLL	Wireless Local Loop
WRC-07	World Radio Communications Conference held in 2007
ZICTA	Zambia Information and Communication Technology Authority
ZMB	ITU country abbreviation for Zambia
ZWE	ITU country abbreviation for Zimbabwe

Table of contents

Table of contents

Table of contents

Table of contents

Table of contents

Table of contents

Table of contents

Table of contents

Table of contents

Table of contents

List of tables

Table of contents

List of figures

Page

Introduction

This report is part of a series of reports in the global activity HCM4A in the HIPSSA Project addressing the Support for Harmonization of ICT Policies in Sub-Sahara Africa.

HIPSSA is a program in partnership between the International Telecommunication Union (ITU) and European Commission (EC), covering all African, Caribbean and Pacific countries.

In particular this report presents the outcome of a survey carried out in Southern Africa regarding a Harmonised Calculation Method (HCM) to facilitate cross-border frequency coordination among different countries in the region.

A method of similar characteristics has been implemented successfully in Europe among 17 countries, and based on this; the objective of the survey is to analyse the feasibility of implementing similar methodology not just in Southern Africa but also in the whole Sub-Sahara Africa.

This Harmonized Calculation Method for Africa (HCM4A) as it has been denominated intents to cover the whole of Sub-Saharan Africa and for that purpose four stages have been considered:

- Assessment phase: reviewing existing bilateral and multilateral cross-border frequency coordination agreements in Sub-Sahara Africa,
- Creation of a Technical Working Group to review the results of the assessment and the proposed multilateral agreement,
- Validation workshop and adoption meeting of the draft agreement if in line with the conclusion of the assessment,
- Development of HCM software adaptation based on the HCM4A Agreement if adopted, software release and training workshops.

Therefore the final purpose is to create a cross-border frequency coordination multilateral agreement and tool to:

- Prevent and easily solve radio interference across borders,
- Take account of other neighbouring stations before putting their own stations into operation,
- Set an harmonized standard that all the countries involved accept on a mutually beneficial approach by consensus,
- Provide a solid basis for bilateral and multilateral agreements,
- To enable the creation of bilateral preferential frequency agreements at border zones: who can operate what and with which interference ranges.

This report thus covers only the first assessment phase analyzing the frequency coordination situation across borders in the following 10 Southern Africa countries:

Angola	Lesotho	Mozambique	South Africa	Zambia
Botswana	Malawi	Namibia	Swaziland	Zimbabwe

Tanzania, Madagascar and Mauritius are dealt with under the East Africa Region and the Democratic Republic of the Congo under Central Africa but results of all regions will be brought together to give to the regional economic organization SADC and the regional regulators' associations CRASA a complete view of their region.

As in the case of Southern Africa other regional experts have addressed the other components of the sub-Saharan Africa: West; East and Central Africa.

Introduction

In order to carry out the assessment phase of Southern Africa the regional expert needed to compile information related to the matter under consideration.

With that purpose the regional expert has:

- Liaised with regional organizations among others Regional Economic Communities (REC) and Regional Regulators' Association (RRA) to receive their views regarding regional practices and challenges in terms of cross-borders frequency coordination.
- Established a list of persons of contact with each national government agency in charge of frequency allocation and management in the sub-region he was assigned to.
- Conducted interviews with the contacted persons and drafted corresponding reports
- Collected existing bilateral or multilateral cross-border frequency coordination agreements from the earlier identified contact persons.
- Reviewed and compared the existing agreements and presented the results of his analysis in summary tables and drafted an overview of the situation in the sub-region.
- Collected the existing spectrum management database format including frequency coordination data.
- Summarized the existing frequency coordination calculation methods and coordination agreements.

Based on the above mentioned points the present report has been prepared and it consists of two parts.

Part 1: presents the regional report of Southern Africa, considering the current regional initiatives towards harmonized cross-border frequency coordination and provides a comparative analysis of the regional survey ending with conclusions and recommendations.

Part 2: presents the report of every country based on the results of the survey carried out.

This part includes a general profile of every country from the geographical, economic and telecommunications point of view. It presents as well the spectrum management framework for every country and investigates the national table of frequency allocations, to see the possible differences that could be encountered at the borders of the different counties. Similarly it analyzes the frequency coordination status of the countries under consideration, particularly with regard to the existing bilateral and multilateral agreements. Consequently the coordination agreements required are indicated for every country. As in the case of the regional report it ends with conclusions and recommendations in every case.

To facilitate the work towards the following three stages each national report includes the details of the persons nominated by each country to be the focal points for the HMC4A.

This report has several annexes to Part 1 and 2 which are included separately in a CD accompanying the report. Those annexes are clearly identified at the end of the regional report and at the end of each national report.

The final consolidated global report including the survey outcome of East Africa, Central Africa, Southern Africa and West Africa will be presented and reviewed during a workshop of a Technical Working Group to be formed under the aegis of the African Union Commission and ATU in 2011.

Main Findings

The most important finding of this particular report is that it is feasible to adapt the European Harmonized Calculation Method to Southern Africa.

On the other hand many countries have been requesting that the HCM4A include as well FM sound broadcasting and VHF/UHF TV broadcasting. Concerns exist with regard to the interference problems that could happen as a consequence of the introduction of the new digital TV standard in the region, especially if there would be countries that will not align to GE06.

Not much will be necessary to modify the HCM2008 to adapt it to Southern Africa if broadcasting is not taken into account in this project.

There is only one frequency coordination agreement (MoU) in force and that is to manage the situation between Lesotho and South Africa. It addresses with emphasis cross-border spillover of public land mobile systems, fixed wireless access systems and other radiocommunication systems; in other words radiocommunication systems that mainly base their coverage on a cellular approach.

Inspired in such MoU, the regional regulators' associations CRASA developed a model MoU that can be used between any of the regulators whose countries belongs to such association.

The CRASA MoU, which provides fundamentally an administrative framework for coordination across borders, is on the verge of being formally used by some countries (such as Mozambique, South Africa, Malawi, etc.). However some countries make use of the steps pointed out in the MoU without properly formalizing an agreement.

In Southern Africa there is no proper framework for coordination of frequencies across borders in force that addresses administrative procedures as well as technical provisions .

Notwithstanding what is mentioned in the previous paragraph it was found that the regional economic organization SADC and CRASA have implemented numerous documents to facilitate cross-border frequency coordination among their members, particularly concerning harmonization on the spectrum utilization at borders.

With the exception of Zimbabwe all the countries have their own national table of frequency allocations. Some of them are up to date while some others require updating.

SADC countries are moving towards a harmonized Regional Band Plan. With the purpose of creating a framework for the harmonisation across Southern Africa of the use of the radio frequency spectrum, SADC established in Luanda, Angola in March 2010 the regional frequency allocation plan (SADC FAP 2010). Obviously many countries are not yet aligned to such plan, but it is expected that SADC Members implement as many portions of SADC FAP 2010 as practically possible. Zimbabwe directly has taken the SADC plan as its national band plan.

In general the level of interference suffered by countries in Southern Africa does not seem to be high. That could be the reason why there are no proper procedures in place to address the resolution of interference.

The most frequent type of cross-border frequency coordination that have been happening in the recent years are in the broadcasting environment particularly VHF FM with some cases of VHF and UHF TV. There have been as well some frequency coordination cases in the VHF and UHF land mobile radio including some in the 900 MHz GSM band.

In some cases microwave frequency coordination between the 6 to 15 GHz bands are carried out quite often (Up to 15 times a year): that was the case between Lesotho and South Africa.

Main Findings

In global terms the periodicity that frequency coordination across borders are carried out are relatively low, normally one or two a year but seldom more than 5 a year, with the exception of VHF land mobile radio that in some cases are greater than 10 per year as well as the already mentioned case on microwave bands.

The responses showed that the majority of the countries do not have a coordination register neither make use of pre-defined frequency/channels category. Nevertheless, the CRASA MoU divides the bands under consideration into preferred and not preferred assignments.

Practically no country has different data formats for the exchange of relevant information, neither for the different bands or radiocommunication services. In addition the majority have responded that they prefer Internet (e-mail), and CD/DVD as the means for exchanging coordination information.

Most of the countries are reasonably equipped to handle interference and frequency coordination cases, although the actual capability of the tools varies from very basic to sophisticated.

Part 1:

Regional Report

Part 1

REGIONAL OVERVIEW

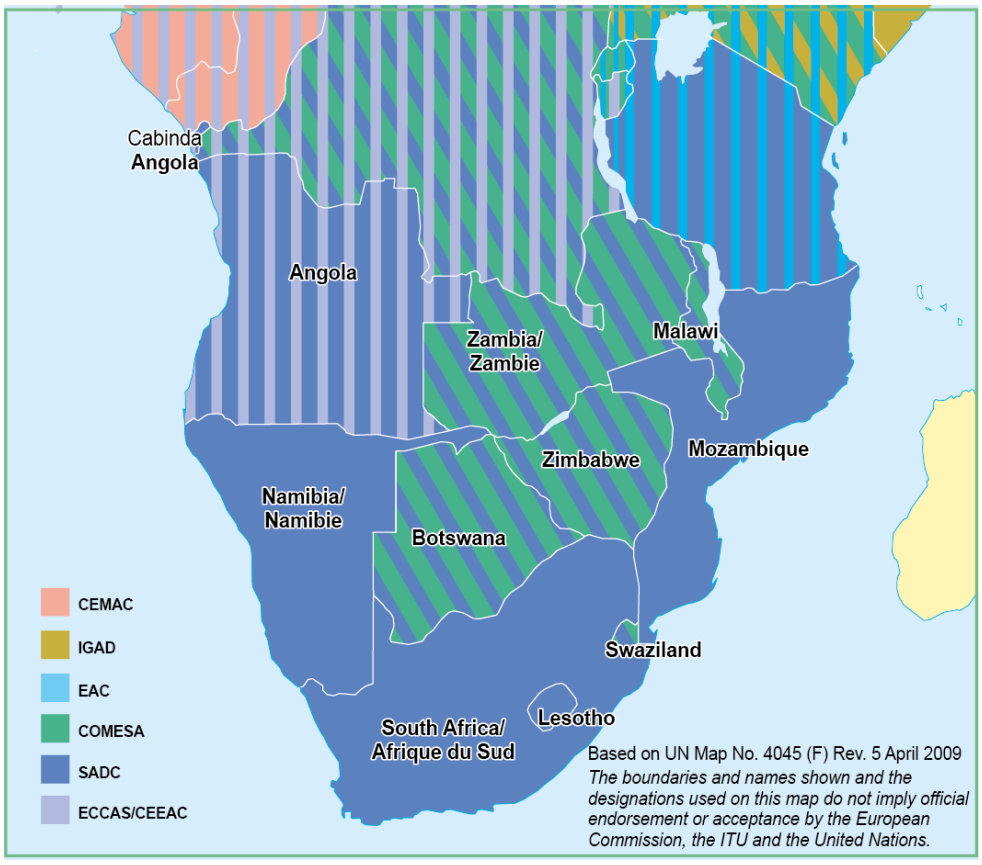
Southern Africa is the southernmost region of the African continent, comprising the countries of Angola, Botswana, Lesotho, Malawi, Mozambique, Namibia, South Africa, Swaziland, Zambia, and Zimbabwe. All these countries are included in this report.

However it must be highlighted that for the United Nations the Southern Africa Region is only constituted by Botswana, Lesotho, Namibia, South Africa, and Swaziland.

The interior of Southern Africa consists of a series of undulating plateaus that cover most of South Africa, Namibia, Botswana and extend into central Angola. Contiguous with this are uplands in Zambia and Zimbabwe. Coastal mountains and escarpments, flanking the high ground, are found in northern Mozambique, South Africa, Namibia, Angola, and along the Mozambique-Zimbabwe border. The terrain of Southern Africa is varied, ranging from forest and grasslands to deserts.

As the map shows, the Southern Africa region under consideration is bordered to the northwest by the Republic of Congo (Brazzaville) and the Democratic Republic of Congo. To the northeast borders with the United Republic of Tanzania. Towards the southwest lies the Atlantic Ocean and the southeast is bathed by the waters of the Indian Ocean.

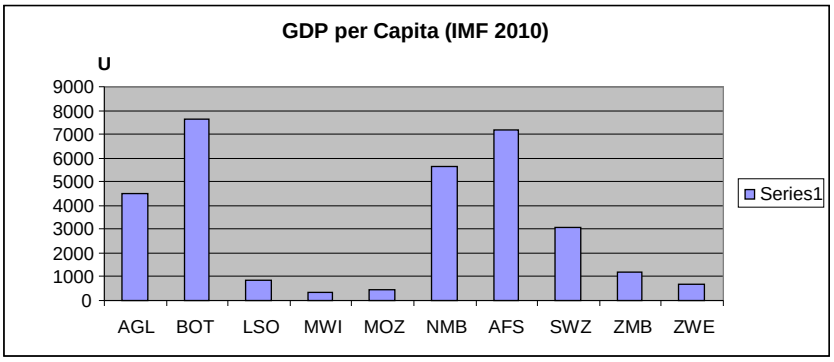
Figure 1: ECCAS and CEMAC member states

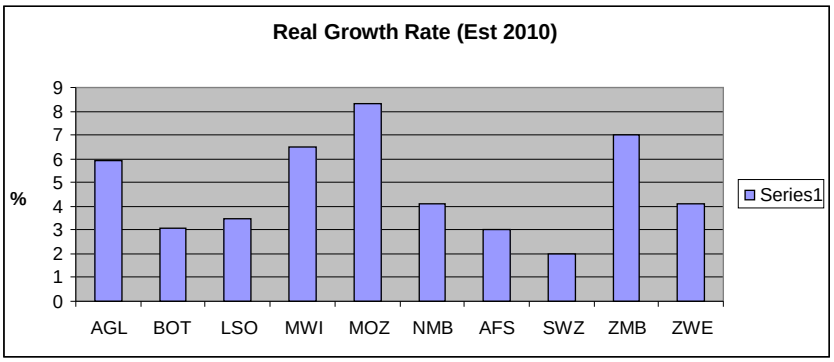


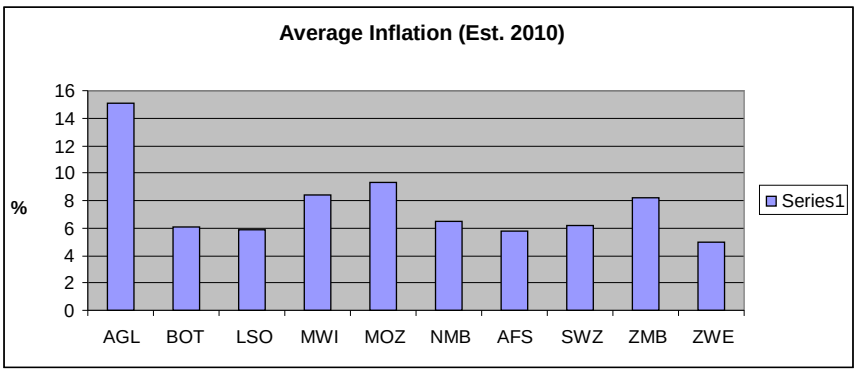
The most common language spoken in the region is English, with the exception of Angola and Mozambique where Portuguese is the main official language.

In terms of natural resources, the region has the world's largest resources of platinum and the platinum group elements chromium, vanadium, and cobalt, as well as uranium, gold, titanium, iron, copper and diamonds. Consequently its economy depends considerably on the export of such resources.

The following three graphs provide an idea of the status of the economy in the Region







Fundamentally there is one big regional organisation which addresses telecommunications among many other issues of regional interest. This is the Southern Africa Development Community (SADC),which is the regional economic organisation. The SADC includes not only the countries covered in this report but additionally the Democratic Republic of Congo, the United Republic of Tanzania and the islands of Madagascar, Mauritius and Seychelles.

The SADC mission is to promote sustainable and equitable economic growth and socio-economic development through efficient productive systems, deeper co-operation and integration, good governance, and durable peace and security, so that the region emerges as a competitive and effective player in international relations and the world economy.

Therefore, the SADC has the widest responsibility on different issues at regional level.

Consequently, at the specific level of Information Communications and Technology (ICT) issues it has one implementing agency. This is the Communication Regulators Association of Southern Africa (CRASA) that groups fundamentally all the ICT regulatory authorities in the region. The Southern Africa Telecommunications Association (SATA) is a consultative member of SADC on telecommunication matters, which groups all the telecommunications operators of the region.

The CRASA mission is to advise policy makers through designing and implementing harmonised ICT policies and regulations thereby contributing to the socio-economic development of the region.

On the other hand the SATA mission is to co-ordinate the development of ICT networks and services of regional nature that are responsive to the diverse needs of commerce and industry in support of the SADC regional socio-economic development programs.

CRASA is the body which deals with cross-border coordination at regional level.

The telecommunications environment in Southern Africa is under a wave of liberalization and promotion of competition, which for its implementation requires a greater utilization of the radio spectrum, be it for fixed services, mobile services or Internet services. The speed of implementation is variable by which some countries are progressing at a reasonable speed and others do it at a slower pace.

The broadcasting environment seems to be relatively stable in the region; however the big explosion is to come with the introduction of digital television, which will create many situations where frequency coordination will be required, in particular where the same standard is not adopted.

The more important regional broadcasting organisations are the Southern Africa Broadcasting Association (SABA) and the Southern Africa Digital Broadcasting Association (SADIBA).

SABA is a non-profit, non-governmental umbrella organisation including commercial, private, community and public broadcasting enterprises in the (SADC) region. One of the primary objectives of the organisation is to promote the development of quality broadcasting and excellence among broadcasters in Southern Africa, as well as organize cooperative activities, including training, staff and other exchanges among members.

SADIBA, on the other hand, prides itself as the leading knowledge hub on digital broadcasting that significantly influences the successful introduction of digital technologies enhancing the quality of life of the citizens of the SADC.

1 Regional initiatives towards harmonized cross-border frequency coordination

CRASA has been the only regional organisation in Southern Africa that has addressed the issue of frequency coordination across borders and particularly the spillover among different cellular operators with base stations close to the borders.

CRASA has issued a document titled: “CRASA, Wireless Technologies, Policies and Regulations”. The purpose of the document is to present guidelines that outline policy and regulatory recommendations for wireless technology deployment in the SADC region. Essentially the guidelines propose recommendations for the removal of structural barriers for the diffusion of wireless communications technologies and services among the SADC countries. See **SA Annex 4**.

CRASA recognizes in their guidelines that the radio frequency spectrum is a natural resource of significant economic, social and cultural importance. Managing the electromagnetic-highway along with the telecommunications infrastructure is the responsibility of each country‘s regulator.

CRASA considers that the usage of the radio frequency spectrum is subject to multiple changing conditions such as the development of new technologies, current manufacturing standards, and importation and sales of spectrum-using equipment. In addition, the technical and operational characteristics of spectrum-using systems are becoming increasingly complex and diverse, pointing to the need for more flexible policies, regulations, standards, and enforcement mechanisms.

One of the main concerns for CRASA is the management of the effect of spill-over signals from neighbouring countries (frequency coordination across-borders). CRASA recognizes that harmonization of radio frequency spectrum use does facilitate frequency coordination across-borders and has the added benefit of allowing regional roaming of certain customer devices (e.g. GSM).

Consequently, one of the most important steps taken by SADC/CRASA was to create a framework for the harmonization across SADC of the use of the radio frequency spectrum by means of a regional frequency allocation plan. This is considered one of the first steps that will facilitate frequency coordination across borders.

SADC and CRASA have gone to the extent of harmonizing radio frequency channeling plans for various fixed and mobile services in different radio frequency bands throughout SADC. Such harmonization covers 800 MHz to 38 GHz.

CRASA also visualizes that harmonization is also critical from the economic point of view to build an economy of scale and promote regional cooperation and integration.

CRASA's guidelines addressed the problem of frequency coordination across borders, in a particular section. This section presents possible scenarios and emphasizes the advantages of having harmonized spectrum across borders. It deals as well with the difficulties that can be found when there is lack of harmonization.

In line with the guidelines, CRASA developed an MoU template on frequency coordination across borders between telecommunications and broadcasting services that can be adopted between two countries. In such document a general framework is established where fundamentally each party commits itself to co-operate on the coordination and control of radio transmission spillover.

The MoU covers Public Land Mobile Radio, Fixed Wireless Access and other radiocommunication systems. It includes very general administrative procedures and does not have much technical provisions other than advisable principles to avoid spillover and the technical data required for the exchange of information.

The MoU has provisions for the creation of a joint forum for the discussion of cross-border coordination and also creates a joint oversight committee to be the custodian of the MoU with power to amend the terms of the MoU if agreed. See **SA Annex 2.**

Regarding broadcasting the MoU limits itself to the agreement between the parties to co-ordinate all broadcasting signal distribution activities, which may require such coordination.

To dates only one MoU has been duly signed between South Africa and Lesotho, others are in the process of implementation based on the CRASA MoU model. (South Africa and Mozambique are already at quite an advanced stage).

Complementing the MoU, CRASA has issued a document on GSM spillover engineering practice and principles; such document mainly addresses the considerations to be taken into account regarding spillover when installing new radio sites on areas of high site density, low site density, and high lying areas that require special consideration. See SA Annex 6.

Similarly, the terms of reference for the joint oversight committee to be created as part of the MoU were established. See **SA Annex 3**.

SADC/CRASA has gone a step further in harmonization, creating a framework on the harmonization of frequency allocations for public protection and disaster relief (PPDR) applications at regional level. In this regard the harmonization covers narrowband, wideband and broadband applications. See **SA Annex 7**

Furthermore CRASA has envisaged a framework to harmonize frequency bands, technical standards and regulatory requirements for the use of Short-Range Devices (SRDs) as well as frequency channeling arrangements for terrestrial fixed and mobile systems in the SADC countries. See **SA Annexes 8 and 5.**

The initiatives towards harmonized cross-border frequency coordination activities of SADC/CRASA have already provided numerous tools to facilitate the process of coordination.

2 Regional cross-border frequency coordination agreements

There is only one formalized cross-border frequency coordination agreement in Southern Africa. That is a MoU signed between South Africa and Lesotho, on coordination of telecommunications and broadcasting services.

The agreement is based on an approach similar to ITU Resolutions. The expressed purpose of the MoU is that both parties promote the co-operation in the regulation of telecommunications and broadcasting on the basis of equality and mutual benefit in accordance with their respective national legislations and the ITU framework.

The MoU signed in 2002 between the parties, addresses with emphasis cross-border spillover of GSM, WLL/FWA and other radiocommunication systems; in other words radiocommunication systems that base their coverage on a cellular approach.

In a very general way the MoU establishes procedures to facilitate the process of spillover coordination.

Among the key issues addressed are:

- The creation of a radio frequency spectrum coordination zone along and overlapping both sides of the borders;
- The prediction of spillover into the coordination zone with acceptable planning techniques, and the acceptance thereof, in advance of operations commencing, including the calculation of signal strength levels at agreed points;
- The subdivision of the frequency band into preferred and not preferred assignments within the coordination zone;
- Monitoring strength levels at agreed points that trigger the steps to be followed mainly based on a reasonable engineering plan that will resolve the issue in an acceptable way for both parties.

The MoU is based on an administrative approach; since it does not detail how to determine the coordination zone, it refers to acceptable planning techniques without setting the technical conditions for its acceptability and even the calculation methodology is not addressed.

Actually the MoU is fundamentally a framework to carry out coordination between the parties, which will need to agree in the technicalities to be used every time there is coordination.

Without any doubt, it is a first approach to solve the spillover problems between countries and it has shown to be a very good aid.

The agreement also considers the creation of a joint forum for cross-border coordination involving all the possible stakeholders that may be affected in both countries by the spillover.

The primary purpose of the forum is to proactively pre-empt the possibility of the commercial impact of spillover coverage and frequency interference by means of rules and procedures in such circumstances.

The joint forum is responsible for the creation of such rules, particularly on radio planning and implementation. Also the other important role of the forum is to assist in the resolution of complaints within an environment of cooperative participation.

The data format for the exchange of relevant information during the process of coordination is clearly stated even establishing the process to follow after receiving that type of information.

