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GENERAL NOTICE

NOTICE 606 OF 2012

INDEPENDENT COMMUNICATIONS AUTHORITY OF SOUTH AFRICA

Draft
Frequency Migration Regulation
And
Frequency Migration Plan

August 2012

Draft Frequency Migration Regulation and Plan Consultation Document

PURSUANT TO SECTION 4 (1) OF THE ELECTRONIC COMMUNICATIONS ACT 2005, (ACT NO. 36 OF 2005)

HEREBY ISSUES A NOTICE INVITING COMMENTS REGARDING THE DRAFT FREQUENCY MIGRATION REGULATION AND RADIO FREQUENCY MIGRATION PLAN

1. The Independent Communications Authority of South Africa ("the Authority'), in terms of section 4, read with sections 31(4), 34(7)(c)(iii), 34(8) and 34(16) of the Electronic Communications Act (Act No. 36 of 2005), hereby gives notice and invites comments on the draft *Radio Frequency Migration Regulations and Radio Frequency Migration Plan*.

2. Interested persons are hereby invited to submit written representations, including an electronic version of the representation in Microsoft Word, of their views on the Draft Frequency Migration Regulations and Radio Frequency Migration Plan by no later than 16h00 on Friday, 28 September 2012.

3. Persons making representations are further invited to indicate whether they are requesting an opportunity to make oral representations which shall not exceed one hour. The public hearings will be held from the 8th to the 11th of October 2012.

4. Written representations or enquiries may be directed to:

The Independent Communications Authority of South Africa

Pinmill Farm Block A

164 *Katherine Street*

South Africa

Private Bag XI0002

Sandton

2146

Attention:

Mr Manyaapelo Richard Makgotlho

e-mail: rmakgotlho@icasa.org.za

5. All written representations submitted to the Authority pursuant to this notice shall be made available for inspection by interested persons from 27th of September 2012 at the ICASA Library or website and copies of such representations and documents will be obtainable on payment of a fee.

Where persons making representations require that their representation or part thereof be treated confidential, then an applications in terms of section 4D of the ICASA Act, 2000 (Act No. 13 of 2000) must be lodged with the Authority. Such an application must be submitted simultaneously with the representation on the draft regulations and plan. Respondents are requested to separate any confidential material into a clearly marked confidential annexure. If, however, the request for confidentiality is refused, the person making the request will be allowed to withdraw the representation or document in question.

Dr SS MNCUBE
CHAIRPERSON

PART 1

Draft Frequency Migration Regulations

DRAFT REGULATION
Radio Frequency Migration Regulations

SCHEDULE

1. Definitions

In these Regulations, terms used shall have the same meaning as in the Electronic Communications Act 2005 (no. 36 of 2005); unless the context indicates otherwise:

"Act" means the Electronic Communications Act, 2005 (Act No. 36 of 2005) as amended;

"ITU" means the International Telecommunications Union;

"SADC FAP" means the Southern African Development Community Frequency Allocation Plan;

"User" means a licensed or licence exempt user of the radio frequency spectrum; and

"**WRC"** means the World Radio Conference.

2. Purpose

The purpose of these regulations is to establish the framework by which the Authority may migrate users of the radio frequency spectrum under the National Radio Frequency Plan of South Africa.

3. Principles

(1) Radio frequency spectrum migration must be in accordance with the Radio Frequency Migration Plan.

(2) Radio frequency spectrum migration must be consistent with the National Radio Frequency plan.

(3) The National Radio Frequency Plan itself must be consistent with the International Telecommunications Union (ITU) Radio-regulations as updated by WRC, and with the SADC FAP.

(4) Allocations and assignments of radio frequency spectrum that are no longer in line and accordance with the National Radio Frequency Plan will be migrated.

(5) The users to be migrated shall not be entitled to be compensated by the Authority for the costs of the migration.

(6) To the extent that it is possible, the cost of migration should be minimised by considering, amongst other things, the duration of the licence and the economic life time of the equipment.

4. Process for Radio Frequency Migration

The Authority shall initiate a process of radio frequency migration in the following circumstances:

(a) As specified in the Frequency Migration Plan.

(b) Where a change in the use of a radio frequency band is required to bring the South African National Frequency Plan into line with ITU Radio-regulations or the final acts of the latest WRC.

(c) Where a change in the use of a radio frequency band is required to ensure harmonisation of the South African National Radio Frequency Plan with the SADC FAP.

(d) Where the Authority has determined that a change in use of the frequency is necessary for efficient utilisation of the radio frequency spectrum and to otherwise meet the objectives of the Act.

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

5. Preparation of a Radio Frequency Spectrum Assignment Plan

(1) A change in the use of a radio frequency band(s) must be initiated through a Radio Frequency Spectrum Assignment Plan for the radio frequency spectrum bands in the manner specified in the latest Radio Frequency Spectrum Regulations.

(2) With respect to the radio frequency migration process, a Radio Frequency Assignment Plan may include

(a) The process for migrating existing users and usages from their existing spectrum location, specifying the bands to which the users and uses will be migrated; including in-band migration where applicable.

(b) The time scale for the reallocation of the radio frequency band in question, specifying the date at which the users to be migrated should cease transmission.

(3) A Radio Frequency Spectrum Assignment Plan shall be subject to public consultation:

(a) The Authority shall publish the Radio Frequency Spectrum Assignment Plan in the Government Gazette, inviting interested persons to submit written representations as specified by the notice in the Gazette.

(b) The Authority may, after any defined period for lodging comments by interested persons has passed, hold a public hearing in respect of the application.

6. Amendment of a Radio Frequency Spectrum Licence

(1) Upon completion of the Radio Frequency Spectrum Assignment Plan, the Authority must issue a notice to users to be migrated.

(2) The notice of amendment may include the following:

(a) The date at which the licensee must cease transmitting within the frequency range of his existing assignment.

(b) The date at which the licensee may commence transmitting within the new assignment.

(c) The date within which the licensee must collect their updated radio frequency spectrum licence which contains the new terms and conditions of the new assignment, including technical parameters and whether the assignment is exclusive or shared.

7. Short title and commencement

These Regulations are called the Radio Frequency Migration Regulations 2012 and shall come into effect upon publication in Government Gazette.

PART 2

Draft Radio Frequency Migration Plan

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1 Introduction

1.1 Purpose

To develop a Radio Frequency Migration Plan with the aim of managing spectrum efficiently to the benefit of all South Africans in terms of section 2(e) of the Electronic Communications Act, 2005 (Act No. 36 of 2005) as amended ("the Act").

The plan provides for:

- Background and basis of the Radio Frequency Migration Plan.
- How the Radio Frequency Migration Plan was developed.
- Identification of the radio frequency bands where migration may be required and makes proposals regarding such frequency migration as may be required.
- The impact of the Frequency Migration Plan.
- International benchmark study on the experience of other countries with respect to matters relevant to spectrum migration.

1.2 Definitions

To avoid terminological confusion, it is useful to discuss exactly what is meant by the various terms that are used in spectrum management.

Full definitions are given in the glossary.

1.2.1 ITU Definitions

The standard definitions for spectrum management in the International Telecommunications Union (ITU) Radio regulations (Article 1) are as follows:

> ***allocation*** (of a frequency band): Entry in the Table of Frequency Allocations of a given frequency band for the purpose of its use by one or more terrestrial or space *radiocommunication services* or the *radio astronomy service* under specified conditions. This term shall also be applied to the frequency band concerned. (1.16)
>
> ***allotment*** (of a radio frequency or radio frequency channel): Entry of a designated frequency channel in an agreed plan, adopted by a competent conference, for use by one or more administrations for a terrestrial or space *radiocommunication service* in one or more identified countries or geographical areas and under specified conditions. (1.17)
>
> ***assignment*** (of a radio frequency or radio frequency channel): Authorization given by an administration for a radio station to use a radio frequency or radio frequency channel under specified conditions. (1.18).