Broadcasting is addressed at a very high level fundamentally considering broadcasting signal distribution activities, which may require coordination.

Among other issues the MoU touches roaming, interconnections and no-man land services

Finally the parties agree to establish a joint oversight committee in which operators, manufacturers, and service providers may participate together with administrators. This is fundamentally to monitor the modus operandi of the memorandum and see its possible amendments or additions.

As pointed out before, CRASA/SADC has implemented a MoU for frequency coordination across borders. The MoU is based on the one that South Africa and Lesotho signed in 2002. It provides a template that can be used to implement an agreement on frequency coordination across borders between two regulators within SADC.

The CRASA MoU is a bit wider than the one signed in 2002, not just considering GSM but extending it to public land mobile systems and dropping the old concept of WLL referring instead to fixed wireless access systems and other radiocommunication systems.

Since this is a very convenient administrative procedure to carry out frequency coordinations across borders, it is noted that some countries follow this procedure to carry out cross-border frequency coordination with their neighbors without formalizing it.

3 Regional survey comparative analysis

The regional survey was carried out by first preparing a set of questions to find out the most convenient approach to implement the HCM4A.

The questionnaire tried to clarify the entities in charge of frequency coordination in each country, particularly frequency coordination across borders for the different radiocommunication services.

Due to the importance that frequency harmonization plays for cross-border coordination information was requested pertinent to the national and regional frequency allocation band plan as well as alignment with the ITU frequency allocations for ITU Radio Region 1.

Of clear importance to the project was the need to know about cross-border frequency coordination framework and agreements in existence, relevant procedures in place as well as capabilities to handle interference/coordinations.

Similarly it was necessary to know about relevant interference problems and cross-border frequency coordination experiences to which the countries were exposed.

The basic approach followed was to consult with the relevant authorities of every country mainly through emails, making use of telephonic contact for minor clarifications or to expedite the response process.

For a more detailed information on the outcome of the regional survey please consult Part 1 where each country is addressed separately

3.1 Regional cross-border coordination responsibilities

CRASA acts as a facilitator for frequency coordination across borders within the SADC.

Table 1 indicates the different entities responsible for the international frequency coordination for all services

	Responsibility for international frequency coordination	Responsibility for national spectrum management	Responsibility for broadcasting spectrum	Responsibility for defense/security spectrum
Angola	INACOM	INACOM	INACOM	INACOM
Botswana	BTA	BTA	LCA	BTA
Lesotho	LCA	LCA	BTA	LCA
Malawi	MACRA	MACRA	MACRA	MACRA
Mozambique	INCM	INCM	INCM	Defense Ministry and Ministry of Internal affairs
Namibia	CRAN	CRAN	CRAN	CRAN
South Africa	Minister of Communications	ICASA	ICASA	ICASA
Swaziland	CRA	CRA	CRA	CRA
Zambia	ZICTA	ZICTA	ZICTA	ZICTA
Zimbabwe	POTRAZ	POTRAZ	BAZ	POTRAZ

Table 1: Entities responsible for the international frequency coordination for all services

Note that in most of the countries the regulatory authority is responsible for the spectrum management /frequency coordination for all radio communications services.

In South Africa the international coordination of the radio spectrum is in the hands of the Minister of Communication for all radiocommunication services while the national spectrum management is the responsibility of the Independent Communications Authority of South Africa (ICASA).

Another exception is with the broadcasting service in Zimbabwe where the responsibility for broadcasting spectrum is a different entity.

Mozambique is the only country where the defence/security spectrum management is in the hands of the Defence Ministry and the Ministry of Internal affairs.

3.2 Regional Cross-Border Frequency Coordination Framework

None of the countries in Southern Africa have a comprehensive coordination framework containing administrative procedures and technical provisions for cross-border frequency coordination.

Lesotho and South Africa make use of the MoU between the countries as a frequency coordination framework between their countries, although it does not have proper technical provisions.

Similarly it has been noted that countries such as Zimbabwe use the CRASA MoU and the HF frequencies harmonised in all SADC countries informally, as a framework for frequency coordination across borders.

3.3 Regional Table of Frequency Allocations

The region has a common frequency allocation plan known as the SADC Frequency Allocations Plan (SADC FAP 2010) which is a very comprehensive document. It contains the common allocations and proposed common sub-allocations within the SADC and compares them with the allocations for the ITU Region 1. It also indicates the main utilization of the bands as well as many relevant notes.

Based on the provisions of the ITU Radio Regulations, the Table covers from 9 KHz to 100 GHz including the decisions of World Radio Conferences up to 2007.

The purpose of SADC FAP 2010 is to create a framework for the harmonization across SADC of the use of the radio frequency spectrum.

It is however acknowledged that the use of the radio frequency spectrum varies from one SADC country to another due to, amongst others, legacies in system deployments, different time scales for the introduction of new technologies, different services and technology requirements as well as different capacity requirements.

It is therefore not possible to align the use of the radio frequency spectrum over all frequency bands between all countries. Nevertheless it is evident that a de facto harmonization already exists in many frequency bands and it could be possible that further harmonization will occur within the SADC common economic zone.

It is expected that SADC Members implement as many portions of SADC FAP 2010 as practically possible.

The document includes as well plans to be implemented in the future mainly concerning the harmonization of frequencies.

It has numerous annexes particularly important for this project:

- A table indicating all those ITU Radio Regulations footnotes containing references to SADC country names
- List of SADC country footnotes relevant to SADC FAP 2010, mainly detailing alternative or additional allocations in certain SADC countries
- SADC harmonised HF cross-border frequencies presenting a list of thirteen (13) HF frequencies harmonised in all SADC countries for mobile communications (e.g. long haul trucks

Table 2 indicates the main different spectrum allocations between the SADC FAP and ITU Region 1 between 80-20 000 MHz. Not all allocations are recorded.

Bands (MHz)	ITU Region 1	Regional Plan (SADC FAP 2010)
138-144	AERONAUTICAL MOBILE (OR)	MOBILE
230-238 and 246-254	FIXED/MOBILE	BROADCASTING
470-790	BROADCASTING	BROADCASTING RADIOASTRONOMY

Bands (MHz)	ITU Region 1	Regional Plan (SADC FAP 2010)
3400-3600	Mobile	MOBILE except aeronautical mobile
5150-5350	Not FIXED	Wireless Access Systems
5470-5725	Not FIXED	Wireless Access Systems
17 100-17 300	Not FIXED	Wireless Access Systems

Table 2: Different spectrum allocations between the SADC FAP 2010 and ITU Region 1 Between 80-20 000 MHz.

Mainly terrestrial allocations have been considered

Obviously many countries still make use of their own frequency allocation plan. **Table 3** shows the actual situation.

Country	Year Plan Issued	Spectrum Covered	Status
Angola	2001	9 KHz to 1000 GHz	Need update
Botswana	2008	9 KHz to 105 GHz	Up to date
Lesotho	2010	9 KHz to 100 GHz	Up to date
Country	Year Plan Issued	Spectrum Covered	Status
Malawi	2010	9 KHz to 100 GHz	Up to date
Mozambique	2011	9 KHz to 400 GHz	Up to date
Country	Year Plan Issued	Spectrum Covered	Status
Namibia	2009	9 KHz to 105 GHz	Up to date but still a draft
South Africa	2010	9KHz to 300 0 GHz	Up to date
Swaziland	2009	9 KHz to-40.5 GHz	Incomplete. Needs revision Partially considers WRC07
Zambia	2009	9 KHz to 1000 GHz	Up to date but still a draft
Zimbabwe	2010	9 KHz to 100 GHz	Does not have a national band plan but uses SADC FAP 2010

Table 3: Main characteristics of National frequency band plans of SADC countries.

For more detailed information on the different band plans particularly its deviations regarding ITU Region 1 allocation see the relevant national report.

3.4 Interference problems and cross-border frequency coordination experiences

In general the level of cross-border interference occurring in SADC countries does not seem to be high.

With the \exception of Zimbabwe no other country has a procedure to handle resolution of interferences and similarly most of the countries do not have a proper record of interferences.

The time taken to resolve interference is variable, going from a few days to years. The main reasons that delay the resolution of interferences are first of all the lack of a proper procedure in place between the countries. Another reason for delay has been lack of knowledgeable staff in the relevant positions.

There have been cases where lack of consultation between countries happened when installing transmitters close to the borders. Additionally, in several cases lack of proper adherence to ITU frequency plans was the reason for interferences.

On the other hand it was reported by one of the countries that the use of reserved channels helped to minimized interferences. Similarly, joint meetings between the countries involved in interference cases have proven to be very effective for their resolution.

VHF FM Sound Broadcasting is the service that experiences the greatest interferences followed by VHF and UHF mobile services including some GSM cases. However the periodicity of occurrence is relatively low.

In general the level of frequency coordination across borders seems to be more frequent than the cases of interferences between countries in Southern Africa.

Usually submission of technical analysis (field strength, pfd, etc) showing that the levels are within acceptable values lead towards a successful coordination or interference resolution. Frequently frequency coordinations are carried out by making use of alternative channels when there are possibilities of frequency overlaps. Generally, coordination takes about a week or two if all technical parameters requested are available.

The CRASA MoU, which provides fundamentally an administrative framework for coordination across borders, is on the verge of being formally used by some countries (such as Mozambique, South Africa, Malawi, etc). However, many countries make use of the steps pointed out in the MoU without properly formalizing an agreement.

No country is making use of the pre-defined coordination category such as preferential or shared channels. However the CRASA MoU considers the subdivision of the frequency band of interest into preferred and not preferred assignments within the coordination zone.

Regarding the point or line where the calculation is made to determine if coordination is required or not, there is no coordination agreement formalized based on a specified point or triggering level. However, some countries would prefer the borderline to be the triggering point for coordination. That also may depend on the coverage provided by the digital terrain model into the neighbouring country.

The most common type of cross-border frequency coordination in recent years are in the broadcasting environment particularly VHF FM with some cases of VHF and UHF TV. There have also been some frequency coordination cases in the VHF and UHF land mobile radio including some in the 900 MHz GSM band.

In some cases microwave frequency coordination between the 6 to 15 GHz bands are carried out quite often (up to 15 times a year between Lesotho and South Africa).

In global terms the periodicity that frequency coordination across borders are carried out are relatively low, normally one or two a year but seldom more than 5 a year, with the exception of VHF land mobile radio that in some cases are greater than 10 per year and the already mentioned case on microwave bands.

In many cases frequency coordination across borders is carried out informally directly between the spectrum management divisions of the countries involved, whenever the circumstances require.

3.5 Coordination agreements required

Table 4 in the following page indicates the coordination agreement required in Southern Africa.

Requesting party ⇓⇓	AFS	AGL	BOT	LSO	MWI	MOZ	NMB	SWZ	ZMB	ZWE	TZA	COD
AFS			BEGHIJKLMNO	BEGHIJKLMNO		BEGHIJKLMNO	BEGHIJKLMNO	BEGHIJKLMNO		BEGHIJKLMNO		
BOT	BE									BE		
LSO	ABCFNS											
MWI						ABDGF			ADFG		ADFG	
MOZ	ABEFGHIJKLMNO				ABEFGHIJKLMNO			ABEFGHIJKLMNO	ABEFGHIJKLMNO	ABEFGHIJKLMNO	ABEFGHIJKLMNO	
NMB#	GHIJKLMN	GHIJKLMN	GHIJKLMN						GHIJKLMN			
SWZ	B					T						
ZMB	ABDFGHIP	ABDFGHIP	ABDFGHIP		ABDFGHIP	ABDFGHIP				ABDFGHIP	ABDFGHIP	ABDFGHIP
ZWE	BGKMR		BGKMR			BGKMR			BGKMR			

Angola did not state any frequency coordination requirement;# Priority not specified but considered medium

Key for frequency bands requiring cross-border coordination

A	VHF BS Sound Band	H	MS 1710-1785	O	FS MW bands 4 to 13 GHz
B	MS bands within 137-174 MHz	I	MS 1805-1880 MHz	P	FS MW bands 4 to 18 GHz
C	FS 140.5-141 MHz	J	MS 1885-2025MHz	Q	FS MW bands 7 to 13 GHz
D	VHF TV band	K	MS 2110-2200 MHz	R	FS MW bands 6 to 8.5 GHz
E	MS bands within 401-470 MHz	L	MS 2300-2400 MHz	S	FS MW bands 8 to 15 GHz
F	UHF TV band	M	MS 2500-2690 MHz	T	FS MW band 3534-3940 GHz
G	MS 790-960 MHz(790-862/862-962 MHz)	N	MS 3400-3600 MHz		

Color key for the required priority

Top	RED	High	GREEN	Medium	BLUE	Low	BLACK

Table 4: Coordination agreements required in Southern Africa.

Note that the different frequency bands requested by the different countries have been included into relevant bands as per table of allocations. (I.e. 130-174 MHz or 146-174 MHz included in 137-174 MHz). To see with precision the band requested please consult the relevant country in Part 2 of the report.

3.6 Analysis of different data exchange format used in the region

At the regional level the countries are, in general, not making use of different data formats for the exchange of relevant coordination information for different services or bands.

The CRASA MoU details only one data format as follows:

"When requesting coordination, at least the following characteristics of the transmitting station shall be forwarded by the requested Party:

- Frequency in MHz
- Maximum transmitted bandwidth in MHz
- Name of transmitter station
- Country of location of transmitter station
- Geographical co-ordinates in degrees, minutes and seconds
- Antenna height above ground level
- Height of antenna site above sea level
- Antenna polarization
- Antenna azimuth
- Directivity in antenna systems
- Effective radiated power
- Service Area
- Date of entry into service and
- Mechanical and electrical antenna tilt."

This data format is clearly considering radio system based mainly on cellular coverage.

Regarding the data exchange format, E-mail and CD/DVD are the preferred ones.

3.7 Analysis of the tools and databases used in the region

The use of ITU tools varies among countries. Some have been using TerRaSys; WISFAT and the BRIFIC for registration and consultation while some have never used these tools. 60 % of the countries use digital terrain data, using the same type of geographical projection and, in most cases, morphological data with terrain resolutions between 50x50 meters to 100x100 meters close to borders.

70 % of the countries make use of commercially available spectrum management software to assist in the frequency assignment and resolution of interference processes

50 % of the countries are reported to have monitoring and radiolocation equipment although it is quite possible that some countries do have that type of tools but did not indicate it on their responses.

In general the use of paper maps is rare but the scales more frequently used in that type of maps are 1: 250 000 and 1:50 000.

Regarding propagation methods used during the interference analysis process, different countries were using different models for the same service. Two countries, Malawi and Zambia were not using, at least for now, any method for the theoretical calculations of interferences.

Table 5 shows the most common propagation models used

Radio spectrum/Service	Propagation model	Remarks
VHF/UHF Land Mobile service	ITU-R P370	
VHF/UHF Land Mobile Service	ITU-R P1546	Used as well for VHF/UHF broadcasting
2G and 3 G cellular services (LMS)	Okumura Hata	
VHF/UHF Broadcasting	ITU-R P 526	Also used for 900/1800 MHz GSM
MW links	ITU-R P452	

Table 5: Most common propagation models used in Southern Africa

4 Observations

It is important to remark that the SADC, as a member of the HIPSSA Project steering committee and CRASA have been very cooperative towards the project, especially CRASA that provided many documents related directly or indirectly to frequency coordination across borders.

Since the correctness of some responses obtained could be debatable it is considered that the answers should be re-checked at the next phase, ideally in face-to-face meetings with the officials that are directly involved with interference and coordination.

5 Regional conclusions and recommendations

The survey has been quite successful in general even if some responses are not complete; the global outcome makes a lot of sense.

The entities responsible for international frequency coordination in each country have been clearly identified

Practically all the band plans from the different countries and even the regional plan were obtained.

The two coordination agreements in the region (MoU between AFS and LSO and the CRASA MoU) were obtained and analysed.

It was found that in the region there is really no comprehensive coordination framework that is to say containing administrative procedures and technical considerations.

In general the level of interference experienced by countries in Southern Africa does not seem to be high. That could be the reason why there are no proper procedures in place to address the resolution of interference.

Some examples of successful and unsuccessful approaches to handle coordination or interference cases were obtained although the actual information and the number of examples do not really impact in the implementation of HCM4A. However some do's and don't can be extrapolated from the interferences and coordination experiences.

With the exception of Angola, all the remaining countries have indicated their cross-border frequency coordination requirements. Possibly this is one of the most important responses since in a certain way it constitutes the heart of the specifications for the HCM4A.

The responses showed that the majority of the countries do not have a coordination register nor make use of pre-defined frequency/channels category. Nevertheless, the CRASA MoU divides the bands under consideration into preferred and not preferred assignments.

Practically no country has different data formats for the exchange of relevant information, neither for the different bands or radiocommunication services. In addition the majority have responded that they prefer Internet (email), and CD/DVD as the means to exchange coordination information.

Most of the countries are reasonably equipped to handle interference and frequency coordination cases, although the actual capability of the tools varies from very basic to sophisticated.

Although the process for coordination and resolution of interference exist in the different ITU broadcasting agreements, it has been found that many countries report interference or spillover cases between them. Many countries consequently have been requesting that the HCM4A include broadcasting. Therefore, it is advisable that ITU considers investigating the reasons why interferences or spillover are occurring, and the possible way to sort it out may be including Broadcasting in the HCM4A.

In some cases it has not been possible to obtain all the information required, but, in the next phases based on the outcome of this survey it should be possible to confirm or enhance some of the responses.

All the relevant work carried out by SADC/CRASA was obtained. Therefore, it is recommended that HIPSSA thoroughly analyze the work already undertaken by SADC/CRASA in the region along cross-border coordination. Consequently, taking into account the relevant measures already taken by CRASA on frequency coordination across borders, it is advisable that to achieve an effective cooperation at regional level for the design of the HCM4A, HIPSSA should enter into discussions with those entities. This will facilitate the introduction and spread of HCM4A in Southern Africa.

The SADC proposed to the regional expert to add to the current process, an additional step where the results of this survey are analysed together by the 15 SADC members, before the implementation of the HMC4A.

SA Annex 9 presents a comparative table where it is possible to see the similarities and differences between the responses provided by the 10 countries involved in this survey.

In conclusion and as a consequence of the survey it should be clear that not much will be necessary to modify the HCM2008 to adapt it to Southern Africa if broadcasting it is not taken into account in this project.

It is considered therefore highly recommendable to establish the HCM4A. This will be beneficial for the countries with advanced tools and experienced staff, but at the same time will rise the know how of those countries short of staff and capabilities.

6 Annexes

6.1 Regional Table of Frequency Allocations

SA Annex 1: SADC/CRASA Regional Frequency Allocation Plan (May 2010)

6.2 Regional cross-border frequency coordination agreements

SA Annex 2: Memorandum of Understanding (MoU) on Coordination on Telecommunications and Broadcasting Services between Regulator A and Regulator B. (Model MoU issued by CRASA to be used by their members when required)

SA Annex 3: Term of Reference for the MoU Joint Oversight Committee

6.3 Relevant Regional Documents

SA Annex 4: CRASA Wireless Technologies Policy and Regulations

SA Annex 5: Harmonized radio frequency channeling arrangements for terrestrial fixed and mobile systems in SADC (March 2011)

Annex 6: CRASA GSM Spillover Engineering Practice and Principles

SA Annex 7: SADC Framework for harmonization of frequencies for Public Protection and Disaster Relief (PPDR) [Draft copy}

SA Annex 8: Framework for the harmonisation of frequencies for Short-Range Devices (SRDs) in SADC

SA Annex 9: Southern Africa comparative table

7 References and bibliography

Information about Southern Africa

Some text extracted from

- www.en.wikipedia.org/wiki/Southern_Africa
- www.britannica.com/EBchecked/topic/556618/Southern-Africa

Economical information

Data extracted from:

- List of countries by GDP (nominal) per capita from Wikipedia: www.en.wikipedia.org/wiki/List_of_countries_by_GDP_(nominal)_per_capita
- Real Growth rate:http//www.indexmundi.com
- Inflation rate: http://www.tradingeconomics.com

Relevant Regional Telecommunication Organisations

- www.sadc.int/
- www.crasa.org/index.php
- www.sata-sec.net/home.php

Regional broadcasting organisations information extracted from

- www.sadiba.org
- www.fesmedia.org/african-media-news/detail/datum/2010/10/01/southern-africa-aochamub-takes-charge-of-saba

Part 2

Part 2:
National Reports

Part 2

Republic of Angola

Part 2

COUNTRY PROFILE

Angola is a country in South-Central Africa that has a population of nearly 18, 5 million (2009), and has a total land area of 1,246, 700- square kilometres.

The country consists of a sparsely watered and somewhat sterile coastal plain extending inland for a distance varying from 48 to 160 km; slightly inland and parallel to the coast is a belt of hills and mountains and behind those a large plateau.

Angola is bordered by Namibia on the South, the Democratic Republic of Congo on the North, and Zambia on the East; its West coast is on the Atlantic Ocean with Luanda as its capital city, which lies in the Northwest of the country. Angola has the province of Cabinda which is an exclave bordering with Congo (Brazzaville) and the Democratic Republic of Congo.

Figure 2: Republic of Angola

Map Extracted from: www.lonelyplanet.com

Angola macro-economic statistics are as follows:

GDP per capita=U$S4478 (IMF2010) World position 91 (4th in Southern Africa)

Real Growth Rate=5.9 % (est.2010)

Inflation=15.04 % (Average 2010)

Portuguese is the official language of the country; the indigenous languages with the largest usage are Umbundu, Kimbundu and Kikongo, in that order.

Regarding regional organisations Angola as part of the African Union is member of the African Telecommunications Union. On the other hand Angola is member of: the Southern Africa Development Community (SADC)- the regional economic organisation, the Communications Regulators' Association of Southern Africa (CRASA), and the Southern Africa Telecommunication Association (SATA)-the regional operators association.

The telecommunication sector in Angola is quite important and as in many other countries the government has been promoting competition. Privatization of the state run telecommunications company is on the cards.

Angola counts three (3) fixed-line network operators: ANGOLA TELECOM, which is a public company, MERCURY TELECOM (MSTELCOM) owned by Sonagol, the national oil company, and in 2009 granted a licence to a new operator MUNDO STARTEL.

Similarly, Angola has two (2) Mobile operators: UNITEL a private company where the main owners are TELEFONICA from Spain and PORTUGAL TELECOM. The second operator is Angola Telecom's MOVICEL.

Regarding the broadcasting environment there is a public broadcaster: The Public Angolan Television (Television Publica de Angola) with two national channels TPA1 and TPA2. Radio Nacional de Angola is the public radio broadcaster with a national coverage provided by 61 FM stations, 23 AM stations and 10 shortwave stations.

Internet is developing rapidly, especially with the landing of a new international fiber system during 2011. There are a number of ISP's but coverage does not reach the total national territory. The fixed operators are the main providers of internet services.

1 Angola Spectrum Management Framework

The "Instituto Angolano das Comunicações" (INACOM) (Angolan Institute for Communications), the regulatory authority, is responsible for the planning, management and control of spectrum utilization for all the radiocommunication services within the national territory.

INACOM represents the country at international spectrum management fora.

1.1 Legislative basis

INACOM is responsible for radio frequency management in terms of the Decree 115/08 of 7 October 2008.

1.2 National Table of Frequency Allocations

The Angolan "Plano Nacional de Frequencias", (the Angolan National Frequency Plan) is quite a comprehensive document, see **AGL *Annex 9***. It presents basic spectrum management concepts, fundamental principles of spectrum planning as well as a quick reference charts covering certain popular bands from 29. 7 to 960 MHz.

The Plan itself only addresses the allocations applicable to Angola as per ITU Radio Regulations applicable to Region 1. It also indicates the actual applications used in the country and some relevant notes.

Unfortunately the Angolan Frequency Plan is out-dated since it was issued in 2001. It only considers the outcome of WRC 2000, missing all the modifications to the Radio Regulations carried out during WRC 2003 and 2007. In addition it does not consider the SADC Regional Band Plan approved in Luanda in 2010.

In general the Angola FAP has a very close correlation with the ITU Table of frequency allocations although it has some minor deviations.

Table 6 indicates fundamental spectrum allocations differences between the SADC FAP; ITU Region 1 FAP and Angola FAP within 80-20 000 MHz. Not all allocations are recorded.

Bands (MHz)	ITU Region 1	Regional Plan (SADC)	Angola Table of Allocations	Applicable footnote to Angola
138-144	AERONAUTICAL MOBILE (OR)	MOBILE	AERONAUTICAL MOBILE (OR)	
230-238	FIXED/MOBILE	BROADCASTING	FIXED/MOBILE	
238-246	FIXED/MOBILE	MOBILE	FIXED/MOBILE	
246-254	FIXED/MOBILE	BROADCASTING	FIXED/MOBILE	
470-790	BROADCASTING	BROADCASTING RADIOASTRONOMY	BROADCASTING	
3400-3600	Mobile	MOBILE except aeronautical mobile	Mobile	
5150-5350	Not FIXED	Wireless Access Systems	Wireless Access Systems	
5470-5850	Not FIXED	Wireless Access Systems	Wireless Access Systems	
17 100-17 300	Not FIXED	Wireless Access Systems	Wireless Access Systems	

Table 6: Different spectrum allocations between the SADC FAP ; ITU Region 1 and AGL FAP within 80-20 000 MHz.

Note: The only differences with ITU Plan are at 5150-5350; 5470-5850 MHz and 17.1-17.3 GHz since SADC considered these bands for the delivery of wireless access at the regional level.

2 Cross Border Frequency Coordination

Angola does not have any formal coordination agreement with its neighbouring countries. However, Angola has carried out some frequency coordination at least in the broadcasting arena.

It is worth mentioning that Angola sent a coordination request to Congo Brazzaville in February 2010, to coordinate the frequencies for new FM and TV VHF band III and UHF band V using the border line concept. In the request maximum acceptable values of field strength at the boundary lines between Angola and Congo were established considering a testing antenna 10 meters above the ground. This case is visualized in **AGL Annex 3**, a typical case of usage of cross-border coordination based on a triggering level.

2.1 Responsibility for cross-border frequency coordination

The international frequency coordination for all the radiocommunication services is the responsibility of INACOM.

2.2 Cross Border Frequency Coordination Framework

Angola does not have a framework for cross-border frequency coordination.

2.3 Bilateral / Multilateral agreement

As stated in 2, Angola does not have any cross-border frequency coordination agreement with its neighbours. However, Angola has carried out frequency coordination with two neighbouring countries: the Democratic Republic of Congo and Congo Brazzaville.

In 2010, cross-border frequency coordination at Cabinda province with Congo Brazzaville was conducted. In the request, Angola proposed coordination criteria based on ITU-R Recommendation BS-412 for FM and BT-655 and GE89 for TV, from which the minimum usable field strength and the protection values, were defined. Similarly, a determined fade margin within the acceptable interference level based on RR 1.168 and ITU-R Recommendation P-1546 was proposed. See attached **AGL *Annex 3***. Congo responded to such request accepting all the FM frequencies except one of the TV channels which was used by them, so another frequency was suggested as an alternative. As it can be seen the coordination however was limited to checking frequency overlaps. See **AGL *Annex* 4**

A similar approach was held with the Democratic Republic of Congo in 2008; see **AGL *Annexes 5; 6 and 7.***

The minutes of a meeting to establish an agreement between the Democratic Republic of Congo and Angola for broadcasting frequency coordination indicates among other things details regarding the exchange of data for coordination. In the proposed solution reference is made to preferential frequencies as well as the harmonization of plans. The minutes also indicate the relevant technical provisions to be met regarding the proposed solution, as well as the propagation model to be used. Finally, the general terms of the proposed agreement are detailed in the recommendations. See **AGL *Annex 8.***

From the documents provided by INACOM, the province of Cabinda, due to is peculiar geographical situation, is from time to time of concern for them, from the interference point of view.

2.4 Interference problems and cross-border frequency coordination experiences

Angola is affected by interference, but, INACOM does not have a procedure in place to handle cross-border interference.

The countries that cause interference are the Democratic Republic of Congo and Congo Brazzaville. The service most affected is the FM sound broadcasting.

No examples of actual successful approaches to handle coordination or interference cases were provided by INACOM, but stated that coordination took two days. INACOM considers that the direct confrontation of the frequencies of the stations between two countries in the border area and its compliance with ITU's plans are the possible causes of unsuccessful coordination or resolution of interference cases.

INACOM does not have a coordination register and they stated that they do not have pre-defined co-ordination category (preferential, shared, etc). Despite this, INACOM has been making use of preferential frequencies in previous coordinations as indicated in **2.3**.

2.5 Coordination agreements required

No information was provided by INACOM regarding their coordination requirements.

2.6 Data Exchange Format

INACOM does not have different data formats for the exchange of information. With regard to data exchange format for the exchange of coordination information INACOM prefer CD, DVD, Internet (e-mail, ftp, etc).

2.7 Tools and database used

Regarding ITU tools for coordination or registration INACOM stated that they use various ITU forms.

It is not possible to assess how well equipped this country is for handling coordination and interference resolutions with the information provided by them. It is assumed that considering the example of coordination presented in 2.3 at least they should have basic equipment to assess signal levels such as spectrum analyzers.

INACOM, judging from their answers to the questionnaire neither have monitoring/radiolocation tools, nor spectrum management software. They do not use digital maps or paper maps and don't have something relevant to comment regarding propagation models.

It seems that INACOM make uses of very basic procedures to resolve interference or coordination using possibly the following steps:

- Assessment of the level of interference signal as well as its frequency by means of spectrum analyzer.
- Determination of the direction of the interference source.
- Identification of the interference source if it is coming from inside the country or external to the country.

Once identified the interferer country and if the level of the signal or the radiation diagram, or the antenna direction, or the antenna height of the interferer or the interfered cannot be changed, they may opt to request a change of frequency from the neighbouring country or they by themselves decide to change their own frequency to avoid interference

3 Observations

INACOM has been cooperative; however there were considerable communication difficulties due to the language and the fact that all the communications were done via the Head of Department of the International Relations who in turn passed the information to the spectrum management staff. No telephone conversation was possible due to difficulties in understanding the Portuguese spoken. INACOM was the country that took longest to respond to the HIPSSA questionnaire.

To facilitate the communication the questionnaire in English was translated to Portuguese and when received back, it was responded in Portuguese. Afterwards the answers to the questionnaire in Portuguese were translated back into English and sent back for acceptance by INACOM which sent them back without amendments.

Given the quality of many of the responses it is considered that the answers should be re-checked at the next phase, ideally in face to face meetings with the officials that are directly involved with interference and coordination.

INACOM did not provide any information regarding their current frequency register database format.

Note that TADIRAN on their website mentions that Angola has the IRIS spectrum management and monitoring system.

4 Conclusions and recommendations

To judge from the answers the capabilities of Angola to properly handle technical resolution of interferences and frequency coordination is not clear. However in the broadcasting arena the technical staff seems to be knowledgeable of the problems of coordination/interference. Proof of this is in the annexes where coordinations were carried out with Congo Brazzaville and the Democratic Republic of Congo considering suitable technical provisions.

INACOM seems to be concerned with broadcasting, but it looks like they have been able to cope up to now with the broadcasting coordinations. The need for coordination for other services may not have been visualized.

Angola is in a very unique situation due to the long war that they suffered which destroyed most of their telecommunications infrastructure. On the other hand and in order to create a new and modern infrastructure government is promoting competition and liberalization. That already should considerably increase the amount of spectrum required to satisfy the proper national coverage with mobile and fixed services. Without any doubt this will create interference situations not only internally but also from neighbouring countries.

To implement HCM4A based on the HCM 2008 will not be difficult, at least for Angola, since not much need to be changed to implement the new software tool. INACOM does not have coordination agreements across borders. They also do not have a framework for coordination nor a register of coordinations. Angola needs to be convinced of the convenience of HCM4A when carrying out possible coordination or interference resolution cases, since these will be abundant if Angola really takes off to communicate with its people.

Something interesting is that although the process for coordination and resolution of interference exists in the different ITU Broadcasting agreements, it is advisable that ITU investigates the reasons why interferences are occurring. INACOM seems to apply the coordination process properly following ITU recommendations but even so, they are actually experiencing frequency overlaps.

Regarding the protection requirements it is recommended to make use of the ones used in the European HCM or the ones addressed in ITU-R Recommendations.

It is recommended that HIPSSA analyzes well the work already undertaken by SADC/CRASA in the region on cross-border coordination. Consequently, taking into account the relevant measures already taken by CRASA on frequency coordination across borders, it is advisable that to achieve an effective cooperation at regional level for the design of the HCM4A, HIPSSA should enter into discussions with those entities. This will facilitate the introduction and spread of HCM4A in Southern Africa.

5 Contacts

5.1 Focal Point

	INACOM
Name	Mr. Octávio Domingos Machado
Rank '/Position	Spectrum Management Staff
Email address	octmach2@yahoo.com.br
Office telephone	+ 244 923605024
Alternative telephone	+ 244 222338352

5.2 Additional Contacts

	INACOM
Name	Dr. Kumba Kianvu
Rank/Position	Head of Department of the International Relations
Email address	kumbakia@yahoo.com
Mobile telephone	+244 91 221 4853

6 Annexes

6.1 Responses to Questionnaire

AGL Annex 1: Final response from Angola

6.2 Cross Border Frequency Coordination Agreements

AGL Annex 2: 2010 Coordination Congo Brazzaville-Angola

AGL Annex 3: 2010 Coordination Congo Brazzaville-Angola. Response from Congo:

AGL Annex 4: 2008 coordination DRC-Angola Part 1:

AGL Annex 5 : 2008 coordination DRC-Angola Part 2:

AGL Annex 6: 2008 coordination DRC-Angola Annex :

AGL Annex 7: 2008 coordination DRC-Angola. Minute of meeting DRC-AGL:

6.3 National Table of Frequency Allocations

AGL Annex 8: Angolan National Frequency Plan

6.4 National Complementary Documents

None

7 References and Bibliography

Angola information:

Some text extracted from:

- www.en.wikipedia.org/wiki/Angola
- www.en.wikipedia.org/wiki/Geography_of_Angola
- www.angolatelecom.com/AngolaTelecom/EN/at/quemSomos.htm
- www.internetworldstats.com/af/ao.htm
- www.goafrica.co.za/africa/angola.stm
- www.rna.ao/exploracao_da_rede.htm
- www.rna.ao/empresa.cgi
- www.budde.com.au/Research/Angola-Telecoms-Mobile-Broadband-and-Forecasts.html?r=51

Economical information

Data extracted from:

- List of countries by GDP (nominal) per capita from Wikipedia: www.en.wikipedia.org/wiki/List_of_countries_by_GDP_(nominal)_per_capita
- Real Growth rate: www.indexmundi.com/angola/gdp_real_growth_rate.html
- Inflation rate: http: www.tradingeconomics.com/angola/indicators

Angolan Institute for Communications Information

- www.inacom.og.ao

Part 2

Republic of Botswana

Part 2

COUNTRY PROFILE

Botswana is a country located in Southern Africa, that has a population of 2 million (2010 estimate) and has a total land area of nearly 600,000 square kilometers.

Geographically the country is flat and up to 70% of Botswana is covered by the Kalahari Desert. It is bordered by South Africa to the south and southeast, Namibia to the west and north, and Zimbabwe to the northeast. It meets Zambia at a single point.

Figure 3: Republic of Botswana

Map extracted from http://www.infoplease.com/atlas/country/botswana.html

Botswana's macro-economic statistics are as follows:

GDP per capita=U$S7627 (IMF2010) World position 67 (1st in Southern Africa)

Real Growth Rate=3.1% (est.2010)

Inflation=6.09% (Average 2010)

The official language of Botswana is English although Setswana is widely spoken across the country.

Regarding regional organisations Botswana as part of the African Union, is member of the African Telecommunications Union. On the other hand Botswana is member of: the Southern Africa Development Community (SADC), the regional economic organisation; the Communications Regulators' Association of Southern Africa (CRASA), and the Southern Africa Telecommunication Association (SATA)- the regional operators association. Both SADC and CRASA have their offices in Gaborone, the capital of Botswana.

Botswana has a quite advanced telecommunications network for the size of the country.

Botswana has a government-owned national and international telecommunication service provider, Botswana Telecommunication Corporation (BTC). BTC also owns one of the three mobile cellular systems "be Mobile". The other two cellular providers are: MASCOM linked to MTN South Africa, and ORANGE BOTSWANA, the latest member of the Orange group of mobile companies.

Regarding the TV broadcasting environment there is a public broadcaster: Botswana Television, and there is also a private national station Gaborone Broadcasting Corporation linked to e-TV from South Africa. Privately-owned satellite TV subscription service is available from Multichoice Botswana.

The country also has two state-owned national radio stations and three privately-owned radio stations that broadcast locally.

Botswana has 10 licensed Internet Service Providers (ISPs) providing a complete range of services to customers.

1 Botswana Spectrum Management Framework

The Botswana Telecommunications Authority (BTA) which falls under Botswana's Ministry of Transport and Communications is responsible for the radio frequency spectrum management in the country for all radiocommunication services.

BTA represents the Republic in International fora, including the ITU, in the International communications arena and on communications issues.

1.1 Legislative basis

BTA is responsible for radio frequency management in terms of section 43 of the Telecommunications Act of 1996.

1.2 National Table of Frequency Allocations

The Table of frequency allocations of Botswana considers the band plan for the future and present use of the radio spectrum between 9 KHz and 105 GHz. A private company developed the plan in April 2008. The information has been updated to take account of the outcome of WRC-07. See **BOT Annex 2.**

The Botswana National Frequency Plan is a comprehensive document that not only presents the allocations in Botswana and the ITU Region 1, but also indicates the main applications of the bands.

In general the table has a great correlation with the ITU Table of frequency allocations although it has some deviations

Table 7 indicates fundamental spectrum allocations differences, between the SADC FAP; ITU Region 1 FAP and Botswana FAP within 80-20 000 MHz.

Bands (MHz)	ITU Region 1	Regional Plan (SADC)	BOTSWANA FREQUENCY PLAN	Applicable ITU footnote
138-144	AERONAUTICAL MOBILE (OR)	MOBILE	Fixed/MOBILE	5.212
156.4875-156.5625	MARITIME MOBILE	MARITIME MOBILE	Fixed/MOBILE (NIB+NPB)	5.227
156.7625-156.8375	MARITIME MOBILE	MARITIME MOBILE	Fixed/MOBILE	
230-238 and 246-254	FIXED/MOBILE	BROADCASTING	BROADCASTING	5.252
3400-3600	Mobile	MOBILE except aeronautical mobile	MOBILE except aeronautical mobile	5.430A
5150-5350	Not FIXED	Wireless Access Systems	Wireless Access Systems	
5470-5850	Not FIXED	Wireless Access Systems	Wireless Access Systems	
17 100-17 300	Not FIXED	Wireless Access Systems	Wireless Access Systems	

Table 7: Different spectrum allocations between the SADC FAP ; ITU Region 1 and BOT FAP within 80-20 000 MHz.

2 Cross Border Frequency Coordination

Botswana does not have coordination agreements with any of the neighbouring countries. Therefore they are not making use of a coordination triggering level for frequency coordination across borders. However, Botswana would prefer the borderline to be the triggering point for coordination.

2.1 Responsibility for cross-border frequency coordination

The international frequency coordination for all the radiocommunication services is the responsibility of the Botswana Telecommunications Authority.

2.2 Cross Border Frequency Coordination Framework

Botswana does not have a framework for cross-border frequency coordination, when possible, ITU Radio Regulations are used.

2.3 Bilateral / Multilateral agreement

Botswana does not have any cross-border frequency coordination agreement as pointed out in paragraph 2.

However, via South Africa, it was possible to obtain documentation used during a process of FM broadcasting coordination that took place in 2007.

The situation was that BTA was in the process of developing a broadcasting frequency plan. During the planning process it was realised that some of the sites in the Geneva 1984 Agreement were far away from the targeted area for coverage, so the stations had to be relocated and in some areas BTA needed additional frequencies.

Furthermore the BTA engineering analysis results indicated some interference between some of BTA stations and some of the stations in the South Africa FM broadcasting frequency plan.

The document for frequency coordination between BOT and AFS, did a technical analysis based on the ITU R BS 412-9 from where the necessary protection ratios were stated. The most suitable propagation models were suggested by BTA. Similarly the characteristics of the DTM were pointed out, being particularly of interest that the Botswana DTM covers the whole of Botswana and areas along the border, up to at least 340 km from the border into South Africa. This was something not mentioned in the responses obtained which is an important point for cross-border coordination. The documents further analyze several radio paths, showing the spillover of one country into the other and vice versa.

During the analysis, the findings showed that many predicted problems were due to incorrect use of the antenna pattern or other crucial parameter. At the end some power reduction, re-calculation of interference analysis with the correct parameters and the use of alternative frequencies solved the problem.

This exercise shows typical frequency coordination across the borders and the type of problems that are usually found. All the relevant information for this case is included in **BOT annexes 3; 4; 5; and 6.**

2.4 Interference problems and cross-border frequency coordination experiences

Botswana is affected by interference, but, BTA does not have a procedure in place to handle cross-border interference.

BTA believes that the submission of technical analysis (field strength, power flux density, etc) showing that levels are within acceptable values leads towards a successful coordination or interference resolution. Generally, coordination takes about a week if all technical parameters requested are available.

A problem that Botswana found refers to the coordination of FM broadcasting frequency plan with South Africa, as presented in 2.3. In accordance to BTA, the problem was failure to respond to a coordination request or lack of communication by South Africa within a reasonable time.

Table 8 shows recent cases of frequency interferences and the periodicity of its occurrence with which these problems are experienced. Botswana mainly is affected by interference coming from South Africa and Zimbabwe on land mobile service.

Band (MHz)	Radiocommunication service	Interferer neighboring country	Quantity of interference cases per year
146-174	Land Mobile	South Africa	5
146-174	Land Mobile	Zimbabwe	3
450-470	Land Mobile	South Africa	3
450-470	Land Mobile	Zimbabwe	2

Table 8: Recent cases of frequency interferences and the periodicity of its occurrence .

Similarly **Table 9** shows some coordination carried out with some neighbouring countries and the amount of coordinations carried out per year.

Band (MHz)	Radiocommunication service	Neighboring country/ies coordinated	Quantity of coordinations per year
146-174	Land Mobile	South Africa	4
146-174	Land Mobile	Zimbabwe	2
450-470	Land Mobile	South Africa	2
450-470	Land Mobile	Zimbabwe	1

Table 9: Recent cases of frequency coordination and the quantity of coordinations per year .

Botswana does not have a frequency register for storing the co-ordination results nor does it have pre-defined co-ordination frequency categories such as preferential, shared, etc.

2.5 Coordination agreements required

Table 10 shows the different agreements that in accordance to Botswana are required. Please note that the priorities are indicated in the table.

Band (MHz)	Radiocommunication service	Interferer neighboring country	Quantity of interference cases per year	Priority: Low; Medium; High; Top
146-174	Land Mobile	South Africa	5	Medium
146-174	Land Mobile	Zimbabwe	3	Medium
450-470	Land Mobile	South Africa	3	Medium
450-470	Land Mobile	Zimbabwe	2	Medium

Table 10 Coordination agreements required.

From the table it can be concluded that Botswana is concerned mainly with VHF and UHF land mobile service with exactly the same as the priority.

2.6 Data Exchange Format

Botswana does not have different data formats for the exchange of information. BTA prefers any electronic means such as internet, CD/DVD, but not paper means for the exchange of coordination information.

2.7 Tools and database used

Regarding terrestrial radiocommunication services BOT uses TERRASYS; WISFAT; BRIFIC for registration purposes, in accordance with ITU radio regulations (Article 11) and regional agreements.

Frequency coordination is carried out as per ITU (i.e. Radio Regulations; Regional Agreements and related ITU software).

The following are the tools reported by BTA.

- **Spectrum Management Software:**
  - "ICS Telecom" software tool for engineering analysis and interference resolution, the tool was purchased from ATDI, a French company
- **Monitoring and radiolocation systems**
  - Nothing was reported but it is estimated that LCA has a monitoring system since the division in LCA is called Spectrum Management and Monitoring
- **Digital terrain maps**
  - Using Morphological data with terrain height and including heights of buildings, trees, etc.
  - Using WGS84 geographical projection system
  - Using a 100x100 meters resolution close to borders
- **Maps on paper**
  - Using, 1: 250 000.
- **Propagation models, Table 11** in next page shows the different ones used

Band (MHz)	Radiocommunication service	Propagation Models
146-174	Land Mobile	ITU-R P370
450-470 MHz	Land Mobile	ITU-R P370
GSM 900	Mobile	ITU-R P525
GSM 1800	Mobile	ITU-R P525
3G	Mobile	Okumura-Hata
2570-2600	Mobile	Okumura-Hata
Broadcasting Bands	Broadcasting	As stipulated in the varies regional agreements

Table 11 Propagation models used by BTA..

3 Observations

The Botswana Telecommunications Authority has been cooperative towards this project. However, it is considered convenient that the answers should be re-checked at the next phase, ideally in face to face meetings with the officials who are directly involved with interference and coordination.

Note that the response obtained with regard to the current frequency register database format was very vague, limiting to state some fields such as: station name, location (lat/long), frequency, antenna type, antenna height, antenna radiation pattern, antenna gain, transmitter eirp, etc. Also note that fields vary according to type of service. In other words the reply does not contain anything peculiar to be taken into consideration.

Note that certain documentation relevant to an FM cross-border coordination between Botswana and South Africa was provided by ICASA South Africa.

4 Conclusions and recommendations

In general BTA gives the impression of being well qualified to deal with coordination and to resolve interference cases, particularly taking into account the FM coordination carried out with South Africa.

Botswana does not have coordination agreements across borders, and does not appear to be currently suffering much interference or carrying out much coordination. They also do not have a framework for coordination, nor a register of coordinations. Land mobile seems to be their main concern. However, with a vision towards the future the HCM4A might be very beneficial due to the mobile telecommunications revolution all over Africa, specially having a neighbour like South Africa.

To implement HCM4A based on the HCM 2008, will not be that difficult, at least for Botswana, since there is not much to be changed to implement the new software tool.

Something that it is interesting to note is that although the process for coordination and resolution of interference exists in the different ITU broadcasting agreements, it is advisable that ITU investigates the reasons why interferences are occurring. May be they are just spillover from one country into the other due to the geographical characteristics of the terrain. Something similar happened in Europe, where surely solutions have been found by now. In the case of Botswana, for example, some of the sites in the Geneva 1984 Agreement are far away from the targeted area for coverage.

Regarding the protection requirements it is recommended to make use of the ones used in the European HCM2008 or the ones addressed in ITU-R Recommendations.

It is recommended that HIPSSA analyzes very well the work already undertaken by SADC/CRASA in the region on cross-border coordination. Consequently, taking into account the relevant measures already taken by CRASA on frequency coordination across borders, it is advisable that to achieve an effective cooperation at regional level for the design of the HCM4A, HIPSSA should enter into discussions with those entities. This will facilitate the introduction and spread of HCM4A in Southern Africa.