The key element here is the clear distinction between allocation and assignment which is not always followed in certain benchmark examples.

1.2.2 Defining Spectrum Migration

It is important to define exactly what is meant by spectrum migration as this defines the scope of the plan and regulation. The ITU does not define spectrum migration as such.

In the Act, the reference to spectrum migration is clearly the migration of users of radio frequency spectrum to other radio frequency bands in accordance with the radio frequency plan. The main focus of the FMP is on migrating existing users.

Since certain issues of spectrum migration involve usage as opposed to users, it is useful to expand the definition of migration to include not just users but also uses[1].

> ***"Radio Frequency Spectrum Migration"*** *means the movement of users or uses of radio frequency spectrum from their existing radio frequency spectrum location to another.*

1.2.3 Spectrum re-farming

The term spectrum re-farming is widely used, but like spectrum migration does not have a universal definition and can mean slightly different things in different countries.

The ICT Regulation Toolkit[2] notes the following regarding spectrum re-farming:

> *Generally speaking, re-farming may be seen as process constituting any basic change in conditions of frequency usage in a given part of radio spectrum. Such basic changes might be:*
>
> 1. *Change of technical conditions for frequency assignments;*
> 2. *Change of application (particular radiocommunication system using the band);*
> 3. *Change of allocation to a different radiocommunication service.*

The term re-farming is used to describe:

- the process where a GSM operator changes the use of all or part of the spectrum used for GSM to UMTS / LTE; especially where the spectrum licence has specified the technology (as GSM) and the operator licence has to be changed[3] .

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[1] This allows spectrum migration to encompass re-farming of spectrum within assigned bands to other technologies and in-band migration such as the digitalisation of TV broadcast.

[2] The ICT Regulation Toolkit is a joint production of infoDev and the International Telecommunication Union

[3] Even where the licences are not technologically specific and it could be argued that the change in use from GSM to LTE does not require a regulator to get involved, in order to make efficient use of the spectrum it may be necessary to modify the individual assignments within the band.

- The situation where the individual assignments within a band are changed to allow more efficient use to be made of the frequency band (usually due to a change in technology).
- The process of reallocating and reassigning frequency bands where the licence period has expired, this is happening in Europe where the original GSM licences are expiring[4].

For the purposes of the plan therefore, radio frequency spectrum re-farming may be defined as follows:

> *"Radio Frequency Spectrum Re-farming" means the process by which the use of a Radio Frequency Spectrum band is changed following a change in allocation, this may include change in the specified technology and does not necessarily mean that the licensed user has to vacate the frequency.*

1.2.4 Other definitions

Where the user of a radio frequency has a change of assignment within the same band, usually to allow greater efficiency in the use of the spectrum, this may be termed **in-band migration**.

In some cases, a radio spectrum user may not only have his assignment changed in the same band, but have a new spectrum allocated in a different band. This has occurred with respect to the balancing of spectrum assignments in the GSM 900 MHz and 1800 MHz bands (refer to Appendix B 1.1.7) and may well become a feature of mobile broadband assignments in the future.

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[4] A good example is in Ireland ref: "Multi-band Spectrum Release: Release of the 800 MHz, 900 MHz and 1800 MHz Radio Spectrum Bands' – various consultations by ComReg 2012.

2 Review of Legislation and Regulations

2.1 Electronic Communications Act

2.1.1 Section 34 - Radio Frequency Plan

Section 34 of the Act deals with the National Radio Frequency Plan and as part of this, radio frequency migration.

Subsection (2) essentially contains the key statement:

.....national radio frequency plan developed by the Authority, which must set out the specific frequency bands designated for use by particular types of services.....

Referring specifically to matter of migration:

- Section 34 (7) (c) (iii), states that the Authority must:

  Co-ordinate a plan for migration of existing users, as applicable, to make available radio frequency spectrum to satisfy the requirements of subsection (2) and the objects of this Act and of the related legislation.

- Section 34 (16) states that:

  The Authority may, where the national radio frequency plan identifies radio frequency spectrum that is occupied and requires the migration of the users of such radio frequency spectrum to other radio frequency bands, migrate the users to such other radio frequency bands in accordance with the national radio frequency plan, except where such migration involves governmental entities or organisations, in which case the Authority—

  (a) must refer the matter to the Minister; and

  (b) may migrate the users after consultation with the Minister

It is clear that ICASA has the obligation and authority to plan and implement the migration of users, subject to the approval of the Minister with respect to government entities.

2.1.2 Section 31 - Radio Frequency Spectrum Licence

Section 31 of the Electronic Communication Act (2005) deals with the radio frequency spectrum licences.

- Section 31 (4) states that:

  (4) The Authority may amend a radio frequency spectrum licence—

  (a) to implement a change in the radio frequency plan;

  (b) in the interest of orderly radio frequency spectrum management;

  (c) to effect the migration of licensees in accordance with a revised radio frequency plan or the transition from analogue to digital broadcasting;

(d) if requested by the licensee concerned to the extent that the request is fair and does not prejudice other licensees; or

(e) with the agreement of the licensee.

This section clearly establishes that the ICASA has the right to amend a radio frequency licence to cater for instances listed in section 31(4) (a)-(e) of the Act.

2.1.3 Chapter 3 – Licensing Framework

Chapter 3 of the Act which in principle deals with the award of licences for individual and class licences for the provision of services. It also refers to the use of the radio frequency spectrum. This is consistent with the provisions of Section 31(1) and (2) of the Act dealing with the radio frequency spectrum licence in that a person cannot provide services, in terms of chapter 3, which requires the use of the radio frequency spectrum without a radio frequency spectrum licence.

2.1.4 Spectrum Licence Duration

The process of migrating users will not have an impact on the duration of their radio frequency spectrum licences.

2.2 Review of Regulations

2.2.1 Radio Frequency Spectrum Regulations

The Final Radio Frequency Spectrum Regulations (Notice 184 0f 2011 in Government Gazette 34172) do not elaborate further (than the Act) on the issue of migration or the related issue of the amendment of a radio frequency spectrum licence initiated by the authority.

Regulation 15 deals with the duration of a radio frequency spectrum licence

- Regulation 15 (1) stipulates that *The grant of a Radio Frequency Spectrum Licence and assignment[5] must not be construed as conferring upon the holder a monopoly of the use of the frequency or a right of continued tenure with respect of the frequency;*
- Regulation 15 (2) stipulates that, *unless otherwise specified, a Radio Frequency Spectrum Licence remains valid for one year and thereafter is renewable upon payment of the annual licence fee.*

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[5] There is a semantic difference between licence and assignment. The assignment is the right of use of a specific frequency or frequency band, the licence is the document giving the assignment. Where a user is migrated from one spectrum location to another, his licence may be amended to give a new assignment and change other terms and conditions.

- Regulation 15 (3) stipulates that where an assignment is issued in the Amateur Radio, Aeronautical, Maritime, Citizen Band frequency bands or for Ski Boats, the radio frequency spectrum licence can be renewed for a maximum period of 5 years.

2.2.2 Terrestrial Broadcasting Frequency Plan

The Final Terrestrial Broadcasting Frequency Plan (Notice 1538 of 2009 in Government Gazette 32728) deals with the planning of the broadcast bands in South Africa including the digitalisation programme and the vacation of broadcast channels from the 800 MHz frequency band following the 2006 regional radio conference in Geneva (GE06), which in turn was derived from resolutions made in WRC 07.