5 Contacts

5.1 Focal Point

The country has not defined officially a focal point; however the person providing information mentioned that he will be the focal point for Botswana:

	Botswana Telecommunication Authority
Name	Mr.Thapelo Maruping
Rank/Position	BTA Engineering Services
Email address	maruping@bta.org.bw
Office telephone	+2673957755
Mobile telephone	+26772301101
Fax line	+2673957976

5.2 Additional Contacts

	Botswana Telecommunication Authority	Botswana Telecommunication Authority
Name	Mr Tshocanetso Kepaletswe	Mr. Luke Bathopi
Rank/Position	Senior Manager Radio	BTA Engineering Services
Email address	kepaletswe@bta.org.bw	bathopil@bta.org.bw
Office telephone	+267 3957755	+267 3957755
Mobile telephone	+2673685542	+26771751523
Fax line	+267 3957976	

6 Annexes

6.1 Responses to Questionnaire

BOT Annex 1: Final response from Botswana

6.2 Cross Border Frequency Coordination Agreements

None

6.3 National Table of Frequency Allocations

BOT Annex 2: Botswana National Frequency Plan

6.4 National Complementary Documents

BOT Annex 3: AFS coordination letter proposed FM Plan 1

BOT Annex 4: Annex A document for coordination with RSA

BOT Annex 5: Annex B Botswana proposed FM plan

BOT Annex 6: AFS response: Botswana coordination

7 References and Bibliography

Botswana information:

Some text extracted from: www.en.wikipedia.org/wiki/Botswana

Economical information

Data extracted from:

- List of countries by GDP (nominal) per capita from Wikipedia: www.en.wikipedia.org/wiki/List_of_countries_by_GDP_(nominal)_per_capita
- Real Growth rate: www.indexmundi.com/botswana/gdp_real_growth_rate.html
- Inflation rate: www.tradingeconomics.com/botswana/indicators

Botswana Telecommunications Authority Information

- www.en.wikipedia.org/wiki/Botswana_Telecommunications_Authority
- www.bta.org.bw/

Part 2

Kingdom of Lesotho

Part 2

COUNTRY PROFILE

Lesotho, mainly a mountainous country, is the southernmost landlocked country in the world, surrounded entirely by the Republic of South Africa. It is just over 30,000 square kilometres in size with a population of approximately 2,067,000 (2009 estimate). Due to its mountainous characteristics many villages can only be accessed by horseback.

Figure 4: Kingdom of Lesotho

Map Extracted from **www.wordtravels.com/Travelguide/Countries/Lesotho/Map**

Lesotho macro-economic statistics are as follows:

GDP per capita=U$S837 (IMF2010) World position 150

Real Growth Rate=3, 5% (est.2010)

Inflation=5.9% (Average 2010)

The main language, Sesotho (or Sotho), is also the first official and administrative language, and it is what the Basotho (a Bantu-speaking people) speak on an ordinary basis. English is the other official and administrative language.

Regarding regional organizations Lesotho as part of the African Union, is member of the African Telecommunications Union. On the other hand Lesotho is member of: the Southern Africa Development Community (SADC), the regional economic organization, the Communications Regulators' Association of Southern Africa (CRASA), and the Southern Africa Telecommunication Association (SATA), the regional operators association.

Lesotho telecommunications are modern and technologically advanced.

The fixed service telecommunications in Lesotho is provided by ECONET TELECOM LESOTHO (TCL), a semi-private organization where government owns 30% of the shareholding.

ECONET Ezi Cel LESOTHO and VODACOM LESOTHO (VCL Communications) provides mobile phone services in Lesotho.

BETHLEHEM TECHNOLOGIES is an organization that operates a satellite Earth Station as an international gateway and provides internet and broadcasting carrier services.

Regarding the broadcasting environment there is one state-owned TV station (Lesotho TV) and one private TV Station, Trinity Broadcasting Network Lesotho. Satellite TV subscription service is available.

It has two state-owned radio stations, and several private stations.

There are also several internet service providers.

1 Lesotho Spectrum Management Framework

The Lesotho Communications Authority (LCA) is responsible for the radio frequency spectrum management in the country for all the radiocommunication services.

1.1 Legislative basis

LCA is responsible for radio frequency management at national and international level in terms of part IX section 51 of the Lesotho Telecommunications Act No. 5 of 2000.

1.2 National Table of Frequency Allocations

The Lesotho National Frequency Allocations Plan is a comprehensive document that not only presents the allocations in Lesotho, the SADC and the ITU Region 1, but also indicates Lesotho's sub allocations when applicable. See **LSO Annex 3**

Based on the provisions of the ITU Radio Regulations the table covers from 9 KHz to 100 GHz including the decisions of World Radio Conferences up to 2007.

The Lesotho National Frequency Allocation Plan is intended to respond to Lesotho domestic spectrum requirements.

The major differences with the allocations in ITU Region 1 are captured under Lesotho footnotes, which detail all the ITU footnotes where Lesotho name appears. The other difference is in the Maritime bands between 4 to 27 MHz whereby some of the bands are reserved in Lesotho. The allocation plan also includes the SADC regional footnotes and the ITU footnotes.

Table 12 indicates fundamental spectrum allocations differences, between the SADC FAP; ITU Region 1 FAP and Lesotho FAP within 80-20 000 MHz. Not all allocations are recorded.

Bands (MHz)	ITU Region 1	Regional Plan (SADC)	Lesotho Plan	Applicable footnote
138-144	AERONAUTICAL MOBILE (OR)	MOBILE	FIXED/MOBILE	ITU 5.212
156.4875-156.5625	MARITIME MOBILE	MARITIME MOBILE	MARITIME MOBILE	RESERVED
156.7625-156.8375	MARITIME MOBILE	MARITIME MOBILE	MARITIME MOBILE	RESERVED
230-238 and 246-254	FIXED/MOBILE	BROADCASTING	BROADCASTING	ITU 5.252
410-430	FIXED MOBILE except aeronautical mobile	MOBILE except aeronautical mobile	FIXED MOBILE except aeronautical mobile AMATEUR	SADC11
430-432	AMATEUR RADIOLOCATION	AMATEUR RADIOLOCATION	FIXED MOBILE except aeronautical mobile AMATEUR RADIOLOCATION	SADC11
470-790	BROADCASTING	BROADCASTING RADIOASTRONOMY	BROADCASTING	
3400-3600	Mobile	MOBILE except aeronautical mobile	MOBILE except aeronautical mobile	ITU 5.430A
5150-5350	Not FIXED	Wireless Access Systems (WAS)	Wireless Access Systems	
5470-5725	Not FIXED	WAS	WAS	
17 100-17 300	Not FIXED	WAS	WAS	

Table 12: Different spectrum allocations between the SADC FAP ; ITU Region 1 and LSO FAP within 80-20 000 MHz.

2 Cross Border Frequency Coordination

Although Lesotho has a MoU with its neighbour, the cross-border frequency coordination agreement is not actually based on a coordination triggering level. The MoU however, addresses monitoring predicted received signal level without stipulating the threshold value or the point where such measurement takes place. The agreement actually presents mainly an administrative framework without many technicalities. In this regard Lesotho indicated that it would prefer the borderline to be the triggering point for coordination.

2.1 Responsibility for cross-border frequency coordination

The international frequency coordination for all the radiocommunication services is the responsibility of the Lesotho Communications Authority.

2.2 Cross Border Frequency Coordination Framework

Lesotho does not have a framework for cross-border frequency coordination. However it has formalized a cross-border coordination agreement with its neighbour, which establishes an administrative coordination framework for cellular spillover (mainly for GSM services) between neighbours.

2.3 Bilateral / Multilateral agreement

Lesotho has signed a MoU with South Africa on frequency coordination on telecommunications and broadcasting services. See **LSO *Annex 2.***

Based on an approach similar to ITU Resolutions the purpose of the MoU is that both parties promote the co-operation in the regulation of telecommunications and broadcasting on the basis of equality and mutual benefit in accordance with their respective national legislations and the ITU framework.

The MoU signed in 2002 between the parties, addresses with emphasis cross-border spillover of public land mobile systems, wireless local loop/fixed wireless access systems and other radiocommunication systems; in other words radiocommunication systems that base their coverage on a cellular approach.

In a very general way the MoU establishes a kind of procedure to facilitate the process of spillover coordination.

Among the key issues addressed are:

- The creation of a radio frequency spectrum co-ordination zone along and overlapping both sides of the borders;
- The prediction of spillover into the co-ordination zone with acceptable planning techniques, and the acceptance thereof, in advance of operations commencing, including the calculation of signal strength levels at agreed points;
- The subdivision of the frequency band into preferred and not preferred assignments within the co-ordination zone;
- Monitoring strength levels at agreed points that trigger the steps to be followed, mainly based on a reasonable engineering plan that will resolve the issue in an acceptable way for both parties.

From the points presented above, the MoU is practically based on an administrative approach, since it does not detail how to determine the coordination zone, it refers to acceptable planning techniques without setting the technical conditions for its acceptability and even the calculation methodology is not addressed.

Actually the MoU provides fundamentally a framework to carry out coordination between the parties, which will need to agree on the technicalities every time that frequency coordination is carried out. Without any doubt, it is a first approach to solve the spillover problems between countries and it has been shown to be a very good aid.

The agreement also considers the creation of a joint forum for cross-border coordination involving all the possible stakeholders that maybe affected in both countries by the spillover. The primary purpose of the forum is to proactively pre-empt the possibility of the commercial impact of spillover coverage and frequency interference, by means of rules and procedures in such circumstances. This forum is responsible for the creation of such rules particularly on radio planning and implementation. Also the other important role of the forum is to assist in the resolution of complaints within an environment of cooperative participation.

The data format for the exchange of relevant information during the process of coordination is clearly stated, even establishing the process to follow after receiving that type of information.

Broadcasting is addressed at a very high level, fundamentally considering broadcasting signal distribution activities which may require coordination.

Among other issues the MoU touches roaming, interconnections, and no-man land services.

Finally the parties agree to establish a joint oversight committee in which operators, manufacturers and service providers may participate together with administrators. This is fundamentally to monitor the modus operandi of the memorandum and see its possible amendments or additions.

2.4 Interference problems and cross-border frequency coordination experiences

Lesotho experiences interference with AFS at times; unfortunately there is no documented procedure on how to handle interference cases.

The only interference reported by the Lesotho Communications Authority occurred in 2007 and was coming from South Africa in the Land Mobile Service within the band 136-174 MHz band.

No examples of actual successful or unsuccessful approaches to handle coordination or interference cases were reported by LCA. The Lesotho Regulator gets assistance from ICASA in difficult cases of coordination or interferences. Lesotho has never experienced any problems regarding coordination, at times it may take longer than usual, especially if the relevant officers are not on duty.

Table 13 shows some coordination carried out with South Africa and the amount of coordinations carried out per year

Band (MHz)	Radiocommunication service	Qty of coordinations per year
136 – 174 MHz	Land mobile	5 to 10
140 – 141 MHz	Alarms	2 to 5
87.5 – 108MHz	Sound Broadcasting	1 to 3
8GHz & 15GHz	Fixed links	10 to 15

Table 13 : Recent cases of frequency coordination with AFS and the quantity of coordinations per year.

Lesotho does not have a frequency register for storing the co-ordination results nor does it have pre-defined coordination frequency categories such as preferential, shared, etc. However in the MoU with South Africa the concept of subdivision of the frequency band into preferred and not-preferred assignments within the co-ordination zone is used.

2.5 Coordination agreements required

Table 14 shows the different agreements that in accordance to the Lesotho Communication Authority are required. Please note that the priorities are indicated in the table.

Band (MHz)	Radiocommunication service	Interferer neighboring country	Priority: Low; Medium; High; Top
136 – 174 MHz	Land mobile	AFS	High
140 – 141 MHz	Alarms	AFS	Medium
87.5 – 108MHz	Sound Broadcasting	AFS	Top
470 – 860 MHz	TV Broadcasting	AFS	Top
3400 – 3600 MHz	FWA	AFS	High
8GHz & 15GHz	Fixed	AFS	High

Table 14 Coordination agreements required.

From the table it can be concluded that Lesotho considers as the most important frequency coordination agreements those concerning VHF Sound Broadcasting and UHF TV with South Africa.

2.6 Data Exchange Format

Lesotho does not have different data formats for the exchange of information. The only data exchange format used is the one stated in the MoU with South Africa.

LCA prefers email for the exchange of coordination information

2.7 Tools and database used

Regarding ITU tools WISFAT is used for frequency registration. This country is basically equipped to resolve interference problems. For frequency coordination LCA get assistance from ICASA in South Africa

The following are the tools reported by LCA.

- **Spectrum Management Software:**
  - "Spectra-EMC" software tool for interference resolution, the tool was purchased from "LS Telecom".
- **Monitoring and radiolocation systems**
  - Not reported
- **Test equipment**
  - Nothing was reported but it is estimated that LCA has a monitoring system since the division in LCA is called Spectrum Management and Monitoring
- **Digital terrain maps**
  - Using morphological data with terrain height and including heights of buildings, trees, etc.
  - Using WGS84 geographical projection system
  - Using a 50x50 meters resolution close to borders
- **Maps on paper**
  - Using, 1: 250 000.
- **Propagation models, Table 15** below shows the different ones used

Band (MHz)	Radiocommunication service	Propagation Models
30MHz – 3GHz	land mobile	ITU-P1546
30MHz – 1GHz	land mobile	ITU-P370
800MHz – 70GHz	Fixed microwave	ITU-P452
150MHz – 1.5GHz	land mobile	Okumura Hata model 1

Table 15 Propagation models used by LCA.

3 Observations

The Lesotho Communications Authority has been very cooperative towards this project. However it is considered that the answers should be re-checked at the next phase, ideally in face to face meetings with the officials that are directly involved with interference and coordination.

Note that LCA has provided a list with the fields/parameters used in Lesotho's frequency register database and it is included in **LSO Annex 4.** Similarly it has provided a list indicating bands for broadband wireless access, which is also included in **LSO Annex 5**.

4 Conclusions and recommendations

In general Lesotho does not seem to be well equipped to carry out coordination across borders and to resolve interference. As a result it resorts to South Africa for assistance when necessary.

The fact that Lesotho has a coordination agreement should make it easier to implement the HCM4A. However, due to the completeness of the HMC4A, considerable attention will be required when introducing new coordination concepts, with special emphasis on technicalities that are not considered in the current agreement. The framework on coordination provided in the agreement with South Africa should be considered in the HCM4A development.

Something interesting is that although the process for coordination and resolution of interference exist in the different ITU Broadcasting agreements, it is advisable that ITU investigate the reasons why interferences are occurring. Proof of this is the fact that LCA considers it top priority to have coordination agreement in VHF and UHF Broadcasting.

Lesotho is in a unique situation since it has only one neighbour, unfortunately one very active in wireless communications and a considerable increase in radio activity in the future can be expected from AFS. In principle, Lesotho will not benefit as much by HCM4A as those countries with many neighbours. However LCA does not count with much technical capacity nor have a lot of tools to handle interference or coordination. Therefore, from the point of view of the level of resources that they have currently, the Kingdom of Lesotho will be much benefitted with the software tool and the protocols to be put in place accordingly.

Regarding the protection requirements it is recommended to make use of the ones used in the European HCM2008 or the ones addressed in ITU-R Recommendations.

It is recommended that HIPSSA analyzes very well the work already undertaken by SADC/CRASA in the region on cross-border coordination. Consequently, taking into account the relevant measures already taken by CRASA on frequency coordination across borders, it is advisable that to achieve an effective cooperation at regional level for the design of the HCM4A, HIPSSA should enter into discussions with those entities. This will facilitate the introduction and spread of HCM4A in Southern Africa.

5 Contacts

5.1 Focal Point

	Lesotho Communications Authority
Name	Mr. Makhabane Mohale
Rank/Position	Engineer Spectrum Management and Monitorin
Email address	mmohale@lca.org.ls
Office telephone	+266 2222 4300
Mobile telephone	+266 5886 7584
Fax line	+266 2231 0984

5.2 Additional Contacts

	Lesotho Communications Authority
Name	Mr. Goolam Nizam
Rank/Position	Manager Frequency Management
Email address	ngoolam@lca.org.ls
Office telephone	+266 2222 4300
Mobile telephone	+266 5958 2449
Fax line	+ 266 22 31 0984

6 Annexes

6.1 Responses to Questionnaire

LSO Annex 1: Final response from Lesotho

6.2 Cross Border Frequency Coordination Agreements

LSO Annex 2: MoU Lesotho-South Africa on coordination on telecommunications and radiocommunication services

6.3 National Table of Frequency Allocations

LSO Annex 3: Lesotho National Frequency Allocations Plan

6.4 National Complementary Documents

LSO Annex 4: Fields, indicating fields used for spectrum management

LSO Annex 5: Bands for Broadband Wireless Access

7 References and Bibliography

Lesotho information:

Some text extracted from:

- www.en.wikipedia.org/wiki/Lesotho
- www.en.wikipedia.org/wiki/Telecommunications_in_Lesotho

Economical information

Data extracted from:

- List of countries by GDP (nominal) per capita from Wikipedia: www.en.wikipedia.org/wiki/List_of_countries_by_GDP_(nominal)_per_capita
- Real Growth rate: www.indexmundi.com/lesotho/gdp_real_growth_rate.html
- Inflation rate: www.tradingeconomics.com/lesotho/inflation-average-imf-data.html

Lesotho Communications Authority Information

- www.lca.org.ls

Part 2

Republic of Malawi

Part 2

COUNTRY PROFILE

The Republic of Malawi is a landlocked country in Southeast Africa. It is bordered by Zambia to the Northwest, Tanzania to the Northeast, and Mozambique on the East, South and West. The country is separated from Tanzania and Mozambique by Lake Malawi. Its size is over 118,000 square kilometres with an estimated population of more than 13,900,000.

Malawi is among the world's least developed countries. The economy is heavily based in agriculture, with a largely rural population.

Figure 5: Republic of Malawi

Map extracted from Google images: www.vivianmau.wordpress.com

Malawi macro-economic statistics are as follows:

GDP per capita=U$S322 (IMF2010) World position 180

Real Growth Rate=6.5% (est.2010)

Inflation=8.36% (Average 2010)

Several African languages are spoken in Malawi, where there are two official languages: Chichewa and English.

Regarding regional organisations, Malawi as part of the African Union, is member of the African Telecommunications Union. On the other hand Malawi is member of: the Southern Africa Development Community (SADC)- the regional economic organisation, the Communications Regulators' Association of Southern Africa (CRASA), and the Southern Africa Telecommunication Association (SATA)- the regional operators association.

The telecommunication sector in Malawi is very much in the development process towards a state of the art network. To promote such development: Malawi has embarked in a process of promoting competition in the telecommunication market.

The country counts two fixed telecommunications operators, MALAWI TELECOMMUNICATIONS LIMITED, owned 20% by the government and 80% by Telecoms Holding Ltd., which is a consortium of several investment companies plus Detecon of Germany as the management partner. The privatization of the former fully government-owned operator was concluded in February 2006.The second fixed network operator is ACCESS COMMUNICATIONS LIMITED, which has been in operation since January 2010. In addition the government is committed to introduce a converged licensing regime, which will allow the two fixed-line operators to enter the mobile market as well, and it is expected to boost competition.

Currently Malawi has two cellular operators: BHARTI AIRTEL (formerly Zain) and TELECOM NETWORKS MALAWI. A third cellular operator has been licensed in 2008 but up to now is not in operation.

Regarding the broadcasting environment there is a public broadcaster: The MALAWI BROADCASTING CORPORATION (MBC), which has a national radio network comprising stations in AM, FM and shortwave. There are also private radio stations and community radio stations.

Television Malawi is the public TV broadcaster 100% owned and run by the government. The station transmits its signal throughout the country via satellite.

The internet sector is reasonably competitive with several licensed ISPs, but the limited availability and high cost of international bandwidth has held back growth and kept broadband prices high.

1 Malawi Spectrum Management Framework

The Malawi Communications Regulatory Authority (MACRA), an independent Government body, is responsible for the national and international spectrum management for all the radiocommunication services.

1.1 Legislative basis

Under the Communications Act (1998), MACRA is charged with the responsibility of spectrum planning, creating new allocations, fulfilling frequency planning coordination and assignments, issuing licenses, regulating and administering the use of radio frequencies, and the monitoring and enforcement procedures. It is further responsible for establishing regulations, frequency fee structure, technical parameters and standards governing the use of each band, ensuring that current international regulations are met.

2.1 National Table of Frequency Allocations

The Malawi National Frequency Allocation Plan (MNFAP) covers the radio frequency spectrum from 9 KHz to 100 GHz. See **MWI Annex 3.**The MNFAP has evolved from the SADC Regional Frequency Allocation Plan revised in 2010.

The purpose of the Plan is to create a framework for the effective utilisation of the radio-frequency spectrum in relation to regional (SADC) and international (ITU Region 1) trends.

The Malawi National Frequency Allocation Plan is a comprehensive and updated document that not only presents the allocations in Malawi and the ITU Region 1, but also indicates the main applications of the bands.

In general the table has a great correlation with the ITU Table of frequency allocations although it has some deviations.

Table 16 indicates fundamental spectrum allocations differences, between the SADC FAP; ITU Region 1 FAP and Malawi FAP within 80 -20 000 MHz. Not all allocations are recorded.

Bands (MHz)	ITU Region 1	Regional Plan (SADC)	MNFAP	Applicable footnote
138-144	AERONAUTICAL MOBILE (OR)	MOBILE	FIXED/MOBILE	ITU5.212
230-238 and 246-254	FIXED/MOBILE	BROADCASTING	BROADCASTING	ITU 5.252
470-582	BROADCASTING	BROADCASTING RADIOASTRONOMY	Fixed	ITU 5.294
470-790	BROADCASTING	BROADCASTING RADIOASTRONOMY	BROADCASTING RADIOASTRONOMY	SADC12:606-614 MHz RADIOASTRONOMY
3400-3600	Mobile	MOBILE except aeronautical mobile	MOBILE except aeronautical mobile	ITU 5.430A
5150-5350	Not FIXED	Wireless Access Systems (WAS)	Wireless Access Systems	
5470-5850	Not FIXED	WAS	WAS	
13.4-13.75	Not FIXED	No FIXED	FIXED Point-to-point links	
17 100-17 300	Not FIXED	WAS	WAS	

Table 16: Different spectrum allocations between the SADC FAP ; ITU Region 1 and MWI FAP within 80-20 000 MHz.

2 Cross Border Frequency Coordination

Malawi does not have cross-border frequency coordination agreements with any of the neighboring countries. Therefore they are not making use of coordination triggering levels for frequency coordination across borders.

2.1 Responsibility for cross-border frequency coordination

The international frequency coordination for all the radiocommunication services is the responsibility of the Malawi Communications Regulatory Authority. A review of MACRA Regulatory activities is included in **MWI Annex 9**.

2.2 Cross Border Frequency Coordination Framework

Malawi does not have a framework (administrative procedures and technical provisions) for cross-border frequency coordination

2.3 Bilateral / Multilateral agreement

Malawi does not have any cross-border frequency coordination agreements; however MACRA has already a draft MoU with Mozambique which is based on the CRASA MoU for frequency coordination across borders in Southern Africa. This MoU is not analyzed in this section because it is based on a template worked out by CRASA; consequently it will be addressed in the regional report. See **MWI Annex 2.**

2.4 Interference problems and cross-border frequency coordination experiences

Malawi sometimes is affected by interference from outside Malawi, but there is no mechanism to handle such interference yet.

Malawi has one interference case in the year with the land mobile service from Mozambique within the 140-174 MHz.

MACRA has carried out less than 5 coordinations per year with Mozambique in the land mobile service operating in 140-174 MHz. Malawi also does coordination with Mozambique on GSM (900 MHz) and Broadcasting frequencies (FM,VHF and UHF TV). Also less than 5 coordinations per year have been taking place.

Malawi does not have a frequency register for storing the co-ordination results nor does it have pre-defined co-ordination frequency categories such as preferential, shared, etc.

2.5 Coordination agreements required

Table 17 in next page shows the different agreements that in accordance to MACRA are required. Please note that the priorities are indicated in the table.

Band (MHz)	Radiocommunication service	Interferer	Priority: Low; Medium: High top
87.5 - 108	Sound Broadcasting	Mozambique, Zambia, Tanzania	Medium
140-174	Land Mobile	Mozambique	Low
174-230	TV Broadcasting	Mozambique, Zambia, Tanzania	Medium
246-254	TV Broadcasting	Mozambique, Zambia, Tanzania	Medium
470 – 854	TV Broadcasting	Mozambique, Zambia, Tanzania	Medium
GSM (900 band)	Mobile cellular	Mozambique, Zambia, Tanzania	Medium

Table 17 Coordination agreements required

The biggest concern for MACRA is carrying out frequency coordination to avoid interference especially from Mozambique, which geographically half surrounds Malawi

2.6 Data Exchange Format

Malawi does not have different data formats for the exchange of information. MACRA prefers any electronic means such as internet, CD/DVD for the exchange of coordination information

2.7 Tools and database used

No ITU tools have been used by Malawi for registration or consultation; and MACRA does not use digital terrain data; or the use of propagation models for the estimation of interference levels. In case of interference they measure signal levels with a spectrum analyzer.

This country is basically equipped to resolve interference problems as well as frequency coordination.

- **Monitoring and radiolocation systems**
  - MACRA continually monitors the usage of the spectrum through the Frequency Management & Monitoring (FM&M) equipment that has remote monitoring stations distributed within the country.
- **Test equipment**
  - Spectrum analysers
- **Maps on paper**
  - Using, 1:250 000 scale map, but MACRA rarely use maps.

3 Observations

MACRA has been very cooperative towards this project. However it is considered that the answers should be re-checked at the next phase, ideally in face to face meetings with the people that are directly involved with interference and coordination.

Note that MACRA has provided several files with the fields/parameters used in Malawi's frequency register database that should be considered confidential and they are included in the **MWI Annexes 4; 5; 6; 7** and **8.**

4 Conclusions and recommendations

In general MACRA, which is responsible for spectrum management in Malawi, seems to have relatively basic capabilities to carry out coordination across borders and to resolve interference. However, the campaign to increase competition of Government, will force MACRA to be better equipped. Mozambique represents the greatest interference threat due to the geographical shape of Mozambique and Malawi. Proof of that is the fact that they are in the verge of formalizing a MoU with Mozambique.

Malawi does not have coordination agreements across borders and currently is not suffering much interference or carrying out much coordination. They also do not have a framework for coordination nor a register of coordinations. Land mobile, GSM 900 MHz band and the broadcasting bands seems to be their main concern, particularly towards Mozambique. However, with a vision towards the future, the HCM4A might be very beneficial due to the mobile telecommunications revolution all over Africa.

To implement HCM4A based on the HCM 2008 will not be difficult, at least for Malawi, since not much need to be changed to implement the new software tool.

Something that is interesting is that although the process for coordination and resolution of interference exist in the different ITU Broadcasting agreements, it is advisable that ITU investigate the reasons why interferences are occurring. Proof of this is the fact that MACRA considers a coordination agreement in VHF and UHF Broadcasting of their highest priority (MEDIUM).

Regarding the protection requirements it is recommended to make use of the ones used in the European HCM2008 or the ones addressed in ITU-R Recommendations.

It is recommended that HIPSSA analyzes very well the work already undertaken by SADC/CRASA in the region on cross-border coordination. Consequently, taking into account the relevant measures already taken by CRASA on frequency coordination across borders, it is advisable that to achieve an effective cooperation at regional level for the design of the HCM4A, HIPSSA should enter into discussions with those entities. This will facilitate the introduction and spread of HCM4A in Southern Africa.

5 Contacts

5.1 Focal Point

The person providing information communicated to the regional expert that he will be the focal point

	MACRA
Name	Mr. Jonathan Pinifolo
Rank/Position	Spectrum Planning Manager (Acting Deputy Director Spectrum management.
Email address 1	jpinifolo@macra.org.mw
Email address 2	jonathanpinifolo@yahoo.com
Office telephone	+265 187 8708
Mobile telephone	+265999 940 907
Fax line	+265 1883 611

5.2 Additional Contacts

	MACRA	MACRA
Name	Mr. Stan Chimgoga	Mr. Derek Konwani
Rank/Position	Spectrum Planning Officer	
Email address	chimgoga@macra.org.mw	dkondwani@macra.org.mw
Office telephone	+2651877912	+2651877912
Mobile telephone	+265881286573	+265999463721.
Fax line	+265 1883 611	+265 1883 611

6 Annexes

6.1 Responses to Questionnaire

MWI Annex 1: Final response from Malawi

6.2 Cross Border Frequency Coordination Agreements

MWI Annex 2: Draft MoU Malawi-Mozambique on coordination on telecommunications and radiocommunication services

6.3 National Table of Frequency Allocations

MWI Annex 3: Malawi National Frequency Allocations Plan

6.4 National Complementary Documents

MWI Annex 4: Malawi Frequency Assignment Register.

MWI Annex 5: Malawi FM Band Plan

MWI Annex 6: Malawi GSM band Register

MWI Annex 7: GSM band register fields

MWI Annex 8: Radio Links register fields

MWI Annex 9: Regulatory Report of MACRA presented to the CRASA 11th AGM 2008

7 References and Bibliography

Malawi information:

Some text extracted from:

Some text extracted from:

- www.en.wikipedia.org/wiki/Malawi
- www.malawi-invest.net/business_opp_costs_cell.html
- www.en.wikipedia.org/wiki/Telecommunications_in_Malawi
- www.sdnp.org.mw/communications/providers/index.html
- www.budde.com.au/Research/Malawi-Telecoms-Mobile-Broadband-and-Forecasts.html
- Regulatory Report of MACRA presented to the CRASA 11th AGM. 2008

Economical information

Data extracted from:

- List of countries by GDP (nominal) per capita from Wikipedia: www.en.wikipedia.org/wiki/List_of_countries_by_GDP_(nominal)_per_capita
- Real Growth rate:www.indexmundi.com/Malawi/gdp_real_growth_rate.html
- Inflation rate: www.tradingeconomics.com/Malawi/inflation-cpi

Malawi Communications Regulatory Authority Information

- www.macra.org.mw

Part 2

Republic of Mozambique

Part 2

COUNTRY PROFILE

Mozambique (*Moçambique* in Portuguese) is a country in South-Eastern Africa that has a population slightly greater than 22 million (2010 estimate) and has a total land area of nearly 800,000 square kilometers.

Mozambique is bordered by the Indian Ocean to the East, Tanzania to the North, Malawi and Zambia to the Northwest, Zimbabwe to the West and Swaziland and South Africa to the Southwest.

Figure 6: Republique of Mozambique

Map Extracted from: www.dugongmozambique.com

Mozambique macro-economic statistics are as follows:

GDP per capita (nominal) =U$S458 (IMF2010) World position 172

Real Growth Rate=8.3% (est.2010

Inflation=9.29% (Average 2010)

Several African languages are spoken in Mozambique where Portuguese is the official language.

Regarding regional organisations Mozambique as part of the African Union, is member of the African Telecommunications Union. On the other hand Mozambique is also a member of: the Southern Africa Development Community (SADC), the regional economic organisation, the Communications Regulators' Association of Southern Africa (CRASA), and the Southern Africa Telecommunication Association (SATA) the regional operators association.

The telecommunications infrastructure is expanding rapidly in Mozambique. It is currently one of the few countries that have allocated 5% of its GDP for the telecommunications sector. However, there is a high disparity of telecommunications access between the urban and the rural areas of Mozambique.

The country counts one fixed-line network operator MOZAMBIQUE TELECOMMUNICATIONS (In Portuguese Telecomunicações de Moçambique (TDM)).TDM is an independent state-owned firm responsible for the provision of public telecommunications services. More fixed network operators licences are on the cards.

Mozambique has two (2) GSM operators (VODACOM part of the South African company and mCELL which is owned 74 % by TDM and the rest is owned by Detecon from Germany. A third cellular operating licence has been recently granted to MOVITEL.

There are several internet service providers. Lately with the introduction of two submarine cables the population has access to cheaper international connectivity and it is expected that the penetration will increase considerably. Recently FORIS TELECOM, a mobile broadband Internet and applications service provider has successfully launched its 4G network in Mozambique.

Regarding the TV broadcasting environment there is a public broadcaster: "*Televisao de Moçambique* (TVM)" and four additional privately owned TV channels. It has as well many AM and FM stations and quite a few shortwave stations.

1 Mozambique Spectrum Management Framework

The National Institute for Communications from Mozambique (In Portuguese *Instituto National das Comunicaçôes de Moçambique {INCM}),* is responsible for the radio frequency spectrum management in the country for all the radiocommunication services except the radio frequency spectrum in use by the forces of defence and security. This part of the radio spectrum is managed by the Defence Ministry and Ministry of Internal affairs (Police and Military entities.) INCM is an autonomous entity, which falls under Mozambique Ministry of Transport and Communications.

The broadcasting spectrum is managed by the Frequency coordination and Information Office for Contents of INCM.

INCM represents the Republic in International fora, including the ITU, in the International communications arena and on communications issues

1.1 Legislative basis

INCM responsibility for radio frequency management of Mozambique is granted in terms of article 4 and article 9 section 3d of the Decree No. 32 of 2001

1.2 National Table of Frequency Allocations

The National Plan of Frequency Allocations (In Portuguese *Plano Nacional de Atribuição de Frequências*) (PNAF) is a relatively simple document. It presents the ITU Region 1 allocations and the applications but does not indicate the actual allocations for Mozambique. In fact, it provides the different applications in MOZ against the different ITU allocations bands. Based on the provisions of the ITU Radio Regulations the table covers from 9 KHz to 400 GHz. See **MOZ Annex 2.**

The National Frequency Allocation Plan (PNAF) of the Republic of Mozambique is a document that expresses the sovereignty of the Mozambican state regarding the administration of the radio spectrum used for different radio services in the national territory.

The PNAF aims to present the way on which the radio spectrum is subdivided. It details the planned frequency bands and the radiocommunication services associated with each band along with its national applications, so as to ensure an efficient, cost effective and optimal spectrum. Additionally it attempts to prevent harmful interference between various telecommunications services.

In general the table has a great correlation with the ITU Table of frequency allocations although it has some deviations.

Table 18 indicates fundamental spectrum allocations differences, between the SADC FAP; ITU Region 1 FAP and Mozambique FAP within 80-20 000 MHz.

Bands (MHz)	ITU Region 1	Regional Plan (SADC)	PNAF	Applicable footnote
138-144	AERONAUTICAL MOBILE (OR)	MOBILE	MOBILE	ITU 5.212 But not FS
238-242.95	FIXED/MOBILE	MOBILE	BROADCASTING	Note that PNAF does not complete align with ITU 5.252. . No application in 246-254 MHz
3400-3600	Mobile	MOBILE except aeronautical mobile	MOBILE except aeronautical mobile	ITU 5.430A Band considered for mobile IMT after WRC-07
5150-5350	No FIXED	Wireless Access Systems (WAS)	Wireless Access Systems	Note: SADC harmonised band
5470-5725	No FIXED	WAS	WAS	SADC harmonised band
17 100-17 300	No FIXED	WAS	WAS	ITU 5.212

Table 18: Different spectrum allocations between the SADC FAP ; ITU Region 1 and MOZ FAP within 80-20 000 MHz.

- Note as well that PNAF only detail the applications in the country. Therefore, it is difficult to determine which application has primary or secondary status.
- Note that in PNAF the following bands are reserved: 230-235 MHz; 267-315 MHz and 4400-4500 MHZ
- Note that the following band s are not planned: 335-360MHz; 400.15-401 MHz and 1656.5-1660 MHz

- Note that in several bands there are no details with regard to the application in Mozambique. That for example is the case in the 246-254 MHz band.

2 Cross Border Frequency Coordination

Mozambique does not have cross-border frequency coordination agreements with any of the neighbouring countries as yet. Therefore they are not making use of coordination triggering level at a particular line/point for frequency coordination across borders.

2.1 Responsibility for cross-border frequency coordination

The international frequency coordination for all the radiocommunication services with the exception of the radio frequency spectrum in use by the forces of defence and security, is the responsibility of the National Institute for Communications from Mozambique

2.2 Cross Border Frequency Coordination Framework

INCM does not have cross-border frequency coordination framework. INCM makes use of the ITU Radio Regulations and its recommendations, including its channel arrangements per each frequency band and ITU agreements, such as GE84; GE89; GE06 and others

2.3 Bilateral / Multilateral agreement

Mozambique does not have any cross-border frequency coordination agreement. However they are in negotiation with South Africa and Malawi to sign a MoU based on the CRASA template on cross-border coordination.

2.4 Interference problems and cross-border frequency coordination experiences

Mozambique is affected by interference from neighbouring countries. The mobile services operating in the GSM bands are one of the main victims of neighbour's interference, although it does not occur often. The service that is frequently affected by interference is the FM broadcasting service.

INCM does not have a specific procedure to handle the resolution of interferences across borders, but makes use of the ITU Radio Regulations procedures in line with recommendations for each frequency band

One situation that is worthy of mention happened two years ago, when INCM had a successful approach with South Africa in the resolution of a cross-border interference case in 450 MHz band. This problem was solved amicably.

For a second time, two years ago and again recently INCM had joint meetings, both with the Malawian Communications Regulatory Authority and mobile telephone operators, to discuss issues on spillage in broadcasting and telecom services.

Consequently Mozambique is in negotiations, as pointed out before, with Malawi and South Africa to sing frequency coordination agreements across their borders.

Table 19 below shows some coordination carried out with some neighbouring countries.

Band (MHz)	Radiocommunication service	Neighbouring country/ies coordinated
87.5-108	Sound Broadcasting	Swaziland, South Africa, Malawi
400-470	Land Mobile	Zimbabwe
800-1000	Land Mobile (GSM Band)	South Africa
450-470	Land Mobile	Zimbabwe

Table 19: Recent cases of frequency coordination.

Note that the quantity of coordinations per year was not indicated since the countries meet only when a problem arise.

Mozambique does not have a frequency register for storing the co-ordination results; nor does it have pre-defined co-ordination frequency categories such as preferential, shared, etc.

2.5 Coordination agreements required

Table 20 shows the different agreements that in accordance to Mozambique are required. Please note that the priorities are indicated in the table.

Band (MHz)	Radiocommunication service	Possible Interferer	Priority:((Low; Medium: High top)
87.5-108	Sound Broadcasting	All Neighbours: South Africa Swaziland, Zimbabwe, Zambia, Malawi and Tanzania	High
138-174	Land Mobile	All neighbours	Medium
400-470	Land Mobile	All neighbours	Medium
470-790	Broadcasting	All neighbours	High
790-862	Broadcasting and Mobile	All neighbours	High
IMT (1920-1980 ;2010-2025; 2110-2170; 2 300-2 400; 2 500-2 690 bands), GSM (900 and 1800 bands)	Mobile cellular	All neighbours	High
3400-3600	Fixed and Mobile (IMT)	All neighbours:	High
4-6-7-8-11-13 GHz	Fixed point to point	All neighbours	Medium

Table 20 Coordination agreements required

From the table it can be concluded that Mozambique is concerned with the future expansion of mobile systems and the digital dividend band (790-890 MHz), where broadcasting needs to move out of the band to leave room for new mobile systems.

2.6 Data Exchange Format

Mozambique does not have different data formats for the exchange of information. INCM prefers any electronic mean such as internet, CD/DVD, for the exchange of coordination information

2.7 Tools and database used

Regarding ITU tools MOZ doesn't have registered any frequency with ITU. Nevertheless, INCM have purchased SMS4DC for use and will start notifying the ITU using this tool.

On the other hand INCM is using “ICS Telecom” from ATDI for spectrum management engineering, link budgets calculations and services networks coverage analysis.

This country seems to be fairly well equipped to resolve interference problems as well as frequency coordinations as the list below shows.

- **Spectrum Management Software:**
  - SMS4DC
  - “ICS Telecom”
- **Monitoring and radiolocation systems**
  - Although not reported specifically it was found in the INCM website that the Mozambican regulator has a modern radiomonitoring and radiolocation system (believed to be from Tadiran)
- **Test equipment**
  - Nothing reported but INCM probably have some spectrum analyzers
- **Digital terrain maps**
  - INCM uses digital maps that have elevation data, including buildings, forests, urban and rural
  - INCM did not know which is the geographical projection since INCM stated that the geographical projection systems used by INCM is the one provided by the ATDI map server (quite possibly WGS84)
  - INCM does not know which is the resolution of the map close to its borders
- **Maps on paper**
  - INCM uses 1:250 000 scale maps
- **Propagation models**
  - The propagation model used by INCM for the land mobile service is as per ITU-R Recommendation P-370, except for the GSM bands where the Okumura -Hata method is used.

3 Observations

The National Institute for Communications from Mozambique has been cooperative towards this project. However it is suggested that the answers should be re-checked at the next phase, ideally in face to face meetings with the officials that are directly involved with interference and coordination.

Note that to facilitate the process of obtainment of the responses to the questionnaire it was translated into Portuguese which was initially responded in Portuguese.

Note that INCM did not supply any information regarding its current frequency register database format. (Although it was duly requested)

Note that TADIRAN mention on their website that Mozambique does have the IRIS spectrum management and monitoring system.

4 Conclusions and recommendations

In general Mozambique seems to be fairly well equipped to resolve interference and to carry out coordination across borders.

Mozambique does not have coordination agreements across borders yet and it does not seem to be currently suffering much interference or carrying out much coordination. It also has neither a framework for coordination nor a register of coordinations. However, Mozambique is quite involved in the telecommunications liberalization wave, which implies a much greater use of the spectrum and the need to do cross-border coordination with logical growth. Practically all its neighbours are in a similar situation which implies the importance of implementing HCM4A very soon.

The HMC4A will fit ideally to the country due to the amount of frequency coordinations required across its different borders.

Regarding the protection requirements it is recommended to make use of the ones used in the European HCM or the ones addressed in ITU-R Recommendations.

Something of interest is that although the process for coordination and resolution of interference exists in the different ITU Broadcasting agreements, it is advisable that ITU investigate the reasons as to why interferences occur. In this regard Mozambique requires frequency coordination of broadcasting services with high priority.

It is recommended that HIPSSA analyzes very well the work already undertaken by SADC/CRASA in the region on cross-border coordination. Consequently, taking into account the relevant measures already taken by CRASA on frequency coordination across borders, it is advisable that to achieve an effective cooperation at regional level for the design of the HCM4A, HIPSSA should enter into discussions with those entities. This will facilitate the introduction and spread of HCM4A in Southern Africa.

5 Contacts

5.1 Focal Point

	INCM
Name	Mr. Mr Hilário Tamele
Rank/Position	Director of Technology and Radiocommunication
Email address	htamele@incm.gov.mz
Office telephone	+258 21 490 131/9
Mobile telephone	+258 84398 7359
Fax line	+258 21 494 435

5.2 Additional Contacts

	INCM
Name	Mr. Martins Simao Langa
Rank/Position	Chief of the Spectrum Management Department
Email address	mlanga@incm.gov.moz
Office telephone	+258 21 490 131/9
Mobile telephone	+258 82 459 2220
Fax line	+258 21 494 435

6 Annexes

6.1 Responses to Questionnaire

MOZ Annex 1: Final response from Mozambique

6.2 Cross Border Frequency Coordination Agreement

None

6.3 National Table of Frequency Allocations

MOZ Annex 2: The National Frequency Allocation Plan (PNAF) of Mozambique

6.4 National Complementary Documents

None

7 References and Bibliography

Mozambique information:

Some text extracted from

- www.en.wikipedia.org/wiki/Mozambique
- www.internetworldstats.com/africa.htm
- www.en.wikipedia.org/wiki/Telecomunicações_de_Moçambique
- www.uneca.org/aisi/nici/country_profiles/mozambique/mozaminfra.htm
- www.einnews.com/mozambique/newsfeed-mozambique-telecommunications
- www.cia.gov/library/publications/the-world-factbook/fields/2015.html

Economical information

Data extracted from:

- List of countries by GDP (nominal) per capita from Wikipedia: www.en.wikipedia.org/wiki/List_of_countries_by_GDP_(nominal)_per_capita
- Real Growth rate: www.indexmundi.com/mozambique/gdp_real_growth_rate.html
- Inflation rate: www.tradingeconomics.com/mozambique/indicators

Mozambican Communications Regulatory Authority information: (National Institute for Communications from Mozambique (Instituto National das comunicaçôes de Moçambique {INCM})

- www.incm.gov.mz/

Part 2

Republic of Namibia

Part 2

COUNTRY PROFILE

Namibia is a country in Southern Africa that has a population of 2, 1 millions, with a total land area of slightly more than 825 thousand square kilometres. It is the second least densely populated country in the world.

It shares land borders with Angola and Zambia to the North, Botswana to the East and South Africa to the South and East, while the Western border is the Atlantic Ocean.

Namibia is a large and mainly arid country, having only 1% of the country arable. The name of the country is derived from the Namib Desert, considered to be the oldest desert in the world. The Kalahari dessert is also part of Namibia

Figure 7: Republic of Namibia

Map Extracted from: www.wordtravels.com

Namibia macro-economic statistics are as follows:

GDP per capita=U$S5652 (IMF2010) World position 81 (3rd in Southern Africa)

Real Growth Rate=4.1% (est.2010

Inflation=6.52% (Average 2010)

Several African and European languages are spoken in Namibia where English is the official language.

Regarding regional organizations Namibia as part of the African Union, is member of the African Telecommunications Union. On the other hand Namibia is also a member of: the Southern Africa Development Community (SADC), the regional economic organization, the Communications Regulators' Association of Southern Africa (CRASA), and the Southern Africa Telecommunication Association (SATA) the regional operators association.

Their telecommunications infrastructure is expanding at a rapid rate. The Namibian government is embarked in a process of reforms towards liberalization and promotion of competition within the sector.

There is one government owned fixed-line network operator TELECOM NAMIBIA.

In addition, the country has three (3) mobile operators, MTC with a high shareholding percentage from government, managed by Portugal Telecoms; TELECEL'S LEO owned by Egypt's Orascom Telecom and since March 2010 TELECOM NAMIBIA was also granted a mobile service license.

Despite being reasonably competitive with several ISPs, development of Namibia's Internet and broadband sector has been held back by high prices for international bandwidth. That was caused by the lack of a direct connection to international submarine fibre optic cables. This situation changed in early 2011 when the WACS cable landed in the country. In spite of these developments, broadband price reductions on the retail level have only been moderate so far.

In the broadcasting environment there is a public broadcaster: The NAMIBIAN BROADCASTING CORPORATION (NBC), which has a national radio network comprising many radio stations that broadcast in the different languages spoken in the country. The stations operate in AM; FM and shortwave.

Television broadcasting comprises of one national channel, belonging to the NBC and two additional, privately owned, free-to-air TV channels: -One Africa television commercial and Trinity Broadcasting Network which is a religious station.

1 Namibia Spectrum Management Framework

The Communications Regulatory Authority of Namibia (CRAN), is the official regulator of the Namibian communications, broadcasting and postal services sector and is operational as of 18 May 2011. CRAN has taken over the responsibilities of the radio spectrum management from the Namibian Communications Commission (NCC). As the NCC, CRAN is responsible for the spectrum management of all the radiocommunication services

1.1 Legislative basis

The Communications Act of 2009, Chapter VIII section 99, establishes that the Communications Regulatory Authority of Namibia is vested with the control, planning, administration, management and licensing of the radio spectrum. Similarly as it was NCC, CRAN is responsible for coordination with regional and international telecommunication bodies and regulators.

1.2 National Table of Frequency Allocations

The Draft National Radio Frequency Plan of Namibia covers the radio spectrum between 9 KHz and 105 GHz. The plan was developed by a private company in September 2009. The information has been updated to take account of the outcome ofWRC-07. See **NMB Annex 2.**

The Namibian Draft Radio Frequency Plan is a comprehensive document that not only presents the allocations in Namibia and the ITU Region 1, but also indicates the main applications of the bands.

In general the table has a great correlation with the ITU Table of frequency allocations although it has some deviations with regard to the ITU Region 1 allocations.

Table 21 indicates fundamental spectrum allocations differences, between the SADC FAP; ITU Region 1 FAP and Namibia FAP within 80-20 000 MHz. Not all allocations are recorded.

Bands (MHz)	ITU Region 1	Regional Plan (SADC)	SATFA	Applicable footnote
138-144	AERONAUTICAL MOBILE (OR)	MOBILE	FIXED/MOBILE	ITU 5.212
230-238 and 246-254	FIXED/MOBILE	BROADCASTING	BROADCASTING	ITU 5.252
3400-3600	Mobile	MOBILE except aeronautical mobile	MOBILE except aeronautical mobile	ITU 5.430A
5150-5350	Not FIXED	Wireless Access Systems	Wireless Access Systems	
5470-5725	Not FIXED	Wireless Access Systems	Wireless Access Systems	

Table 21: Different spectrum allocations between the SADC FAP ; ITU Region 1 and NMB FAP within 80-20 000 MHz.