This plan is being currently updated and will reflect the WRC12 resolutions on the migration of broadcast channels from the 700 MHz band.

This plan essentially deals with the conversion of analogue to digital Television and the subsequent migration of the existing TV channels to a new spectrum location. The key issues of interest are that there is a period during which broadcasts continue simultaneously in analogue and digital until the analogue channels are switched off.

2.3 Overview of rights and responsibilities

2.3.1 Radio frequency spectrum rights

Neither in the Act, nor in the regulations are there any rights on the parts of users to retain spectrum. The spectrum licence is currently valid for one year only and a spectrum assignment can be revoked at any time. As the International benchmark study (refer to Appendix B (1) indicates, this is not unique to South Africa and many administrations retain the ultimate right to decide on the use of the spectrum at any time, notwithstanding the procedures for withdrawal, amendment or suspension of a licence.

The process for spectrum migration shall include the following:

- a consultation process,
- consideration of the economic lifetime of the equipment,
- the identification of alternative frequencies for users who have to be migrated out of a frequency band,
- advance planning along with an adequate time frame,
- consideration of the duration of the radio frequency spectrum licence,
- consideration of the duration of a broadcast licence.

2.3.2 Responsibilities

ICASA is the responsible body for frequency migration planning.

ICASA has the obligation to consult with the Minister[6] on various issues, notably where migration involves government entities and organisations.

[6] Section 34 (16) of the Act

3 Principles Governing Frequency Migration

3.1 Identification of Bands are subject to Frequency Migration

Bands are identified for radio frequency migration according to the following hierarchy

- First Level – where the ITU radio regulations / decision of a World Radio Conference (WRC) require a change in national allocation that will require existing users to be migrated.
- Second Level - where a Regional Radio Conference require a change in national allocation that will require existing users to be migrated
- Third Level – where the SADC Frequency Allocation Plan (FAP) requires a change in a change in national allocation that will require existing users to be migrated.
- Fourth Level – a decision is taken to change the use of a frequency band at national level and this requires the migration of existing users.

3.2 Process

The process of frequency migration is carried out in a manner consistent with the radio frequency spectrum regulations and the generic process is described in the draft frequency migration regulation that is attached to this draft plan. The key processes are:

- Preparation of a Radio Frequency Spectrum Assignment Plan
- Amendment of a Radio Frequency Spectrum Licence

When it has been established that migration is required, then the critical issue is to determine the time frame in a manner consistent with sound radio frequency spectrum management.

3.3 Time Frame for Migration

In principle, ICASA can migrate a user to another location as part of sound radio frequency spectrum management. However, an appropriate time frame should be applied as a matter of standard practice.

In determining the time frame, the following factors should be taken into account:

- the duration of the spectrum licence,
- the time frame to migrate existing customers (end users)
- the economic life of the equipment installed,
- adequate forward planning

3.3.1 Duration of the radio frequency spectrum licence

The radio frequency spectrum licences in South Africa are in principle granted for a one year period, the multi-year licences will be restricted so that any migration will not fall within the period of a multi-year licence.

3.3.2 Time Frame to migrate existing end users

The issue of the migration of existing users is a key determinant of a spectrum migration time frame. The issue arose in the past with cessation of the analogue mobile phone systems and the migration to GSM and is currently an issue with respect to broadcasting. In Europe, the main controversy is with regard to proposed plans to terminate VHF FM and possibly Medium Wave broadcasting and as a result of this opposition; the termination of FM does not seem likely in the short term. There has been less opposition to the cessation of analogue television broadcasts.

The critical area in South Africa is the digitalisation of TV where end users have to obtain a digital-to-analogue box to accommodate digital signals to their existing televisions before analogue switch off in 2015.

Potential areas that may arise in the future include:

- Conversion of existing cellular frequencies to HSPA/ LTE.
    - Because of the large number of GSM customers with voice / text only phones and the availability of other bands for mobile broadband, it is unlikely that GSM bands will be shut off any time soon.
    - A switch over from 3G / HSPA to LTE – if this ever occurs would involve a time frame of 3-5 years to accommodate the life cycle of the end-terminal equipment.
- Switch off of analogue radio. This is unlikely to occur within the time frame envisaged by this spectrum migration strategy.

3.3.3 Economic life of the equipment installed

It should not be automatically assumed that a change in frequencies will require new transmission equipment; it is entirely possible that the equipment can be retuned at relatively low cost.

In terms of the economic lifetime of the equipment, SABRE 2 which was gazetted in August 2001, planned for switchover deadline of December 2005 for the services subject to migration which was a time frame of just under 5 years. This was at a time when the technological life-cycle was longer than it is today.

3.3.4 Adequate Forward Planning

Probably the most important factor for a frequency migration is the allowance of sufficient time for adequate forward planning. In terms of the overall process this may include:

- Proper time for consultation.
- Band planning.
- Adequate time for existing users of the spectrum to migrate out.
- Adequate time required for dual illumination during a switchover period subject to no interference.

In terms of the time frame, the critical determinant is the earliest time in which new users can begin transmitting as this will be the final date at which existing users cease transmitting. In principle, there is little to be achieved by shutting down existing transmission before new licensees are ready to start transmitting.

3.3.5 Conclusions regarding time frame.

It is proposed that the forward looking time frame for a process of spectrum migration should be 3-5 years from the moment of announcement, unless otherwise specified.

To ensure that there is no confusion, where there are multi-year radio frequency spectrum licences, these should generally not exceed 5 years. Where there is a spectrum migration planned for a particular frequency band, there is nothing to stop a licence being issued for the period up to the date at which transmission should cease if the licensee is able to 'live with' this.

4 Development of the Radio Frequency Migration Plan

4.1 Background

The table below illustrates the time line of documents and conferences that informs the creation of this radio Frequency Migration Plan.

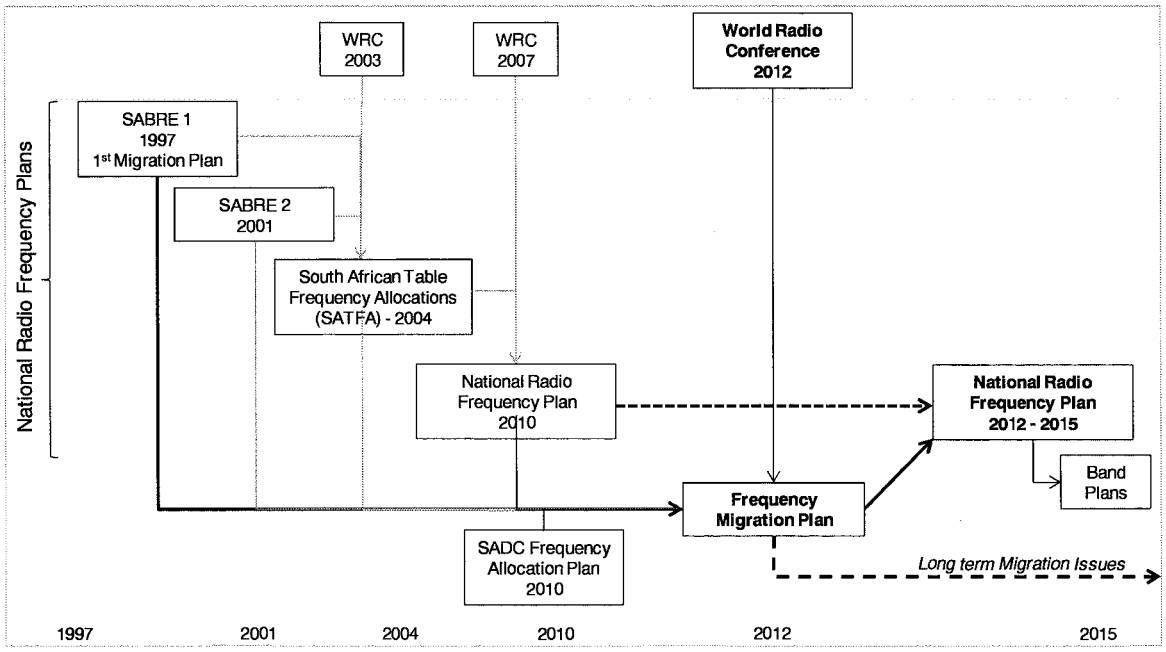

Figure 1 Time Frame and events informing Frequency Migration Plan

The radio Frequency Migration Plan reflects all relevant activities to date and comments on potential long term migration issues.

4.2 International Context

The use of the Radio Frequency Spectrum is fundamentally determined through the ITU Radio Regulations which are established by treaty and modified by treaty in the form of the Resolutions of the World Radio Conferences in which South Africa has participated since 1994. South Africa fundamentally follows the allocations in the Radio Frequency Plan for Region 1 in the ITU Radio Regulations and the primary driver for a change in use is a change in allocation stemming from a World Radio Conference Resolution.

As Region 1 also includes Europe, it is common for South Africa to harmonise the way it uses and manages frequency bands with Europe on the grounds that this facilitates coordination and allows South Africa to benefit from potential economies of scale with regard to equipment as well being able to capitalize on existing development work.

South Africa also participates in the African Telecommunications Union and again will seek to harmonise its frequency allocations with other African countries.

For Southern Africa, South Africa is part of SADC, the Southern African Development Community. South Africa has actively participated in the preparation of the SADC Frequency Allocation Plan (SADC FAP) and to keep the National Radio Frequency Plan as harmonised as possible with the latest version of the SADC FAP is necessary to maintain international co-ordination with neighbouring countries.

4.3 Approach to development of FMP

The Radio Frequency Migration Plan is drawn up using the latest National Radio Frequency Plan (NRFP 2010) as a baseline.

As a first step, a check is made as concerning the frequency migrations proposed in SABRE[7] (see below) with respect to the following:

- Whether the migration as proposed (both from and to other bands) has been carried out and
- If certain services still continue to occupy the original band, whether these services should still be migrated or if this now irrelevant in the present context. This is carried out by:
    - Evaluating the current utilization of these bands by the incumbent
    - Determining whether these bands could be put to better use

In the next step, the proposals in the SADC Frequency Allocation Plan 2010 (SADC FAP 2010) are considered for relevancy in the Republic of South Africa. In terms of relevancy, points under consideration are:

- Whether the bands proposed for alternate use by SADC are being currently utilized (by whom and to what extent).
- If there is a global trend and perceived economic benefit in migrating the current users to accommodate new services.

The third step involves looking at the resolutions adopted at the World Radiocommunication Conference (WRC) 7 and 12 applicable to Region 1 and determine applicability for South Africa. Similar criteria as used to evaluate SADC proposals would be applied here.

The fourth step involves identifying South Africa specific migration issues.

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[7] The Revision of South African Frequency Allocation Plans (Band Plans) and Migration Strategies – Notice 759 of 1997 – which covered 20MHz to 3 GHz (SABRE-1) and 3.4GHz to 3.6 GHz.

In this manner, all matters of significance from global, regional and national context along with the historical activities around migration are awarded due consideration in drafting the frequency migration plan.

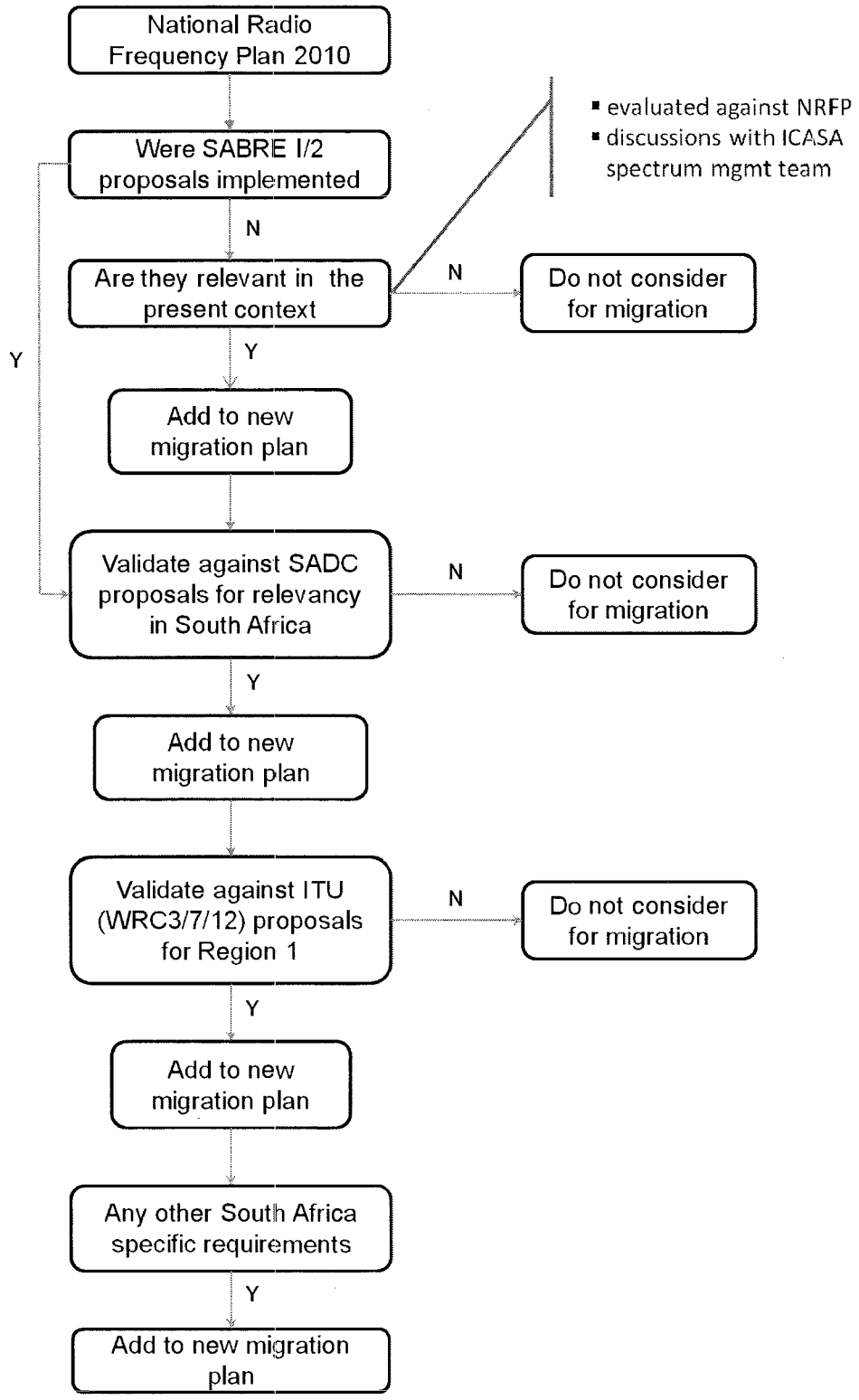

Figure 2 Process for Development of Frequency Migration Plan

4.4 SABRE 1 and SABRE 2

There were two South African Band Re-planning Exercises (SABRE) carried out in 1997 and 2001. SABRE 1 has been the most comprehensive spectrum migration exercise to date.