2 Cross Border Frequency Coordination

Namibia does not have cross-border frequency coordination agreements with any of the neighbouring countries as yet. Therefore, they are not making use of coordination triggering level at a particular line/point for frequency coordination across borders.

2.1 Responsibility for cross border frequency coordination

The international frequency coordination for all the radiocommunication services in Namibia is the responsibility of the Communications Regulatory Authority of Namibia, the successor of NCC.

2.2 Cross Border Frequency Coordination Framework

Namibia does not have a framework for cross-border frequency coordination.

2.3 Bilateral / Multilateral agreement

Namibia does not have any coordination agreement with neighbouring countries. However Namibia carries out frequency coordinations across borders whenever any of its neighbors' request it.

2.4 Interference problems and cross-border frequency coordination experiences

NCC (CRAN) does not have a specific procedure to handle the resolution of interferences across borders,

Namibia never had interference from South Africa, Botswana, Zambia, except from Angola on HF Broadcasting bands

Namibia has carried out frequency coordination successfully with South Africa, Botswana and Zambia

Namibia does have the same frequency register for storing the co-ordination results and assignment data but does not have pre-defined co-ordination frequency categories such as preferential, shared, etc.

2.5 Coordination agreements required

There is a high probability in the future to have some interference across the Namibian borders. Some interference from South Africa, Botswana, Angola and Zambia is expected

NCC (CRAN) concern is within the Mobile bands, especially GSM and the IMT bands. Therefore n accordance with the response received frequency coordination agreements are mainly for the GSM and IMT bands with all Namibia's neighbours.

NCC (CRAN) concern is within the commercial cellular Land Mobile bands, especially GSM and the IMT bands. Therefore, in accordance with the response received, frequency coordination agreements with all Namibia's neighbours is required particularly in the bands mentioned.

2.6 Data Exchange Format

NCC (CRAN) does not have different data formats for the exchange of frequency coordination information. Namibia considers Internet as the preferred method for exchange of data,

2.7 Tools and database used

Regarding ITU tools NCC (CRAN) do not have any ITU tool. NCC (CRAN) has not registered Namibian Frequency to ITU, except GE-84, GE-89, and GE-06 Plans.

This country is quite well equipped to resolve interference problems as well as frequency coordinations as the list below shows.

- **Spectrum Management Software:**
  - ATDI "ICS Telecom"
- **Monitoring and radiolocation systems**
  - Spectrum Monitoring System TCI USA Model 715
- **Test equipment**
  - Spectrum Analyzers covering up to 40 GHz.
- **Digital terrain maps**
  - Elevation data is used for all VHF/UHF propagation analysis, this includes field strength calculations and interference calculations..
  - Using WGS84 geographical projection system
  - Using 90m resolution for the terrain data which is from SRTM data set. User can specify the square area to be calculated. The square area is center from the transmitter station. The provided terrain data (3D map) typically covers the whole country and is extended out 100Km into neighbouring countries.
- **Maps on paper**
  - NCC (CRAN) does not use paper maps
- **Propagation models**

- NCC (CRAN) reported that their system comply with ITU recommendations models.

3 Observations

NCC has been cooperative towards this project. However, due to the fact that one person was responsible for the management of spectrum management of the whole country; it was difficult at times to obtain significant answers.

Perhaps the reason for the level of responses obtained is due to the fact that NCC ceased during the time that this survey was carried out. CRAN, a totally new organization, has taken over the NCC functions as from18 May 2011. Thus, it is imperative that the answers should be re-evaluated at the next phase; mainly because the spectrum management approach from NCC not necessarily would be the same as in CRAN. Ideally, it would be convenient to confirm the answers in face to face meetings with CRAN officials that are directly involved with spectrum interference and frequency coordination.

Note as well that all the information obtained through the contact is from NCC which in some cases has been extrapolated to CRAN. That has been indicated as “NCC (CRAN)”

Note that the current frequency register database for the high part of VHF is attached in the **NMB Annex 3.**

4 Conclusions and recommendations

With the quality of response obtained is difficult to arrive at a reliable conclusion. The impression gathered is that Namibia is well equipped to handle frequency coordinations and resolution of interferences.

It seems that interference has not been a big problem in Namibia; mainly coordinations have been carried out when other countries have requested that.

With the birth of CRAN it is expected that greater attention will be given to interference and frequency coordination especially considering that Namibia and the countries surrounding it are embarked in processes of liberalization and promotion of competition. These will unavoidably create many situations where frequency coordination will be crucial. From this point of view HCM4A may provide a service that will be very much appreciated.

Namibia does not have coordination agreements across borders; neither does it seem to be currently affected by much interference or carrying out much coordination. NCC (CRAN) also does not have a framework for coordination. Third and fourth generation cellular mobiles seems to be their main concern. Therefore, to implement HCM4A based on the HCM 2008 it will not be difficult, particularly for Namibia, since there is not much to be considered to be changed to implement the new HIPSSA software tool.

It is recommended that HIPSSA analyzes very well the work already undertaken by SADC/CRASA in the region on cross-border coordination. Consequently, taking into account the relevant measures already taken by CRASA on frequency coordination across borders, it is advisable that to achieve an effective cooperation at regional level for the design of the HCM4A, HIPSSA should enter into discussions with those entities. This will facilitate the introduction and spread of HCM4A in Southern Africa.

5 Contacts

5.1 Focal Point

Due to the fact that CRAN has very recently taken over the functions of NCC, Namibia has not defined as yet the relevant focal point, however the person providing in formation was:

	NCC (CRAN)
Name	Mr. Barthos/Hara-#Gaeb
Rank/Position	Engineering Technician
Email address	Barthos@ncc.org.na
Office telephone	+264 61 222666
Mobile telephone	+264 81 1283567/ +264 855510096
Fax line	+264 61 222790

Mr.Barthos Hara-#Gaeb is no longer at NCC but he works at the ICT ministry. However his contact details are maintained. No one currently at CRAN deals with spectrum management.

5.2 Additional Contacts

	CRAN		TELECOM NAMIBIA
Name	Mr.Stanley Shanapinda	Name	Jan Kruger
Rank/Position	Acting CEO	Rank/Position	Project coordinator
Email address	sshanapinda@cran.na	Email address	krugerj@telecom.na
Office telephone	+264 61 222666	Mobile telephone	+264811272666

6 Annexes

6.1 Responses to Questionnaire

NMB Annex 1: Final response from Namibia in Excel

6.2 Cross Border Frequency Coordination Agreements

None

6.3 National Table of Frequency Allocations

NMB Annex 2: Namibia Draft National Frequency Plan

6.4 National Complementary Documents

NMB Annex 3: VHF High frequencies register.

7 References and Bibliography

Namibia information:

Some text extracted from:

- www.en.wikipedia.org/wiki/Namibia
- www.totel.com.au/namibia-telecommunications-research.asp
- www.budde.com.au/Research/Namibia-Telecoms-Mobile-and-Broadband.html
- www.en.wikipedia.org/wiki/Namibian_Broadcasting_Corporation

Economical information

Data extracted from:

- List of countries by GDP (nominal) per capita from Wikipedia: www.en.wikipedia.org/wiki/List_of_countries_by_GDP_(nominal)_per_capita
- Real Growth rate: www.indexmundi.com/namibia/gdp_real_growth_rate.html
- Inflation rate: www.tradingeconomics.com/namibia/indicators

Namibia Communications Commission (NCC) and the Communication Regulatory Authority of Namibia (CRAN) Information

- www.ncc.org.na ; http://www.cran.na/

Part 2

Republic of South Africa

Part 2

COUNTRY PROFILE

South Africa, which occupies the Southern tip of Africa, has a population of 49, 99 million (Mid 2010 estimate) and has a total land area of slightly more than 1.2-million square kilometres.

On dry land, going from West to East, South Africa shares long borders with Namibia and Botswana, touches Zimbabwe, has a longitudinal strip of border with Mozambique to the East, and lastly curves in around Swaziland before rejoining Mozambique's Southern border.

In the interior, nestled in the curve of the bean-shaped Free State is the small mountainous Kingdom of Lesotho, completely surrounded by South African territory.

Figure 8: Republic of South Africa

Map Extracted from: Afrilux.co.za

South Africa macro-economic statistics are as follows:

GDP per capita=U$S7158 (IMF2010) World position 71 (2nd in Southern Africa)

Real Growth Rate=3% (est.2010

Inflation =5.79% (Average 2010)

There are 11 official languages in South Africa, but English is the dominant language in government and the media.

Regarding regional organizations South Africa as part of the African Union, is member of the African Telecommunications Union. On the other hand South Africa is member of: the Southern Africa Development Community (SADC), the regional economic organization, the Communications Regulators' Association of Southern Africa (CRASA), and the Southern Africa Telecommunication Association (SATA) the regional operators association.

The telecommunication and broadcasting sector in South Africa is very important:

Counts with Two (2) fixed-line network operators (TELKOM SA and NEOTEL). TELKOM is owned partially by the Government and is in the South African Stock Exchange, while NEOTEL is a fully private company. NEOTEL, a newcomer, is particularly making use of wireless to penetrate in the South African houses.

Similarly, South Africa has Five (5) GSM operators (VODACOM, MTN, CELL-C, VIRGIN MOBILE and 8TA) of which four are private; VIRGIN MOBILE is a virtual operator and 8TA belongs to the fixed line operator TELKOM a semi-private organization.

In addition South Africa counts with National Radio Trunking systems, mobile data service providers and several Internet access providers.

Regarding the broadcasting environment there is a public broadcaster: The South African Broadcasting Corporation (SABC), which has a national radio network comprising 18 radio stations.

The SABC also is responsible for CHANNEL AFRICA, an international satellite TV channel, as well as shortwave and Internet Radio station.

The national SABC television network comprises three free-to-air television channels.

The only privately owned free-to-air national TV channel is e-TV.

On the other hand M-NET is a private provider of terrestrial television service by subscription.

There is also a company MULTICHOICE AFRICA (MCA) which offers digital satellite TV broadcasting including HD-TV to the whole of Africa.

There are as well several private radio stations including community radios.

In South Africa, Mobile television is now accessible via 3G streaming (3G) and Digital Video Broadcast Handheld Technology (DVB-H).

Within the broadcasting environment it is important to mention the National Association of Broadcasters (NAB), the voice of South Africa's broadcasting industry. The vision of NAB is to maintain an environment in which South African radio and television broadcasters can thrive-serving audiences and contributing to development and diversity

1 South Africa Spectrum Management Framework

The Minister of Communications acts as a custodian of the spectrum on behalf of the people of South Africa.

In this regard the Minister issues Policies and Policy Directions to promote the rational, economic, efficient and effective usage of the Radio Spectrum.

The Minister represents the Republic in International fora, including the ITU, in respect of the international allocation of radio frequency spectrum usage and the international frequency coordination in accordance with international treaties, multinational and bilateral agreements entered into by the Republic.

The Independent Communications Authority of South Africa (ICASA), the Regulatory entity, control, plan, administers and manages the use and licensing of the radio frequency spectrum. This particularly includes the radio spectrum used for telecommunications, broadcasting, government services, defence services, scientific services, etc. In fulfilment of its function it must issue regulations in line with the Policies and Policy Directions issued by the Minister.

1.1 Legislative basis

The Electronic Communications Act (ECA) of 2005 governs the ICT environment in South Africa. The ultimate responsible for the South African ICT environment is the Minister of Communications who is assisted by the Department of Communications.

The Act particularly legislates that the Minister may make policies on matters of national policy applicable to the ICT sector. On the other hand the Independent Communication Authority of South Africa (ICASA), an independent regulatory body, is mandated to regulate electronic communications (i.e. broadcasting and telecommunications) and postal services.

The same Act legislates that the Minister must manage the international affairs of spectrum management in terms of section 34(1) (b) of the Act. Similarly the Act establishes that ICASA must be responsible for the radio frequency spectrum management at national level in terms of section 33 of the Electronic Communications Act.

1.2 National Table of Frequency Allocations

The South African Table of Frequency Allocations (SATFA) is a comprehensive document that not only presents the allocations in South Africa and the ITU Region 1, but also indicates the main applications of the bands. Based on the provisions of the ITU Radio Regulations SATFA covers from 9 KHz to 3 000 GHz including the decisions of World Radio Conferences up to 2007. See **AFS Annex 3**

SATFA is aimed at current users, potential users and investors in the radiocommunication sector.

In general the table has a great correlation with the ITU Table of frequency allocations although it has some deviations.

Table 22 indicates fundamental spectrum allocations differences, between the SADC FAP; ITU Region 1 FAP and SATFA within 80-20 000 MHz. Not all allocations are recorded.

Bands (MHz)	ITU Region 1	Regional Plan (SADC)	SATFA	Applicable footnote
138-144	AERONAUTICAL MOBILE (OR)	MOBILE	Fixed/MOBILE	ITU 5.212 AFS fs instead of FS
230-238 and 246-254	FIXED/MOBILE	BROADCASTING	BROADCASTING	ITU 5.252
470-790	BROADCASTING	BROADCASTING RADIOASTRONOMY	BROADCASTING RADIOASTRONOMY	SADC12:606-614 MHz RADIOASTRONOMY
3400-3600	Mobile	MOBILE except aeronautical mobile	MOBILE except aeronautical mobile	ITU 5.430A
5150-5350	No FIXED	Wireless Access Systems	Wireless Access Systems	

Bands (MHz)	ITU Region 1	Regional Plan (SADC)	SATFA	Applicable footnote
5470-5725	Not FIXED	Wireless Access Systems	Wireless Access Systems	
17 100-17 300	Not FIXED	Wireless Access Systems	Wireless Access Systems	

Table 22: Different spectrum allocations between the SADC FAP ; ITU Region 1 and AFS FAP within 80-20 000 MHz.

2 Cross Border Frequency Coordination

Although South Africa has a MoU with its neighbour, the cross-border frequency coordination agreement is not actually based on a coordination triggering level. The MoU however, addresses monitoring predicted received signal level without stipulating the threshold value or the point where such measurement takes place.

Nevertheless, a new system is to be implemented soon with a DTM stretching over the border and will be using the ITU R recommendation P 526.This will provide flexibility to implement a point or line as a triggering level for coordination.

2.1 Responsibility for cross-border frequency coordination

The international frequency coordination for all the radiocommunication services is the responsibility of the Minister of Communications. However, the actual cross border frequency coordination process is carried out by ICASA while the Department of Communications , on behalf of the Minister, develop any multilateral or bilateral cross-border frequency coordination agreements, which needs to be approved by the Minister.

2.2 Cross Border Frequency Coordination Framework

South Africa does not have a framework for cross-border frequency coordination. However it has formalized a cross-border coordination agreement with one of its neighbours.

2.3 Bilateral / Multilateral agreement

South Africa has signed a MoU with Lesotho on coordination on telecommunications and broadcasting services. See **AFS Annex 2.**

Based on an approach similar to ITU Resolutions the purpose of the MoU is that both parties promote the co-operation in the regulation of telecommunications and broadcasting on the basis of equality and mutual benefit in accordance with their respective national legislations and the ITU framework.

The MoU signed in 2002 between the parties, addresses with emphasis cross-border spillover of public land mobile systems, wireless local loop/fixed wireless access systems and other radiocommunication systems; in other words radiocommunication systems that base their coverage on a cellular approach.

In a very general way the MoU establishes a kind of procedure to facilitate the process of spillover coordination.

Among the key issues addressed are:

- The creation of a radio frequency spectrum co-ordination zone along and overlapping both sides of the borders;
- The prediction of spillover into the co-ordination zone with acceptable planning techniques, and the acceptance thereof, in advance of operations commencing, including the calculation of signal strength levels at agreed points;
- The subdivision of the frequency band into preferred and not preferred assignments within the co-ordination zone;
- Monitoring strength levels at agreed points that trigger the steps to be followed, mainly based on a reasonable engineering plan that will resolve the issue in an acceptable way for both parties.

From the points presented above, the MoU is practically based on an administrative approach, since it does not detail how to determine the coordination zone, it refers to acceptable planning techniques without setting the technical conditions for its acceptability and even the calculation methodology is not addressed. Actually the MoU provides fundamentally a framework to carry out coordination between the parties, which will need to agree on the technicalities every time that frequency coordination is carried out. Without any doubt, it is a first approach to solve the spillover problems between countries and it has shown to be a very good aid.

The agreement also considers the creation of a joint forum for cross-border coordination involving all the possible stakeholders that maybe affected in both countries by the spillover. The primary purpose of the forum is to proactively pre-empt the possibility of the commercial impact of spillover coverage and frequency interference, by means of rules and procedures in such circumstances. This forum is responsible for the creation of such rules, particularly on radio planning and implementation. Also the other important role of the forum is to assist in the resolution of complaints within an environment of cooperative participation

The data format for the exchange of relevant information during the process of coordination is clearly stated, even establishing the process to follow after receiving that type of information.

Broadcasting is addressed at a very high level fundamentally considering broadcasting signal distribution activities, which may require co-ordination.

Among other issues the MoU touches roaming, interconnections and no-man land services.

Finally the parties agree to establish a joint oversight committee in which operators, manufacturers and service providers may participate together with administrators. This is fundamentally to monitor the modus operandi of the memorandum and see its possible amendments or additions.

2.4 Interference problems and cross-border frequency coordination experiences

South Africa does experience interferences from its neighbours from time to time but there are no proper records available regarding the cases experienced, neither is there a set procedure in place to resolve interference problems.

One situation that it is worth mentioning is an interference case between mobile services with Mozambique in the 450 MHz band which took almost five years to be resolved. Although it was successful at the end, it took longer due to the fact that there are no procedures in place to address the resolution of interference.

This does nothing but reinforce the importance of having good procedures for dealing with cases of interference.

South Africa has carried out on average 5 cross-border coordination with Lesotho, Botswana and Mozambique on FM/TV broadcasting services and land mobile radio in VHF.

South Africa does not have a frequency register for storing the co-ordination results nor does it have pre-defined co-ordination frequency categories such as preferential, shared, etc. However in the MoU with Lesotho it used the concept of subdivision of the frequency band into preferred and not-preferred assignments within the co-ordination zone.

2.5 Coordination agreements required

Table 23 in next page shows the different agreements that in accordance to South Africa are required. Please note that the priorities are indicated in the table.

Band (MHz)	Radiocommunication service	Possible Interferer	Priority: Low; Medium: High top
3400-3600	Fixed and Mobile (IMT)	All neighbors: Botswana; Lesotho; Mozambique; Namibia; Swaziland; Zimbabwe	High
138-174	Land Mobile	All neighbors	High
790-862	Broadcasting and Mobile	All neighbors	High
IMT (1920-1980 ;2010-2025; 2110-2170; 2 300-2 400; 2 500-2 690 bands), **GSM** (900 and 1800 bands)	Mobile cellular	All neighbors	High
450-470	Mobile	All neighbors	Medium
4-6-7-8-11-13 GHz	Fixed point to point	All neighbors	Medium

Table 23 Coordination agreements required.

From the table it can be concluded that South Africa is concerned with the future expansion of mobile systems and the digital dividend band (790-890 MHz), where broadcasting needs to move out of the band to leave room for new mobile systems.

Note that the relevant protection requirements were not obtained.

2.6 Data Exchange Format

South Africa does not have different data formats for the exchange of information. The only data exchange format used is the one stated in the MoU with Lesotho.

2.7 Tools and database used

Regarding ITU tools TerRaSys have been used for notification.

This country is quite well equipped to resolve interference problems as well as frequency coordinations as the list below shows.

- **Spectrum Management Software:**
  - L&S "Chirplus BC"Version 5.4 for broadcasting (TV and FM)
  - L&S "Chirplus Multilink"(Fixed services)
  - L&S "Chirplus LM" (Land mobile services)
- **Monitoring and radiolocation systems**
  - Rhode & Schwarz with Argus operating software
- **Test equipment**
  - HP and Rhode & Schwarz spectrum analysers
  - HP Communication analyser
- **Digital terrain maps**
  - Using Morphological data with terrain height and including heights of buildings, trees, etc.
  - Using WGS84 geographical projection system
  - Using a 100x100 meters resolution close to borders
- **Maps on paper**
  - Using 1: 50 000, 1:250 000, 1:500 000, 1: 1 000 000 scale maps
- **Propagation models Table 24** below shows the different ones used

Service	Bands	Raster	Propagation Model	Method	ITU-R Recom-mendation
Broadcasting (TV)	VHF	100 DTM	VHF/UHF Tunable	Multi-knife Edge	P-526
Broadcasting (TV)	UHF	100 DTM	VHF/UHF Tunable	Multi-knife Edge	P-526
Broadcasting (FM)	VHF	100 DTM	VHF/UHF Tunable	Multi-knife Edge	P-526
Land Mobile (Tetra System)	255-470 MHz	100 DTM	LS "CHIRplus_LM"	Effective heights	P-1546
Fixed (Microwave point-to-point)	Above 1 GHz	100 DTM	LS "CHIRplus_FX"	Combination	P-452

Table 24 Propagation models used by AFS

3 Observations

The South African government and ICASA have been very cooperative towards this project. However it is considered convenient that the answers should be re-checked at the next phase, ideally in face to face meetings with the officials that are directly involved with interference and coordination.

Note that certain documentation relevant to an FM cross-border coordination between Botswana and South Africa is addressed under the Republic of Botswana.

Note as well that the current frequency database formats used in South Africa for some of the different services are included in the **AFS Annexes 4 and 5.**

4 Conclusions and recommendations

In general South Africa is a very well equipped country to carry out coordination across borders and to resolve interference with a good legislative framework. This includes among other things clear and well consolidated spectrum management regulations, some of which could be considered for inclusion in the process of building the HCM4A.In this regard the South African Spectrum Management Regulations are included in the **AFS Annexes 6 and 7.**

It is important to take into consideration that the Department of Communications, on behalf of the Minister of Communications, is dealing with the agreements and ICASA with the day to day frequency coordination.

The fact that South Africa has a coordination agreement should make it much easeir to implement the HCM4A. However, due to the completeness of the HMC4A, considerable attention will be required when introducing new coordination concepts, with special emphasis on technicalities that are not considered in the current agreement. The framework on coordination provided in the agreement with Lesotho should be considered in the HCM4A.

It is unfortunate that South Africa does not have proper record of interference cases. It is known that interferences from neighbouring countries were experienced with certain frequency. In this regard, one of the more common problems has been the fact that the technical data exchanged between the countries was not always complete, which caused considerable delays to carry out coordination or resolve interference. Lack of proper procedures even made the situation worst.

Although the process for coordination and resolution of interference exists in the different ITU Broadcasting agreements, it is advisable that ITU investigate the reasons why interferences are occurring.

Given the considerable amount of coordination across the borders of the different neighbours required by South Africa, the HCM4A will fit ideally to the country.

Regarding the protection requirements it is recommended to make use of the ones used in the European HCM or the ones addressed in ITU-R Recommendations.

It is recommended that HIPSSA analyzes very well the work already undertaken by SADC/CRASA in the region on cross-border coordination. Consequently, taking into account the relevant measures already taken by CRASA on frequency coordination across borders, it is advisable that to achieve an effective cooperation at regional level for the design of the HCM4A, HIPSSA should enter into discussions with those entities. This will facilitate the introduction and spread of HCM4A in Southern Africa.