- SABRE I – in 1997 addressing the radio frequency spectrum between 20MHz and 3 GHz, and between 3.4 – 3.6 GHz
- SABRE II – in 2001 addressing radio frequency spectrum above 3 GHz with the exception of those bands already addressed in SABRE I

4.4.1 SABRE 1 – 1997

SABRE 1[8] was a significant programme to re-plan the radio frequency in line with the ITU Region 1 frequency allocation plan from 20 MHz to 3GHz and to migrate users that either did not accord with the existing allocation plan or prevented efficient use of the spectrum. A prime example of this was the drive to migrate fixed links to over 3 GHz. SABRE 1 was extended to cover 3.4 – 3.6 GHz

The primary services which were targeted for this exercise were

- Fixed links – plan to migrated the fixed links (wherever possible) to higher frequencies above 3 GHz. The primary rationale was that the frequency below 3 GHz was prime estate for mobile communications and should be reserved for that purpose
- Mobile services in VHF High Band – plan for migrating existing services such as paging, alarms, municipal and governmental authorities into bands reserved for their use. Migrate in mobile services into the cleared band
- Paging services – consolidate paging services into bands specifically allocated for that purpose. This would include low power paging, amateur, regional and other paging system
- Alarms – consolidate alarm systems into specific bands

4.4.2 SABRE 2 – 2001

SABRE 2[9] was a programme to re-plan the radio frequency spectrum from 3GHz to 70 GHz (with the exception of 3.4 – 3.6 GHz which was part of SABRE 1), partly driven by the need to in-migrate fixed-links from below 3Gz.

Extracts from SABRE 2 are given in the appendix (1.3Appendix C).

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[8] The Revision of South African Frequency Allocation Plans (Band Plans) and Migration Strategies – Notice 759 of 1997 – which covered 20MHz to 3 GHz (SABRE-1) and 3.4GHz to 3.6 GHz.

[9] Radio frequency spectrum band plan covering the range 3 GHz to 70 GHz – (SABRE-2) Notice 1920 of 2001

4.4.3 Analysis of SABRE

The analysis conducted shows that the following migration of services out of specified bands as proposed under SABRE (1 and 2) did not take place.

Table 1 SABRE planned allocations that have not been implemented

Frequency Band (MHz)	Planned allocation under SABRE	Current allocation in NRFP 2010
53.025 – 53.225	Low power paging	Wireless Microphones (53 -54 MHz)
(81 – 81.625 BTX) paired with (86.375 - 87 MTX)	Dual frequency alarms/ Mobile	Mobile 7 BTX only
141 – 142	None	Remote controlled industrial apparatus (should be in the ISM band)
150.05 – 151	Wide area paging	Wildlife telemetry tracking 148-152 MHz
(165.55 – 167.4875) paired with (172.05 – 173.9875)	BTX-DF (165.55 – 167.4875 MHz) MTX-DF(172.05 – 173.9875 MHz)	MTX-DF (165.55 – 167.4875 MHz) BTX-DF(172.05 – 173.9875 MHz)
240 – 246	DAB	International distress (239 MHz)
278 - 286	FLEX outbound paging services	SF Mobile
406.1 – 410	SF links only	Fixed links (406.1 – 407.625 MHz) paired with (416.1 – 417.625 MHz) Fixed links (407.625 – 410 MHz) paired with (417.625 – 420 MHz)
426.1 – 427.625	Public trunking	SF links (426.1 – 430 MHz)
427.625 – 430	urban–government and public safety rural – SF links	SF links (426.1 – 430 MHz) only
(454.425 – 460) paired with (464.425 – 470)	Mobile trunking MTX (454.425 – 460 MHZ) BTX (464.425 – 470 MHz)	Mobile trunking BTX (454.425 – 460 MHZ) MTX (464.425 – 470 MHz)
463 – 463.975	SF Mobile out of the band	SF Mobile
876 – 880	Digital trunking	Mobile Wireless Access (824 – 849 MHz paired with 869 - 894 MHz)
925 – 925.4	Two-way paging (FLEX inbound)	No allocation
1885 – 1980	FPLMTS (satellite)	No allocation

Frequency Band (MHz)	Planned allocation under SABRE	Current allocation in NRFP 2010
1980 – 2010/ 2170 - 2200	Mobile – Satellite (earth – to – space)	Fixed links 1980 – 2010 MHz paired with 2170 – 2200 MHz
21400 – 22000	Broadcasting satellite service	Fixed links

4.5 National Radio Frequency Plans

After SABRE, there have been two national radio frequency plans, SATFA and the NRFP 2010.

4.5.1 The South African Table of Frequency Allocations 2004

SATFA: The South African Table of Frequency Allocations 2004[10] consolidated SABRE 1 and SABRE 2 in one plan covering the range 20MHz to 70 GHz.

This plan is discussed in the appendix (1.3Appendix D) with respect to frequency migration.

4.5.2 National Radio Frequency Plan 2010

The National Radio Frequency Plan 2010[11] updated SATFA 2004[12] and extended the frequency range covered (now 9 kHz – 3000 GHz). Its stated aim was to incorporate the decisions taken by WRC and include updates on the Table of Frequency Allocations extending up to 3000GHz.

This plan is discussed in the appendix (1.3Appendix E) with respect to frequency migration.

4.6 SADC Frequency Allocation Plan (FAP)

The SADC Frequency Allocation Plan was drawn up in 2010 and guides the use of frequency in the SADC countries as spectrum coordination is required between SADC members. The allocations of the SADC FAP are largely consistent with those for South Africa and the SADC FAP is used as a reference in the preparation of the FMP.

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[10] The South African Table of Frequency Allocations (SATFA) – Notice 1442 of 2004.

[11] The National Radio Frequency Plan – Notice 727 of 2010

[12] The main reason for the name change is that the term 'National Radio Frequency Plan' is used in the ECA.

4.7 ITU World Radio Conference resolutions

The following resolutions from the World Radio Conferences have been taken into consideration. The primary focus is on WRC12, however 4 resolutions from WRC07 have also been analysed. WRC12 is discussed in the annex (1.3Appendix F).

Table 2 WRC resolutions

Frequency Band (MHz)	WRC	Res. No.	Resolution
108 - 117.975	12	413	Use by aeronautical mobile (R) service without interfering with existing ARNS systems
450 – 470	7	224	Frequency bands for the terrestrial component of International Mobile Telecommunications below 1 GHz
690 – 794	12	232	Use of the frequency band 694-790 MHz by the mobile, except aeronautical mobile, service in Region 1 and related studies
790 – 862	12	224	Frequency bands for the terrestrial component of International Mobile Telecommunications below 1 GHz
960 – 1164	12	417	Use of 960 – 1164 MHz by aeronautical mobile (R) service meeting standard and recommended practice
1518 - 1544 1545 - 1559 1610 - 1626.5 1626.5 - 1645.5 1646.5 - 1660.5 1668 - 1675 2483.5 - 2500	12	225	Use of additional frequency bands for the satellite component of IMT
1525 – 1559/ 1626.5 – 1660.5	12	222	Use of 1525-1559 MHz and 1626.5-1660.5 MHz by the mobile-satellite service, and procedures to ensure long-term spectrum access for the aeronautical mobile-satellite (R) service
1885 – 2025/ 2100 - 2200	7	212	Implementation of International Mobile Telecommunications in the bands 1885-2025 MHz and 2110-2200 MHz
2300 – 2400	12	223	Additional frequency bands identified for IMT
5150 – 5250/ 5250 – 5350/ 5470 - 5725	12	229	Use of the bands 5150-5250 MHz, 5250-5350 MHz and 5470-5725 MHz by the mobile service for the implementation of wireless access systems including

Frequency Band (MHz)	WRC	Res. No.	Resolution
			radio local area networks
15400 – 15700	7	614	Use of the band 15.4-15.7 GHz by the radiolocation service
22550 – 23150	7	753	Use of the band 22.55-23.15 GHz by the space research service

4.8 Key issues with respect to migration

The following explains the approach to key issues regarding the frequency migration plan:

Broadcasting Service

- DTT – Digital Terrestrial Television. The process of moving TV services from analogue to digital (and corresponding in-band migration) is in progress. The plans need to be updated following the WRC 12 along with the allocation of the 700 MHz band to IMT and the corresponding need to consolidate UHF TV broadcasting to the 470-692 MHz UHF band in line with the original Draft Broadcasting Digital Migration Framework (Government Gazette number 31490). The freed spectrum that has been reallocated to IMT in the 800 MHz (WRC07) and 700 MHz band will be the major spectrum resource for mobile broadband.
- Studio Links – These are point-to-point links connecting broadcast studios to transmitters that have been part of the broadcast frequency bands, especially the 800MHz band. With the reallocation of the 700MHz and 800 MHz band to IMT, these studio links also need to be migrated out. They should be given assignments in the bands allocated for Fixed Point to Point links.
- Self Help Stations – These are repeater stations rebroadcasting television channels to limited areas on a low power basis[13]. These must be migrated into the broadcast bands below 692 MHz.

Mobile Service

- Mobile broadband. 'Mobile' broadband is an important use of radio frequency spectrum at the current time and there is a large demand for spectrum in several bands for this purpose. As such, mobile broadband is the service that is most likely to require the migration of other services to accommodate its spectrum needs. The allocation of spectrum for mobile broadband / IMT has already been done via WRC

[13] Refer to 'Review of Self-Help Stations' – ICASA Position Paper February 2006 and 'Inquiry into Self Help Stations' – ICASA Discussion document of December 2004.

resolutions for ITU region 1 as well as per SADC proposed common sub-allocation/ utilization. This ensures that equipment is readily available and a harmonized service can be provided both across the Southern African region as well as other countries in Region 1

- Paging – Paging was still considered to be a major service at the time of SABRE, however (due mainly to GSM) the use of paging services is declining to the point where it will only be used in certain niche areas such as hospitals. SABRE aimed to consolidate paging channels and planned specific migration to achieve this; however this is probably no longer relevant. It is expected that the remaining principle use will continue to be in medical environments where current allocations for low-power paging services would be more than adequate to meet the demand. Accordingly, the SABRE plans for paging can be discounted.
- Alarms – There are a large number of assignments in the bands allocated for alarms and the bands are generally highly utilised. If the present trend of demand for new assignments continues, there are two options:
    - Direct users to convert to a newer technology that is more spectrally efficient and can be accommodated in the existing spectrum allocation.
    - Allocate more spectrum for Alarms in adjacent bands.
- Public Safety: It is proposed that:
    - All public safety services should be consolidated in the same radio frequency band (380 – 400 MHz)
    - It is recommended that where possible public safety users should adopt a common standard. This would have multiple benefits including economic benefits borne out of infrastructure sharing as well as increased effectiveness due to interoperability between users using a common equipment base.

4.9 Proposed Migration Plan

The following table deals with all bands where there is a potential frequency migration issue. The motivation for a migration is either that it is an original SABRE proposal, stems from WRC resolutions and the SADC FAP or is a 'New ICASA' proposal for migration.

Column 1 indicates the frequency range.

Column 2 states the existing allocation in the National Radio Frequency Plan 2010 and also any applications that are mentioned in the NRFP. As is the standard practice for frequency plans, primary allocations are in UPPER CASE, secondary allocations are in Lower Case. Applications are (within brackets).

Column 3 indicates the proposals for new allocations and utilization. The proposed allocation is indicated along with the source of the proposal (SABRE, WRC, SADC FAP, New ICASA proposals).

Column 4 contains notes on any migration issues.

This table only includes those bands where frequency migration is under consideration.

Table 3 Proposed migration plan

Frequency Band (MHz)	Existing Allocation in NRFP 2010 (Applications)	Proposed Allocation/ (Utilization)	Notes on migration/ usage
75.2 – 87.5	MOBILE except aeronautical mobile (Private and communal repeaters)	Allocate (81 – 81.625 MHz) BTX paired with (86.375 – 87 MHz) MTX for dual frequency (DF) alarms as per SABRE DF and SF links remain as-is	Migrate in DF alarms in line with original SABRE 1 proposed allocation (SABRE proposal, refer 4.4) Other SF / DF links can be maintained for use in private/ communal repeaters (refer to 4.11.1)
138 – 143.6	MOBILE Fixed (SF alarms, SF Mobile, MTX-BTX paired links, Remote controlled industrial apparatus)	Expand allocation for SF Alarms to (140.5 – 141.5 MHz) Mobile 1 MTX-BTX pairing remain as-is	Migrate SF Mobile (141 – 141.5 MHz) out of this band and allocate for SF alarms (New ICASA Proposal)[14] Migrate remote controlled industrial apparatus from 141 – 142 MHz to ISM Band (New ICASA Proposal) (refer to 4.11.2)
150.05 – 153	FIXED MOBILE except aeronautical mobile (Alarms, telemetry, SF Mobile and paging[15])		152.05 – 152.55 MHz should be exclusively allocated to SF alarms. All other users must migrate out of this band (refer to 4.11.3)
156.4875 –	MARITIME MOBILE	Maritime Distress	Migrate any SF mobile

[14] Proposal only if alarm systems cannot be migrated to more spectrally efficient technologies

[15] Alarms, SF Mobile. In-house paging and load shedding (148.95 – 151 MHz); SF Alarms (152.05 – 152.55 MHz); Government Service Wildlife Telemetry Tracking (148 – 152 MHz); SF Mobile (152.55 – 153.05 MHz)

Frequency Band (MHz)	Existing Allocation in NRFP 2010 (Applications)	Proposed Allocation/ (Utilization)	Notes on migration/ usage
156.5625	(distress and calling via DSC) FIXED MOBILE (Maritime Radio-navigation and location (radar), SF mobile in inland areas)	(distress and calling via DSC) SF Mobile (in in-land areas)	(156.375 – 156.7625 MHz) operating inland in the vicinity of water-bodies out of this band (in accordance with ITU Appendix 18) (refer to 4.11.4)
156.8375 – 174	MOBILE except aeronautical mobile (R) Mobile Satellite Services (Earth-to-space)	Migrate BTX-DF (165.55 – 167.4875 MHz) to (172.05 – 173.9875 MHz) swap with the MTX-DF band	Allows for contiguous spectrum for MTX and BTX (currently MTX lies between the BTX assignments and vice-versa) (refer to 4.11.5)
174 - 223	BROADCASTING (TV)	TV Broadcasting (174 – 214 MHz) T-DAB (214 – 230 MHz) As per SADC FAP proposed common sub-allocation/ utilization	TV Band III (GE-06 applies) Migration from analogue to digital in accordance with planned SADC timelines T-DAB would be the new service introduced in this band (refer to 4.11.6)
214 – 230	BROADCASTING (TV)	T-DAB (214 – 230 MHz) As per SADC FAP proposed common sub-allocation/ utilization	TV Band III (GE-06 applies) Migration from analogue to digital in accordance with planned SADC timelines T-DAB would be the new service introduced in this band