5 Contacts

5.1 Focal Point

The country has not defined as yet the relevant focal point however the persons providing information were:

	Department of Communications	ICASA
Name	Mr. Linden Petzer	Mr. Richard Makgotlho.
Rank/Position	Chief Director Radio and Satellite	RF Specialist
Email address	linden@doc.gov.za	Makgotlho@icasa.org.za
Office telephone	+27 12 4278000	+27 11 566 3000
Mobile telephone	+27 82 880 4616	+27 72 954 9348
Fax line	+27 12 421 7044	+27 11 566 3281

5.2 Additional Contacts

	Department of Communications	ICASA
Name	Mr. Jim Patterson	Mr. Mandla Mchunu.
Rank/Position	Director Multilateral affairs International Relations	Manager spectrum management
Email address	jim@doc.gov.za	MMchunu@icasa.org.za
Office telephone	+2712 427 8226	+27 11 566 3000
Mobile telephone	+27 78 737 9949	
Fax line	+2712 427 8159	+27 11 566 3281

6 Annexes

6.1 Responses to Questionnaire

AFS Annex 1: Final response from South Africa

6.2 Cross Border Frequency Coordination Agreements

AFS Annex 2: MoU Lesotho-South Africa on coordination on telecommunications and radiocommunication services

6.3 National Table of Frequency Allocations

AFS Annex 3: South African Table of Frequency Allocations

6.4 National Complementary Documents

AFS Annex 4: Fixed services database register format

AFS Annex 5: Land mobile service database register format

AFS Annex 6: Radio Frequency Spectrum Regulations 1

AFS Annex 7: Radio Frequency Spectrum Regulations 2

7 References and bibliography

South Africa information:

- Population : *www.statssa.gov.za*

Some text extracted from:

- http://www.southafrica.info/about/geography/geography.htm

Economical information

Data extracted from:

- List of countries by GDP (nominal) per capita from Wikipedia: http://en.wikipedia.org/wiki/List_of_countries_by_GDP_(nominal)_per capita

  Real Growth rate: http://www.indexmundi.com/south_africa/gdp_real_growth_rate.html

  Inflation rate: http://www.tradingeconomics.com/south-africa/indicators

Independent Communications Authority of South Africa and Department of Communications information:

- http://www.icasa.org.za/
- http://www.doc.gov.za/

National Association of Broadcaster information

- http://www.nab.org.za/

Part 2

Kingdom of Swaziland

Part 2

COUNTRY PROFILE

The Kingdom of Swaziland is a landlocked country in Southern Africa. It has a population of 1,185 million (est. 2009) and has total land area of 17,364 square kilometers.

Swaziland is bordered to the north, south and west by South Africa and to the east by Mozambique.

The western half is mountainous, descending to a low veld region to the east. The eastern border with Mozambique and South Africa is dominated by the escarpment of the Lebombo Mountains.

Figure 9: Kingdom of Swaziland

Map Extracted from: www.worldwebsites.ws/articles.php?lng=en&pg=197

Swaziland macro-economic statistics are as follows:

GDP per capita=U$S3061 (IMF2010) World position 108

Real Growth Rate=2% (est.2010

Inflation=6.22% (Average 2010)

There are two official languages in Swaziland, SiSwati a Bantu language of the Nguni Group and English.

Regarding regional organisations Swaziland as part of the African Union, is member of the African Telecommunications Union. On the other hand Swaziland is also a member of: the Southern Africa

Development Community (SADC), the regional economic organisation, the Communications Regulators' Association of Southern Africa (CRASA), and the Southern Africa Telecommunication Association (SATA) the regional operators association.

Swaziland may be one of the last countries in the world where government have an almost complete monopoly of the telecommunications and broadcasting scenario.

The state-owned posts and telecommunications operator, SWAZILAND POST AND TELECOMMUNICATIONS CORPORATION (SPTC) also acts as the industry regulator and gains in the country's sole mobile network, in partnership with South Africa's MTN.

The Internet sector is open to competition with limited licensed ISPs, prices have remained high and market penetration relatively low.

With respect to the broadcasting environment, the Swaziland Broadcasting and Information Service is the state owned broadcast and print information provider of Swaziland.

The Swaziland Television Authority runs a station known today as "Swazi TV", which broadcast nationally through several relay stations.

Radio broadcasting hosts a public broadcaster: Radio Swaziland that is the state owned radio broadcast system in Swaziland. There are several stations in AM, FM and shortwave.

1 Swaziland Spectrum Management Framework

The Communication Regulatory Unit of the SPTC has the responsibility of the management of the radio frequency spectrum for all the radiocommunication services.

1.1 Legislative basis

The legislative basis for SPTC to have the responsibility of the country spectrum management resides in the Swaziland Post and Telecommunications Corporation Act of 1983 .Chapter VII of the Act addresses radio regulations without mentioning specifically spectrum management. In 1992 Swaziland Radio Regulations were published by SPTC, under the umbrella of the Act afore mentioned.

1.2 National Table of Frequency Allocations

The Swaziland National Frequency Spectrum Plan covers from 9 KHz to 40.5 GHz. The plan is a basic Excel list of some ITU bands and its allocations to services in Swaziland, particularly indicating relevant ITU footnotes. The list seems to be updated in line with the 2008 ITU Radio Regulations. Many bands, however, are not considered and the band segments are not always consistent with ITU. Additionally the list has some inaccuracies. See **SWZ Annex 2.**

In general, barring some deviations, the Plan has a reasonable correlation with the ITU Table of frequency allocations.

Table 25 indicates fundamental spectrum allocations differences, between the SADC FAP; ITU Region 1 FAP and the Swaziland frequency band plan within 80-20 000 MHz. Not all allocations are recorded.

Bands (MHz)	ITU Region 1	Regional Plan (SADC)	Swaziland Plan	Applicable footnote
138-144	AERONAUTICAL MOBILE (OR)	MOBILE	FIXED/MOBILE	ITU 5.212
230-235	FIXED/MOBILE	BROADCASTING	BROADCASTING Fixed Mobile	ITU 5.252 Fs/Ms not aligned
235-238 and 246-254	FIXED/MOBILE	BROADCASTING	BROADCASTING FIXED MOBILE	ITU 5.252
460-470	FIXED/MOBILE	FIXED/MOBILE	BROADCASTING	
470-790	BROADCASTING	BROADCASTING RADIOASTRONOMY	BROADCASTING Mobile	ITU 5.296
1550-1559	MOBILE-SATELLITE	MOBILE-SATELLITE	MOBILE-SATELLITE - FIXED	FS as per ITU 5.359
1610-1645.5	Not FIXED	As ITU No FIXED	FIXED	FS as per ITU 5.359
1646.5-1660	Not FIXED	As ITU No FIXED	FIXED	FS as per ITU 5.359
3300-3400	RADIOLOCATION	RADIOLOCATION	RADIOLOCATION Amateur Fixed Mobile	Note :Aligned with ITU Region 2
3400-3600	Mobile	MOBILE except aeronautical mobile	MOBILE except aeronautical mobile	ITU 5.430A
5650-5850	Not FIXED Mobile except aeronautical mobile within 5650-5725	As per ITU plus Wireless Access Systems	FIXED/MOBILE	ITU 5.453
8500-8750	Not FIXED Not MOBILE	Aligned with ITU	FIXED/MOBILE	ITU 5.468
14 000-14 300	Not FIXED	Aligned with ITU but No RADIOLOCATION	FIXED	ITU 5.505
15.7-17.3 GHz	Not FIXED Not MOBILE	As per ITU plus Wireless Access Systems within 17.-17.3 GHz	FIXED/MOBILE	ITU 5.512

Table 25: Different spectrum allocations between the SADC FAP ; ITU Region 1 and SWZ FAP within 80-20 000 MHz.

Note that in general only terrestrial allocations are considered.

2 Cross Border Frequency Coordination

Swaziland does not have cross-border frequency coordination agreements with any of the neighbouring countries as yet. Therefore, they are not making use of coordination triggering level at a particular line/point for frequency coordination across borders.

2.1 Responsibility for cross-border frequency coordination

The international frequency coordination for all the radiocommunication services is the responsibility of the Communication Regulatory Unit of the Swaziland Post and Telecommunications Corporation (SPTC)

2.2 Cross Border Frequency Coordination Framework

Swaziland does not have a coordination framework. However, wherever possible ITU Radio Regulations are applied

2.3 Bilateral / Multilateral agreement

Swaziland has signed the CRASA MOU on frequency coordination (spillage), but Swaziland has not started employing it with any of its neighbours yet. Therefore, it does not currently have any bilateral or multilateral agreement with any of its neighbouring countries, concerning frequency coordination across borders.

2.4 Interference problems and cross-border frequency coordination experiences

From time to time Swaziland experiences interferences from its neighbours.

There are currently no laid down procedures to handle cross-border interference.

A case of Interference worth mentioning is one where Mozambique lodged a complaint with one of Swaziland's TV channels assigned at 625.25 MHz, reported to be interfering with their TV station on the same channel. Administrations met and conducted a thorough investigation. The outcome proved to be an interference coming from a TV channel in AFS.

Another peculiar interference case was when a Land Mobile frequency 166.700 MHz paired with 173.200MHz it was reported by one of the frequency users who complained about severe frequency interferences. Swaziland approached Mozambique about the problem, but to no avail, no support was granted, the interference vanished while under investigation.

Table 26 shows recent cases of frequency interferences and the periodicity of its occurrence with which these problems are experienced. Swaziland mainly is affected by interference coming from South Africa and Mozambique, the only neighbours, on land mobile and broadcasting services.

Band (MHz)	Radiocommunication service	Interferer neighbouring country	Quantity of interference cases per year
459-469	Land Mobile	Mozambique	1
88-108	Broadcasting	South Africa	3
88-108	Broadcasting	Mozambique	2

Table 26: Recent cases of frequency interferences and the periodicity of its occurrence

Similarly **Table 27** shows some coordination carried out with the neighbouring countries and the amount of coordinations carried out per year

Band (MHz)	Radiocommunication service	Neighbouring country/ies coordinated	Quantity of coordinations per year
900-960	Land Mobile	Mozambique	2
2480-2690	Fixed	South Africa	2
2480-2690	Fixed	Mozambique	2

Table 27: Recent cases of frequency coordination and the quantity of coordinations per year .

Swaziland does not have a frequency register for storing the co-ordination results nor does it have a pre-defined co-ordination frequency category such as preferential, shared, etc.

2.5 Coordination agreements required

Table 28 in next page shows the different agreements required according to Swaziland. Please note that the priorities are indicated in the table.

Band (MHz)	Radiocommunication service	Interferer neighbouring country	Quantity of interference cases per year	Priority: Low; Medium; High; Top
3534-3940	Fixed	Mozambique	2	High
138-174	Land Mobile	South Africa	5	High

Table 28 Coordination agreements required.

From the table it can be concluded that Swaziland need coordination agreement for the fixed and mobile service, with the neighbours Mozambique and South Africa. Based on the priority requested it seems that this is an issue which Swaziland would like to have resolved soon.

2.6 Data Exchange Format

Swaziland does not have different data formats for the exchange of information regarding the different radiocommunication services. Any types of data exchange format available would be acceptable. For storage purposes CD/DVD are the most favored.

2.7 Tools and database used

From the terrestrial services point of view, Swaziland uses some of the ITU tools such as TerRaSys; WISFAT; BRIFIC for registration and consultation purposes, as means of compliance with ITU Radio Regulations as per article 11 and other associated regional agreements.

This country is basically equipped to resolve interference problems as well as frequency coordinations as indicated by the list below.

- **Spectrum Management Software:**
  - None.

- **Monitoring and radiolocation systems**
  - ROHDE& SCHWARZ Radiomonitoring /Radiolocation testing equipment.
- **Digital terrain maps**
  - Swaziland does not make use of digital maps yet.
- **Maps on paper**
  - Swaziland use paper maps for profiles when assigning the frequency spectrum at a scale of 1:50,000.
- **Propagation models, Table 29** in the following page show the different models used.

Band (MHz)	Radiocommunication service	Propagation Models
146-174	Land Mobile	ITU-R P370
450-470 MHz	Land Mobile	ITU-R P370
GSM 900	Mobile	ITU-R P525
GSM 1800	Mobile	ITU-R P525
3G	Mobile	Okumura-Hata
2570-2600	Mobile	Okumura-Hata
Broadcasting Bands	Broadcasting	As predetermined in the various regional agreements

Table 29 Propagation models used by SPTC.

3 Observations

SPTC have been very cooperative towards this project. However it is suggested that the answers should be re-evaluated at the next phase. Ideally face to face meetings with officials directly involved with interference and coordination.

Note that the response obtained with regard to the current frequency register database format was very basic, mostly irrelevant consisting on site location and station name.

4 Conclusions and recommendations

In general Swaziland seems to be basically equipped to resolve interference problems as well as frequency coordination.

Swaziland does not have coordination agreements across borders yet and it does not seem to be affected much by interference or carrying out much coordination. It also has neither a framework for coordination nor a register of coordinations. Land mobile in the 138-174 MHz and fixed services between 3.5 and 4 GHz seem to be their main concern. Nevertheless, with a vision towards the future the HCM4A might be very beneficial due to the mobile telecommunications revolution all over Africa, particularly having neighbours such as South Africa and Mozambique.

Swaziland is a country that is still not heavily embarked on a process of liberalization and promotion of competition; conversely it is in the process of delivering modern telecommunication services. Consequently, the HCM4A may become a very useful tool.

To implement HCM4A based on the HCM 2008 will not be very difficult, particularly for Swaziland, since there is not much to be changed to implement the new software tool.

Something of interest is that although the process for coordination and resolution of interference exist in the different ITU Broadcasting agreements, it is advisable that ITU investigate the reasons why interferences occur. For example in the case of Swaziland a complaint was due to an interference coming from a TV co-channel, which took sometime to find the actual cause.

It is recommended that HIPSSA analyzes very well the work already undertaken by SADC/CRASA in the region on cross-border coordination. Consequently, taking into account the relevant measures already taken by CRASA on frequency coordination across borders, it is advisable that to achieve an effective cooperation at regional level for the design of the HCM4A, HIPSSA should enter into discussions with those entities. This will facilitate the introduction and spread of HCM4A in Southern Africa.

5 Contacts

5.1 Focal Point

	SPTC Communications Regulatory Unit
Name	Mr. Austin Mgabi
Rank/Position	Manager Frequency Management
Email address	mamgabhi@sptc.co.sz
Office telephone	+268 2405 2393
Mobile telephone	+268 7605 1097/+268 7712 2989
Fax line	+268 2405 2020

5.2 Additional Contacts

	SPTC Communications Regulatory Unit
Name	Ms. Nozipho Freya Simelane
Rank/Position	Policy and Planning Officer Regulatory Affairs
Email address	nfsimelane@sptc.co.sz
Office telephone	+268 2405 2328
Mobile telephone	+268 7602 9277
Fax line	+268 24052013

Note that the contact details of Ms. Simelane will change shortly as the unit is on the way to become a standalone unit. Currently she is the Acting Head of Regulation.

6 Annexes

6.1 Responses to Questionnaire

SWZ Annex 1: Final response from Swaziland

6.2 Cross Border Frequency Coordination Agreements

None

6.3 National Table of Frequency Allocations

SWZ Annex 2: Swaziland National Frequency Spectrum Plan

6.4 National Complementary Documents

None

7 References and bibliography

Swaziland information:

Some text extracted from:

- www.en.wikipedia.org/wiki/Swaziland
- www.en.wikipedia.org/wiki/Telecommunications_in_Swaziland
- www.commonwealth-of-nations.org/Swaziland/Telecommunications/Swaziland_Posts_And_Telecommunications_Corporation/welcome

Economical information

Data extracted from:

- List of countries by GDP (nominal) per capita from Wikipedia: www.en.wikipedia.org/wiki/List_of_countries_by_GDP_(nominal)_per_capita
- Real Growth rate: www.indexmundi.com/swaziland/gdp_real_growth_rate.html
- Inflation rate: www.tradingeconomics.com/swaziland/indicators

Swaziland Post and Telecommunications Corporation Information

- www.sptc.co.sz/

Part 2

Republic of Zambia

COUNTRY PROFILE

Zambia is a landlocked country in Southern Africa, it has a population of nearly 13 million (2009), and has a total land area of slightly more than 750,000 square kilometres.

The neighbouring countries are the Democratic Republic of the Congo to the north, Tanzania to the northeast, Malawi to the east, Mozambique, Zimbabwe, Botswana and Namibia to the south, and Angola to the west. The population is concentrated mainly around the capital Lusaka in the south-central part of the country and the Copperbelt to the Northwest.

The terrain is mostly high plateau with some hills and mountains

Figure 10: Republic of Zambia

Map Extracted from: www.geography.about.com/library/cia/blczambia.htm

Zambia macro-economic statistics are as follows:

GDP per capita=U$S1221 (IMF2010) World position 139

Real Growth Rate=7% (est.2010

Inflation=8.23% (Average 2010)

The official language of Zambia is English.. The main local language, especially in Lusaka, is Nyanja. However, Bemba and Nyanja are spoken in the urban areas in addition to other indigenous languages. There are more than 80 languages spoken in Zambia.

Regarding regional organisations Zambia as part of the African Union, is member of the African Telecommunications Union. On the other hand Zambia is also a member of: the Southern Africa Development Community (SADC)-the regional economic organisation, the Communications Regulators' Association of Southern Africa (CRASA), and the Southern Africa Telecommunication Association (SATA) the regional operators association.

The telecommunication and broadcasting sector in Zambia are in the process of privatization, liberalization and thus promotion of competition.

Zambia counts one fixed-line network operator ZAMTEL which has been partially privatized selling 75% of shares to a Libyan telecommunications company. Consequently, a big development in the fixed services could be expected in line with the investment plan of the Libyan company.

With regard to mobile cellular operators , Zambia has three operators: BARTHI AIRTEL formerly Zain, belonging to an Indian company, MTN belonging to a South African company and CELL Z the mobile division of ZAMTEL.

Zambia has several land mobile public radio systems.

There has been limited growth in the Internet and broadband sector with some of the highest prices for international bandwidth. However, new alternative international links operated by companies others than ZAMTEL, have reduced the cost of international bandwidth promoting Internet access.

Regarding the broadcasting environment, there is a public broadcaster: The Zambia National Broadcasting Corporation, owned by government. The broadcaster operates three radio stations and two television stations. The second TV channel TV2 – was officially launched on 15 January 2010. In addition there are 7 privately owned TV channels.

There are also many private and community radio stations. In total Zambia counts 19 AM; 5FM and 4 shortwave radio stations.

1 Zambia Spectrum Management Framework

The Zambia Information and Communication Technology Authority (ZICTA) has the responsibility of the management of the radio frequency spectrum for all the radiocommunication services.

In Zambia the Head of State, via the Minister of Communications and Transport, acts as a custodian of the spectrum on behalf of the people of Zambia.

ZICTA represents the country on all international spectrum management fora, unless the Minister or his appointee decide to attend. In the latter case, ZICTA takes the advisory role.

Zambia has incorporated, by reference, the ITU Radio Regulations in its legislation.

ZICTA, the Regulatory entity, controls, plans, administers and manages the use and licensing of the radio frequency spectrum. This particularly includes the radio spectrum used for telecommunications, broadcasting, government services, scientific services, etc. In fulfilment of its function it must issue regulations in line with the Policies and Policy directions issued by the Minister. Cross-border frequency coordination process is carried out by ZICTA.

Any multilateral or bilateral cross-border frequency coordination agreement would need to go via a relevant processing of international agreements and treaties which would include the Ministries of Communications and Transport, Justice, and Foreign Affairs.

1.1 Legislative basis

ZICTA is responsible for radio frequency management in terms of Part II section 6 (a, b, k, l) of the Information and Communications Technology Act of 2009.

The Information and Communication Technologies Act (ICT) of 2009 governs the ICT environment in Zambia. The ultimate body responsible for the Zambian ICT environment is the Minister of Communications and Transport.

The Act particularly legislates that the Minister may make policies on matters of national policy applicable to the ICT sector.

1.2 National Table of Frequency Allocations

The Table of frequency allocations of Zambia (Zambia radio frequency spectrum plan draft January 2009) considers the uses of the radio spectrum between 9 KHz and 1000 GHz. The information has been updated to take account of the outcome of WRC-07. The Zambia footnotes are correlated to the ITU footnotes but the numbering is different. See **ZMB Annex 2.**

The Zambia Spectrum Plan is a comprehensive document that not only presents the allocations in Zambia and the ITU Region 1, but also indicates the utilization, associated documents, and the applicable standards as well as any comments or relevant notes for each band.

In general the table has a great correlation with the ITU Table of frequency allocations although it has some deviations.

Table 30 in next page indicates fundamental spectrum allocations differences, between the SADC FAP; ITU Region 1 FAP and the Zambia frequency band plan within 80-20 000 MHz. Not all allocations are recorded.

Bands (MHz)	ITU Region 1	Regional Plan (SADC)	Zambia Spectrum Plan	Applicable footnote
138-144	AERONAUTICAL MOBILE (OR)	MOBILE	FIXED/MOBILE	ITU 5.212
230-238	FIXED/MOBILE	BROADCASTING	BROADCASTING	ITU 5.252
238-246	FIXED/MOBILE	MOBILE	BROADCASTING FIXED/MOBILE	
246-254	FIXED/MOBILE	BROADCASTING	BROADCASTING	ITU 5.252
470-790	BROADCASTING	BROADCASTING RADIOASTRONOMY	BROADCASTING RADIOASTRONOMY	SADC12:606-614 MHz RADIOASTRONOMY 5.304
3400-3600	Mobile	MOBILE except aeronautical mobile	MOBILE except aeronautical mobile	ITU 5.430A
5150-5350	Not FIXED	Wireless Access Systems	Wireless Access Systems	

Bands (MHz)	ITU Region 1	Regional Plan (SADC)	Zambia Spectrum Plan	Applicable footnote
5470-5850	Not FIXED	Wireless Access Systems	Wireless Access Systems	
17 100-17 300	Not FIXED	Wireless Access Systems	Wireless Access Systems	

Table 30: Different spectrum allocations between the SADC FAP ; ITU Region 1 and ZMB FAP within 80-20 000 MHz.

Note that in general only terrestrial allocations are considered.

2 Cross Border Frequency Coordination

Zambia does not have cross-border frequency coordination agreements with any of the neighbouring countries as yet. Therefore they are not making use of coordination triggering level at a particular line/point for frequency coordination across borders.

2.1 Responsibility for cross-border frequency coordination

The international frequency coordination for all the radiocommunication services is the responsibility of The Zambia Information and Communication Technology Authority (ZICTA)

2.2 Cross Border Frequency Coordination Framework

Zambia does not have a framework for cross-border frequency coordination.

2.3 Bilateral / Multilateral agreement

Zambia does not currently have any bilateral or multilateral agreement with any of its neighbouring countries concerning frequency coordination across the borders.

Zambia, via ZICTA, may not have explicitly signed the CRASA MOU on coordination. However, ZICTA fully endorses it as part of CRASA guideline documents.

To date, Zambia has had no major issues with international interference or cross-border coordination. The ad-hoc cross-border coordination has worked. However, a formalized coordination is undoubtedly most welcome.

2.4 Interference problems and cross-border frequency coordination experiences

As far as ZICTA recalls, Zambia has had no interference with their neighbours - i.e. nothing worth noting

Zambia does not have a procedure to handle interference resolution. However, on the ZICTA website guidelines for the public to report interference cases can be found. These guidelines can be found at www.caz.zm/index.php/guidelines/interference-reporting-guidelines.html

Clearance of identified frequencies for 2-way radios and GSM900 system were carried out successfully. Average response time from Namibia and Botswana was 2 weeks.

Table 31 below shows some coordination carried out with some neighbouring countries and the amount of coordinations carried out per year

Band (MHz)	Radiocommunication service	Interferer neighbouring country	Quantity of coordinations in the past 10 years
138-174	Land Mobile	Namibia and Botswana	3
GSM900	Land Mobile	Zimbabwe	1
7 GHz	Fixed	Malawi	1

Table 31 : Recent cases of frequency coordination and the quantity of coordinations.

Note that Zambia is the Southern Africa country with the greatest number of neighbouring countries: Eight in total.

Zambia does not have a frequency register for storing the co-ordination results; nor does it have pre-defined co-ordination frequency categories such as preferential, shared, etc.

2.5 Coordination agreements required

Table 32 in the following page shows the different agreements that are required by Zambia. Please note that the priorities are indicated in the table.