Frequency Band (MHz)	Existing Allocation in NRFP 2010 (Applications)	Proposed Allocation/ (Utilization)	Notes on migration/ usage
			(refer to 4.11.7)
235 – 267	BROADCASTING (TV) MOBILE	235 – 238 MHz TV Broadcasting (DTT) 238 – 242.95 MHz PMR 242.95 – 243.05 MHz International Distress 243.05 – 246 MHz Low power devices 246.18 – 254.18 MHz TV Broadcast (DTT) (Channel 13) 254 – 267 MHz PMR as per SADC FAP proposed common sub-allocation/ utilization	TV Band III (GE-06 applies) Migration from analogue to digital in accordance with planned SADC FAP timelines Migration as per SADC FAP proposed common sub-allocation/ utilization (refer to 4.11.8)
335.4 - 387	FIXED MOBILE	335.4-336 MHz/ 346.0-356.0 MHz/ 366.0-380.0 MHz PMR and/or PAMR 336-346 MHz paired with 356-366 MHz Fixed Wireless Access/ PTP/PTMP rural system (as per SADC FAP proposed common sub-allocation/ utilization)	Migrate existing fixed links to above 3 GHz as per SADC proposed common sub-allocation/ utilization (refer to 4.11.9)
380 – 400	FIXED (380 – 387 MHz) MOBILE (380 – 400 MHz) (Public safety, SAPS, DOD, Army etc)	380.0-387.0 MHz paired with 390.0-397.0 MHz for digital systems to be used for PPDR 387.0-390.0 MHz paired with 397.0-399.9 MHz. To be used mainly for digital systems (PMR and/or PAMR) (SADC FAP proposed	Consolidate all public safety services into this band, migrating all users falling into this category into this band (New ICASA proposal) Other links to be migrated out as per SADC FAP proposed common sub-allocation/

Frequency Band (MHz)	Existing Allocation in NRFP 2010 (Applications)	Proposed Allocation/ (Utilization)	Notes on migration/ usage
		common sub-allocation/ utilization)	utilization (refer to 4.11.10)
405 – 430	FIXED Mobile except aeronautical mobile (Government services, Mobile Data and public trunking)	PMR and/ or PPDR (SADC FAP proposed common sub-allocation/ utilization) Public digital trunking only (New ICASA proposal)	Migrate government services (especially SAPS) to public safety band 380 – 400 MHz, Mobile Data - Migrate Mobile Data users out of this band Band reserved for Public Digital Trunking (New ICASA proposal) (refer to 4.11.11)
440 – 450	FIXED Mobile except aeronautical mobile (Short range business radio and PMR)	Short range business radio and PMR (New ICASA proposal) Other allocations stay as-is	Other users to be migrated out of the sub-band for Short-range business radio (440 – 440.1/ 445 – 445.1 MHz) (New ICASA proposal) (refer to 4.11.12)
450 – 470	FIXED MOBILE (Trunked Mobile Railways, Mines etc)	Mobile (IMT) as per WRC-07 (Res. 224)	Migrate existing users out of this band (refer to 4.11.13)
694 – 790	BROADCASTING RADIO ASTRONOMY	IMT (Terrestrial) (WRC-12)	Digital Dividend 2; DTT bands between 470 – 690 MHz Planned migration of TV out of this band by 2015 Migrate studio links out Migrate self-help stations below 692 MHz (refer to 4.11.14)
790 – 862	FIXED	IMT (Terrestrial) (WRC-	Digital Dividend 1; DTT

Frequency Band (MHz)	Existing Allocation in NRFP 2010 (Applications)	Proposed Allocation/ (Utilization)	Notes on migration/ usage
	BROADCASTING MOBILE except aeronautical mobile (TV Broadcast including fixed links (Secondary transmitter links))	07)	bands between 470 – 690 MHz Align with the on-going efforts within the 800 MHz band as defined in Notice 911 of 2011 Government Gazette 34872. Migrate studio links out. Migrate self-help stations below 692 MHz (refer to 4.11.15)
862 – 890	FIXED MOBILE except aeronautical mobile (Wireless audio (863-865 MHz), Fixed links (868.1–876 MHz), RFID (865 – 868 MHz), RFID (869.4- 869.65 MHz) Alarms (868.6 – 868.7 MHz, 860.25 – 869.3 MHz, 869.65 – 869.7 MHz) Wireless Access Services (824-849 MHz paired with 869-894 MHz) Mobile (880-890 MHz paired with 925-935 MHz))	Mobile (IMT) (as per SADC FAP proposed common sub-allocation/ utilization)	Migrate to IMT as per SADC FAP proposed common sub-allocation/ utilization to facilitate development of harmonized channelling arrangement (refer to 4.11.16)
890 – 942	MOBILE except aeronautical mobile (Mobile (890-915 MHz paired with 925-935 MHz)	Allocate 921 – 925 MHz for GSM-R (New ICASA proposal) All other allocations maintained as-is	Allocate 921 – 925 MHz to GSM-R. (SABRE 1 proposal to allocate this band for Digital Trunking was never implemented)

Frequency Band (MHz)	Existing Allocation in NRFP 2010 (Applications)	Proposed Allocation/ (Utilization)	Notes on migration/ usage
	Several RFID systems (915.1 – 921 MHz), (GSM900 band)		(refer to 4.11.17) Spectrum re-farming when deemed required may be carried out based upon defined process (refer to 4.13)
942 – 960	MOBILE except aeronautical mobile (GSM 900)		No migration planned Spectrum re-farming when deemed required may be carried out based upon defined process (refer to 4.13)
1350 – 1375 paired with 1492 – 1517 1375 – 1400 MHz paired with 1427 – 1452	FIXED (Fixed low capacity PTP DF links)	Rural BFWA (New ICASA proposal)	Allocate to rural BFWA; maintain existing links where required (refer to 4.11.19)
1452 – 1492	BROADCASTING BROADCASTING-SATELLITE (T-DAB and S-DAB (L-band))	FWBA/ PTP/ PMP/ LMR (New ICASA proposal)	Currently allocated to T-DAB (1452 – 1479.5 MHz) and S-DAB (1479.5 – 1492) Propose to align allocation with ITU Region 1 (New ICASA proposal) (refer to 4.11.20)
1518 – 1525	FIXED MOBILE-SATELLITE (space-to-earth)	Band is currently not occupied; potential application for LMR repeaters (New ICASA proposal)	Migrate in fixed links for LMR repeaters, band could also be used for outside-broadcasting links currently operating in 2300 – 2450 MHz (New ICASA proposal) (refer to 4.11.21)
1525 – 1559	(1525 – 1530 MHz)	potential application for LMR repeaters	Migrate in fixed links for LMR repeaters, band

Frequency Band (MHz)	Existing Allocation in NRFP 2010 (Applications)	Proposed Allocation/ (Utilization)	Notes on migration/ usage
	SPACE OPERATION (space-to-earth) FIXED MOBILE-SATELLITE (space-to-earth) Earth exploration satellite Mobile except aeronautical mobile (Mobile satellite services)	(New ICASA proposal)	could also be used for outside-broadcasting links currently operating in 2300 – 2450 MHz (New ICASA proposal) (refer to 4.11.22)
	(1530 – 1535 MHz) SPACE OPERATION (space-to-earth) MOBILE-SATELLITE (space-to-earth) Earth exploration satellite Mobile except aeronautical mobile Fixed (Mobile satellite services)		No migration planned (refer to 4.11.22)
	(1535 – 1559 MHz) MOBILE-SATELLITE (space-to-earth)		No migration planned (refer to 4.11.22)
1668 – 1675	(1668 – 1668.4 MHz) MOBILE SATELLITE (earth-to-space) RADIO ASTRONOMY SPACE RESEARCH (passive)	(refer to 4.11.23)	Propose to align allocation with ITU Region 1 (New ICASA proposal) (refer to 4.11.23)
	(1668.4 – 1670 MHz)	(refer to 4.11.23)	Propose to align