Band (MHz)	Radiocommunication service	Possible Interferer	Priority: Low; Medium: High top
138-174	Land Mobile	All neighbours: Angola; Botswana; Congo (DRC); Malawi; Namibia; Mozambique; Tanzania; Zimbabwe	Medium
87-108	Broadcasting	All neighbours	Top
174-230	Broadcasting	All neighbours	Top
470-862 MHz	Broadcasting	All neighbours	Top
GSM 900/1800	Land Mobile	All neighbours	High
4;6;7;8;11;13;15 and 18 GHz bands	Fixed point-to point	All neighbours	Medium

Table 32 Coordination agreements required

From the table it can be concluded that Zambia is concerned with the broadcasting service in VHF and UHF. The mobile GSM systems come in second term, in spite of the CRASA MoU on GSM.

2.6 Data Exchange Format

Zambia does not have different data formats for the exchange of information. Regarding the data exchange format for the exchange of coordination information E-mail would typically be preferable.

2.7 Tools and database used

This part of spectrum management is under development and as such, little information can be made available.

Regarding ITU tools Zambia has used TerRaSys to register frequencies with ITU.

This country is in the process of being well equipped to resolve interference problems as well as frequency coordinations.

TCI International, Inc. (TCI) has signed two contracts with the Zambia Information and Communications Technology Authority (ZICTA) to supply and install additional spectrum management systems and provide extended maintenance services for the systems that TCI supplied to ZICTA in 2008.

The key component in the new systems is the TCI Model 745 Spectrum Monitoring System, which provides monitoring capabilities covering the entire HF/VHF/UHF/SHF spectrum ranging from 9 kHz to 40 GHz. The Model 745 utilizes a unique, dual 20/2 MHz bandwidth capability that offers the flexibility to measure and monitor both conventional and short-duration signals. The new equipment will network seamlessly with the existing equipment and provides for remote operation of the stations.

- **Spectrum Management Software:**
  - ATDI analysis tool “ICS Telecom”
- **Monitoring and radiolocation systems**
  - TCI 745. See Annex **ZMB Annex 3**
- **Test equipment**
  - It is assumed that ZICTA has Spectrum analyzers
- **Digital terrain maps**
  - Zambia is currently procuring the digital maps to be used with the ATDI/TCI systems mentioned.
- **Maps on paper**
  - Zambia is procuring the 1:50 000 resolution maps that will be used to determine the relevant terrestrial profiles.
- **Propagation models**
  - No propagation method is in use as yet. At this point in time ZICTA does not has any frequency coordination calculation method, because the Authority is analyzing the capabilities of the tools recently acquired

3 Observations

ZICTA has been very cooperative towards this project. However, it is suggested that the answers should be re-checked at the next phase. Ideally in face to face meetings with officials directly involved with interference and coordination.

The main required fields that ZICTA uses in the spectrum management database are as follows: station name, location (lat/long), Transmitter equipment make and model, equipment Type Approval (TA) number, frequency, bandwidth, eirp power, spurious radiation, selectivity, sensitivity, antenna make and model, antenna TA number, antenna type, antenna height and antenna radiation pattern. ZICTA also believes that these fields should also apply for coordination.

On the other hand ZICTA reported that frequency assignment to date has been on national pre-coordinated basis during the planning phase. This worked because of the limited number of transmitters in any given band. However, due to the recent increase in demand and installation of more transmitters, national frequency coordination will become necessary. As a result, ZICTA has since established the TCI Spectrum Management and Monitoring System which has the relevant analysis tools.

4 Conclusions and recommendations

In general Zambia will become a very well equipped country to carry out coordination across borders and to resolve interference whenever all the tools are in place. Currently Zambia does not appear to be much affected by interference or carrying out much coordination. The ICT Act of 2009 in addition provides a good legislative framework

Zambia is a country that is becoming heavily embarked on a process of liberalization and promotion of competition; which will imply a considerable increase in the use of the radio spectrum, with the consequent increase of interferences and coordination requirements. This perception may become of primary importance for the ICT development, considering the amount of countries with which Zambia has borders and the considerable length of those borders with some of their neighbours. Additionally several of the neighbouring countries are getting very involved in the mobile telecommunications revolution which is impacting the whole of Africa. Consequently, the HCM4A may become a very useful tool.

To implement HCM4A based on the HCM 2008 will not be difficult, at least for Zambia, since there is no much to be changed to implement the new HIPSSA software tool. ZICTA does not have coordination agreements across borders. It also has neither a framework for coordination nor a register of coordinations. If the broadcasting service is not taken into consideration due to the field of application of the HCM 2008, Zambia's main concern reside on the land mobile and fixed services, very much within the scope of the European HCM.

Something of interest is that although the process for coordination and resolution of interference exists in the different ITU Broadcasting agreements, it is advisable that ITU investigate the reasons as to why interferences occur. Zambia particularly considers of top importance to have coordination agreements with all its neighbours on VHF and UHF broadcasting

Regarding the protection requirements, it is recommended to make use of the ones used in the European HCM or the ones addressed in ITU-R Recommendations.

It is recommended that HIPSSA analyzes very well the work already undertaken by SADC/CRASA in the region on cross-border coordination. Consequently, taking into account the relevant measures already taken by CRASA on frequency coordination across borders, it is advisable that to achieve an effective cooperation at regional level for the design of the HCM4A, HIPSSA should enter into discussions with those entities. This will facilitate the introduction and spread of HCM4A in Southern Africa.

5 Contacts

5.1 Focal Point

	ZICTA
Name	Mr. Patrick Mutimushi
Rank/Position	Director- Technology & Engineering
Email address	pmutimushi@zicta.zm
Office telephone	+260 21 244 431
Mobile telephone	+260 96 692 0905 +260 97 716 4972
Fax line	+260 21 124 6701

5.2 Additional Contacts

	ZICTA
Name	Mr. Kezias Mwale
Rank/Position	Manager Spectrum Planning & Licensing
Email address	kmwale@zicta.zm
Office telephone	+260 211 246698
Mobile telephone	+260 976 344 950

6 Annexes

6.1 Responses to Questionnaire

ZMB Annex 1: Final response from Zambia

6.2 Cross Border Frequency Coordination Agreements

None

6.3 National Table of Frequency Allocations

ZMB Annex 2: Zambia Table of Frequency Allocations

6.4 National Complementary Documents

ZMB Annex 3: Communications Authority of Zambia SMMS System Expansion.doc

7 References and bibliography

Zambia information:

Some text extracted from:

- www.en.wikipedia.org/wiki/Zambia
- www.geography.about.com/library/cia/blczambia.htm
- www.totel.com.au/zambia-telecommunications-research.asp
- www.en.wikipedia.org/wiki/Telecommunications_in_Zambia
- www.budde.com.au/Research/Zambia-Telecoms-Mobile-Broadband-and-Forecasts.html

Economical information

Data extracted from:

- List of countries by GDP (nominal) per capita from Wikipedia: www.en.wikipedia.org/wiki/List_of_countries_by_GDP_(nominal)_per_capita
- Real Growth rate: www.indexmundi.com/zambia/gdp_real_growth_rate.html
- Inflation rate: www.tradingeconomics.com/zambia/indicators

Zambia Information and Communication Technology Authority Information

- www.caz.zm/ (www.zicta.zm)

Part 2

Republic of Zimbabwe

Part 2

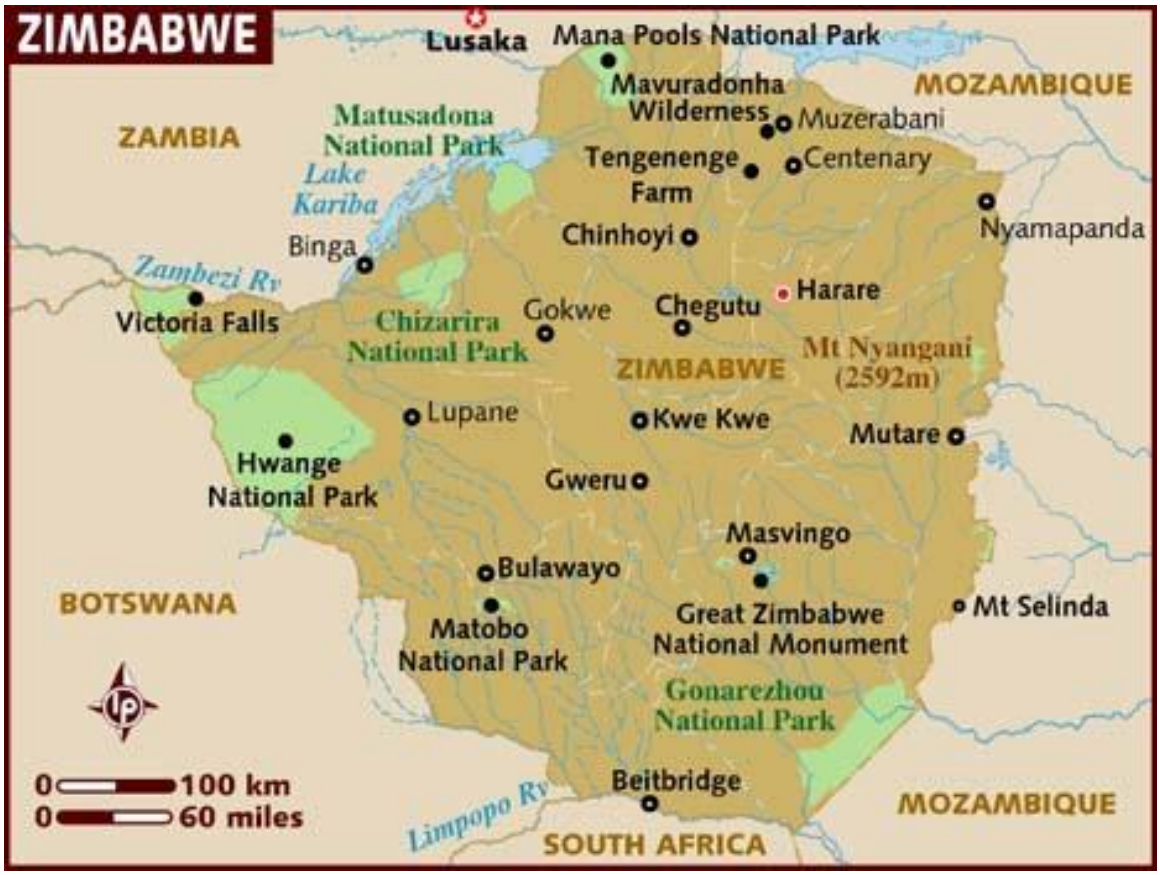
COUNTRY PROFILE

Zimbabwe is a landlocked country located in the southern part of the African continent, between the Zambezi and Limpopo rivers. It has a population of 12, 5 million (est. 2009) and has total land area of 350,757 square kilometres.

Most of the country is elevated in the central plateau (high veld) stretching from the southwest to the northwest at altitudes between 1200 and 1600m.

It is bordered by South Africa to the south, Botswana to the southwest, Zambia to the northwest and Mozambique to the east.

Figure 11: Republic of Zimbabwe



Map Extracted from: www.lonelyplanet.com

Zimbabwe macro-economic statistics are as follows:

GDP per capita=U$S673 (IMF2010) World position 159

Real Growth Rate=4.1% (est.2010)

Inflation=5.0% (Average 2010)

Zimbabwe has three official languages: English, Shona, and Ndebele.

Regarding regional organisations Zimbabwe as part of the African Union, is member of the African Telecommunications Union. On the other hand Zimbabwe is also a member of: the Southern Africa Development Community (SADC), the regional economic organisation, the Communications Regulators' Association of Southern Africa (CRASA), and the Southern Africa Telecommunication Association (SATA) the regional operators association.

The telecommunication sector in Zimbabwe is in rapid development due to the promotion of competition, industry privatization and the pressure of government to reduce the high cost of telecommunications services.

The country counts One fixed-line network operator TelOne belonging, for the time being, entirely to government but its partial privatization is being re-considered.

Zimbabwe has three mobile operators, ECONET WIRELESS from a South African based company which is the leader in the market. TELECELL owned by Egypt's Orascom Telecom and NetOne a private company wholly owned by government, that was formed as a subsidiary of the Posts and Telecommunications Corporation (PTC) in 1996.

Regarding the broadcasting environment, there is a public broadcaster: The Zimbabwe Broadcasting Corporation, which has 4 national radio network and also 2 national TV channels: Channel 1 and Channel 2. In total Zimbabwe have 7 AM stations, 4 FM and 1 shortwave station.

Despite the limited fixed-line infrastructure, internet usage in Zimbabwe has continued to rise. The fact that it is a landlocked country has affected the accessibility of the people to Internet due fundamentally to the price. However, the situation may improve considerably, since new fibre optic links are now being deployed to improve international connectivity via neighbouring countries, allowing access to international submarine fibre optic cables.

1 Zimbabwe Spectrum Management Framework

The Postal and Telecommunications Regulatory Authority of Zimbabwe (POTRAZ) has the responsibility of the management of the radio frequency spectrum for all the radiocommunication services with the exception of the broadcasting spectrum, which is managed by the Broadcasting Authority of Zimbabwe (BAZ)

1.1 Legislative basis

POTRAZ has the responsibility of managing the radio spectrum as stated in the Postal and Telecommunications Act [Chapter 12:05]. While the responsibility of the management of the broadcasting service spectrum is given to BAZ by the Broadcasting Services Act, 2001

1.2 National Table of Frequency Allocations

Zimbabwe does not have a National Table of Frequency Allocations, instead uses the latest SADC Band Plan of 2010, which is up to date.

In general the ZWE (SADC) FAP has a great correlation with the ITU Table of frequency allocations although it has some deviation from the ITU allocations for ITU Region 1.

Table 33 indicates fundamental differences from 80 MHz to 20 000 MHz. Not all allocations are recorded.

Bands (MHz)	ITU Region 1	Regional Plan (SADC)	Applicable footnote
138-144	AERONAUTICAL MOBILE (OR)	MOBILE	5.212 RSA FS instead of fs
230-238 and 246-254	FIXED/MOBILE	BROADCASTING	5.252
470-790	BROADCASTING	BROADCASTING RADIOASTRONOMY	SADC12:606-614 MHz RADIOASTRONOMY
3400-3600	Mobile	MOBILE except aeronautical mobile	5.430A
5150-5350	Not FIXED	Wireless Access Systems	
5470-5850	Not FIXED	Wireless Access Systems	
17 100-17 300	Not FIXED	Wireless Access Systems	

Table 33: Different spectrum allocations between the ZWE (SADC) FAP and ITU Region 1 within 80-20 000 MHz.

2 Cross Border Frequency Coordination

Zimbabwe does not have cross-border frequency coordination agreements with any of the neighbouring countries as yet. Therefore, they are not making use of coordination triggering level at a particular line/point for frequency coordination across borders.

This country considers that the point or line whereof the calculation is made to determine if frequency coordination is required or not is coverage dependent. The spectrum management tools will provide coverage prediction which is then used to determine whether or not to invoke coordination procedures. If there is no signal spillover then there will be no need for coordination. This obviously depends on a number of factors including terrain, antenna directivity and gain, power etc.

2.1 Responsibility for cross-border frequency coordination

The international frequency coordination for all the radiocommunication services except broadcasting is the responsibility of POTRAZ. The cross-border coordination of broadcasting service is the responsibility of BAZ.

2.2 Cross Border Frequency Coordination Framework

Zimbabwe uses as a coordination framework for HF the harmonised HF cross-border frequencies agreement as per Annex G of the latest SADC band plan. For GSM Zimbabwe makes use of the CRASA MoU on GSM coordination. Particularly, between Zambia and Zimbabwe it used preferential channel arrangements for GSM

2.3 Bilateral / Multilateral agreement

Zimbabwe does not have any formal coordination agreement with its neighboring countries, although they consider the SADC harmonisation of HF frequencies and the CRASA MoU as a procedure to use whenever it is required. Zimbabwe even stated at one time that they have an agreement with Zambia. After consultation with Zambia it was confirmed that Zambia has not signed any agreement with Zimbabwe in this regard.

2.4 Interference problems and cross-border frequency coordination experiences

Zimbabwe does experience interferences from its neighbours and it has a procedure to handle those cases. The description of the procedure is as follows:

"In the event of interference emanating from a neighbouring country the following happens:

- We conduct in-country investigations to establish the nature of interference and this includes; frequency of interferer, bandwidth, field strength and direction of arrival.
- Records are checked to confirm that assignment was notified to neighbouring country.
- If notified then a letter is generated advising authorities of the neighboring country of the interference providing all the necessary details pertaining to the coverage of the interferer within Zimbabwe, frequency, field strength and bandwidth. Copy of notification correspondences is also attached.
- At this point the neighbouring country is expected to take necessary action; otherwise the matter may be raised with ITU. However the ITU has at no point had to get involved as Zimbabwe's neighbours have been cooperative."

Two successful interference cases to mention are: One on the GSM 900 MHz band with Mozambique resolved by changing channels on the Mozambican side, operation took three weeks. The second is in the 146-174 MHz band with Zambia, only a few days taken to resolve. In addition POTRAZ found that the use of reserved channels has helped minimize cases of interference.

Table 34 shows recent cases of frequency interferences and its periodicity.

Band (MHz)	Radiocommunication service	Interferer country	Quantity of interference cases per year
GSM 900	Cellular Mobile	Zambia	2
146-174	Land Mobile	Zambia	2

Table 34 : Recent cases of frequency interference and the quantity of cases per year.

Similarly, **Table 35** shows some coordination carried out with some neighboring countries and the amount of coordinations carried out per year

Band (MHz)	Radio communication Service	Neighbouring Country Coordinated	Quantity of Coordination per year
900-960	Land Mobile	Mozambique	1
146 - 174	Land Mobile	Mozambique	1
		Zambia	10
		Botswana	4
6 – 8.5 GHz	Fixed Service	Mozambique	1
		Zambia	2

Table 35 : Recent cases of frequency coordination and the quantity of coordinations.

Zimbabwe does have a database to register GSM frequency coordination cases, however a copy of that database was not provided.

POTRAZ makes use of preferential channel arrangements for GSM, as was the case between Zambia and Zimbabwe.

2.5 Coordination agreements required

Table 36 shows the different agreements that, in accordance to Zimbabwe, are required. Please note that the priorities are indicated in the table.

Band (MHz)	Radiocommunication service	Interferer neighboring country	Priority: Low; Medium; High; Top
146 -174	Land Mobile	AFS, BOT, MOZ, ZMB	H
880 - 960	Land Mobile	AFS, BOT, MOZ, ZMB	H
2.1GHz	Mobile (UMTS)	AFS, BOT, MOZ, ZMB	H
2.5GHz	Mobile (Wimax)	AFS, BOT, MOZ, ZMB	H
6-8.5GHz	Fixed	AFS, BOT, MOZ, ZMB	H

Table 36 Coordination agreements required

From the table it can be concluded that Zimbabwe is concerned with the future expansion of mobile systems as well as the traditional land mobile?????

2.6 Data Exchange Format

Zimbabwe does not have different data format for different services or bands. Zimbabwe uses only the data format as per CRASA MoU. The preferred mode for data exchange of coordination information is e-mail.

2.7 Tools and database used

POTRAZ uses "IRIS" supplied by Tadiran Electronic Systems. The "IRIS" system enables Zimbabwe to do, among other things, coordination and notification/registrations without the need of using ITU tools such as TerRaSys. In addition "IRIS" has its own database. In other words Zimbabwe does not need to use ITU tools since "IRIS" is used for coordination and registration cases.

This country is well equipped to resolve interference problems as well as frequency coordination as the list below shows.

- **Spectrum Management Software:**
  - "ICS Telecom" which works with "IRIS"
- **Monitoring and radiolocation systems**
  - Tadiran "IRIS" integrated spectrum management and Monitoring system
- **Test equipment**
  - It is assumed that Zimbabwe has spectrum analyzers with the necessary spectrum capabilities
- **Digital terrain maps**
  - Zimbabwe only uses DTM without morphology as this provides worst case scenario. However the system supports morphological data.
  - Using WGS84 geographical projection system
  - Using a 50x50 meters resolution close to borders
- **Maps on paper**
  - Using 1: 50 000 scale maps
- **Propagation models**
  - "ICS Telecom" can use any of the models recommended by the ITU

3 Observations

POTRAZ has been cooperative towards this project. However it is suggested that the answers should be re-checked at the next phase. Ideally face to face meetings with officials directly involved with interference and coordination.

Note that POTRAZ did not supply any information regarding its current frequency register database format.

4 Conclusions and recommendations

Zimbabwe seems to be quite well equipped to resolve interference and to carry out coordination across borders.

POTRAZ does not have formal coordination agreements across borders yet. Zimbabwe is affected by interference from GSM systems (possibly spillover situations) and carries some coordination, particularly with Zambia, where the amount of coordination per year is relatively high.

POTRAZ, which informally makes use of the CRASA MoU, does not have a comprehensive framework for coordination, since the CRASA MoU fundamentally gives an administrative framework without really technical provisions. It seems that Zimbabwe has a register of coordination only for GSM systems. In

addition Zimbabwe is quite involved in the telecommunications liberalization wave, which will imply a much greater use of the spectrum in the future and the need to do cross-border coordination will logically grow. Practically all its neighbours are in a similar situation which implies the importance of implementing HCM4A soon.

Given the considerable amount of coordination across the borders of the different neighbours that Zimbabwe requires, the HCM4A will fit ideally to the country.

Regarding the protection requirements it is recommended to make use of the ones used in the European HCM or the ones addressed in ITU-R Recommendations.

It is recommended that HIPSSA analyzes very well the work already undertaken by SADC/CRASA in the region on cross-border coordination. Consequently, taking into account the relevant measures already taken by CRASA on frequency coordination across borders, it is advisable that to achieve an effective cooperation at regional level for the design of the HCM4A, HIPSSA should enter into discussions with those entities. This will facilitate the introduction and spread of HCM4A in Southern Africa.

5 Contacts

5.1 Focal Point

The country has not defined as yet the relevant focal point but the person providing information stated that he is the focal point.

	POTRAZ
Name	Mr. Baxton Sirewu
Rank/Position	Head Spectrum Managements
Email address	baxton.sirewu@potraz.gov.zw
Office telephone	+263 4 797380
Mobile telephone	+263 7 721 30581
Fax line	+263 4 333041

5.2 Additional Contacts

	POTRAZ
Name	Mr. Gideon Magodo
Rank/Position	Director, Communications
Email address	gmagodo@potraz.gov.zw
Office telephone	+263 4 333032
Mobile telephone	+263 71 2860 768
Fax line	+263 4 333041

6 Annexes

6.1 Responses to Questionnaire

ZWE Annex 1: Final response from Zimbabwe

6.2 Cross Border Frequency Coordination Agreements

None

6.3 National Table of Frequency Allocations

None

6.4 National Complementary Documents

None

7 References and bibliography

Zimbabwe information:

Some text extracted from:

- www.en.wikipedia.org/wiki/Zimbabwe
- www.en.wikipedia.org/wiki/Telecommunications_in_Zimbabwe
- www.netone.co.zw/netone/new.show.php?page=new.page&link=135
- www.budde.com.au/Research/Zimbabwe-Telecoms-Mobile-Broadband-and-Forecasts.html
- www.zimbabwe.embassyhomepage.com/zimbabwe_travel_information_zimbabwean_embassy_london_uk_cheap_flights_zimbabwe_hotel_deals_zimbabwe_holiday_travel_insurance.htm
- www.kubatana.net/html/archive/legisl/010404broa.asp

Economical information

Data extracted from:

- List of countries by GDP (nominal) per capita from Wikipedia: www.en.wikipedia.org/wiki/List_of_countries_by_GDP_(nominal)_per_capita
- Real Growth rate: www.indexmundi.com/zimbabwe/gdp_real_growth_rate.html
- Inflation rate: www.tradingeconomics.com/zimbabwe/indicators

Postal and Telecommunications Authority of Zimbabwe (POTRAZ) Information

- www.potraz.gov.zw/

International Telecommunication Union
Telecommunication Development Bureau (BDT)
Place des Nations
CH-1211 Geneva

E-mail: bdtmail@itu.int
www.itu.int/ITU-D/projects/ITU_EC_ACP/

Geneva, 2013