Frequency Band (MHz)	Existing Allocation in NRFP 2010 (Applications)	Proposed Allocation/ (Utilization)	Notes on migration/ usage
	METEOROLOGICAL AIDS MOBILE SATELLITE (earth-to-space) RADIO ASTRONOMY		allocation with ITU Region 1 (New ICASA proposal) (refer to 4.11.23)
	(1670 – 1675 MHz) METEOROLOGICAL AIDS MOBILE MOBILE SATELLITE (earth-to-space)	(refer to 4.11.23)	Propose to align allocation with ITU Region 1 (New ICASA proposal) (refer to 4.11.23)
1710 – 1785 paired with 1805-1880	FIXED MOBILE (GSM1800 band)		No migration planned Spectrum re-farming when deemed required may be carried out based upon defined process (refer to 4.13)
1880 – 1900	FIXED MOBILE (Cordless DECT phone)	FWA (SADC FAP proposed common sub-allocation/ utilization)	Currently under use by Telkom in a WLL configuration. Can be allocated for FWA (refer to 4.11.24)
1920 – 1980 paired with 2110 – 2170	FIXED MOBILE (Current 3G band)		No migration planned Spectrum re-farming when deemed required may be carried out based upon defined process (refer to 4.13)
1980 – 2010 paired with 2170-2200	FIXED MOBILE-SATELLITE (Earth-to-space) (Fixed Links (DF), IMT (Satellite))	Fixed Links (DF), BFWA (New ICASA Proposal)	Migrate in Fixed links (DF) from other bands; consider for BFWA (New ICASA proposal) (refer to 4.11.25)
2025 – 2110 paired with 2200 -	FIXED	Fixed Links (DF)	Fixed links – currently under-utilized.

Frequency Band (MHz)	Existing Allocation in NRFP 2010 (Applications)	Proposed Allocation/ (Utilization)	Notes on migration/ usage
2285	(Fixed links)	BFWA (New ICASA proposal)	Migrate in Fixed links (DF) from other bands (refer to 4.11.26)
2110 – 2170	FIXED MOBILE (Current 3G band)		No migration planned Spectrum re-farming when deemed required may be carried out based upon defined process (refer to 4.13)
2290 – 2300	FIXED	BFWA (as per SADC FAP proposed common sub-allocation/ utilization)	Band currently unused; can be allocated for BFWA as per SADC FAP proposed common sub-allocation/ utilization (refer to 4.11.27)
2300 – 2450	FIXED MOBILE Amateur (Fixed links (2307 – 2387 MHz) paired with (2401 – 2481 MHz) Several outside broadcasting links ISM band (2400 – 2483.5 MHz))	IMT (Terrestrial) 2300 – 2400 MHz as per SADC FAP proposed common sub-allocation/ utilization	Migrate existing fixed links above 3 GHz (refer to 4.11.28)
2500 – 2690	2500-2520 MHz FIXED MOBILE except aeronautical mobile		Currently being used by Sentech (2500 – 2550 MHz) and WBS (2550 – 2565 MHz). 125 MHz available for assignment Align with the on-going efforts within the 800
	2520-2655 MHz FIXED MOBILE except	BFWA Mobile IMT	

Frequency Band (MHz)	Existing Allocation in NRFP 2010 (Applications)	Proposed Allocation/ (Utilization)	Notes on migration/ usage
	aeronautical mobile Radio astronomy 2655-2690 MHz FIXED MOBILE except aeronautical mobile Radio astronomy	(as per SADC FAP proposed common sub-allocation/ utilization)	MHz band as defined in Notice 911 of 2011 Government Gazette 34872. (refer to 4.11.29)
3400 – 3600	FIXED MOBILE except aeronautical mobile	BFWA Mobile IMT (as per SADC FAP proposed common sub-allocation/ utilization)	Band needs harmonizing in SADC for IMT; channelling plan to be developed (refer to 4.11.30)
3600 – 4200	FIXED FIXED-SATELLITE (space-to-earth) (Satellite (VSAT, downlink), Terrestrial backhaul)	(3600-4200 MHz) Fixed services (PTP) (3600-4200 MHz) Fixed-satellite (space-to-Earth) (PTP/VSAT/SNG) (3600-3800 MHz) Broadband Fixed Wireless Access (BFWA) as per SADC FAP proposed common sub-allocation/ utilization	Migrate VSAT to Ku band, and use 3600 – 3800 for BFWA as per SADC FAP proposed common sub-allocation/ utilization (refer to 4.11.31)
5150 – 5350	(5150 – 5250 MHz) AERONAUTICAL RADIONAVIGATION FIXED-SATELLITE-SERVICE (Earth-to-space) Mobile except aeronautical mobile (Wireless Access (short	Wireless Access Systems / RLAN As per SADC FAP proposed common sub-allocation/ utilization	License exempt; Wireless Access Systems / Radio Local Access Network (WAS & RLAN) indoor use only. as per Notice 184 of 2011 Government Gazette 34172 *(previously Notice number 944 of 2008 in*

Frequency Band (MHz)	Existing Allocation in NRFP 2010 (Applications)	Proposed Allocation/ (Utilization)	Notes on migration/ usage
	range))		*Government Gazette 31321)*
	(5250 – 5255 MHz) SPACE RESEARCH Mobile except aeronautical mobile		
	(5255 – 5350 MHz) EARTH EXPLORATION SATELLITE (active)		
5470 – 5725	(5470 – 5570 MHz) MARITME RADIONAVIGATION Mobile except aeronautical mobile EARTH EXPLORATION SATELLITE (active) SPACE RESEARCH (active) RADIOLOCATION (Maritime radionavigation (radar) and Wireless Access (short range))	Wireless Access Systems / RLAN As per SADC FAP proposed common sub-allocation/ utilization	No migration planned; as per as per Notice 184 of 2011 Government Gazette 34172 *(previously Notice number 944 of 2008 in Government Gazette 31321)* (refer to 4.11.32)
	(5570 – 5650 MHz) MARITME RADIONAVIGATION Mobile except aeronautical mobile RADIOLOCATION		
	(5650 – 5725 MHz) RADIOLOCATION Mobile except		

Frequency Band (MHz)	Existing Allocation in NRFP 2010 (Applications)	Proposed Allocation/ (Utilization)	Notes on migration/ usage
	aeronautical mobile Amateur Space Research (deep space)		
5725 – 5830	FIXED-SATELLITE (earth-to-space) RADIOLOCATION Amateur (ISM, Amateur, SRD)		No migration for South Africa; maintain for ISM as per Notice 184 of 2011 Government Gazette 34172 *(previously Notice number 926 of 2008 in Government Gazette 31290).*
5850 -5925	FIXED FIXED-SATELLITE (earth-to-space) Mobile (Upper C-band (VSAT, Satellite PTP links), ISM (5725 – 5875 MHz))	(5850-6425 MHz) Fixed-satellite uplinks (PTP/VSAT/SNG)/ temporary Outside broadcast links (5850-5925 MHz) FIXED links (5725-5875 MHz) ISM as per SADC FAP proposed common sub-allocation/ utilization	(refer to 4.11.34)
5925 – 6700	FIXED FIXED-SATELLITE (earth-to-space) (Fixed links/ VSAT, FSS, SNG feeder links)	5925 – 6425 MHz Fixed links 6425 – 7110 MHz Fixed links as per SADC FAP proposed common sub-allocation/ utilization	(refer to 4.11.35)
10700 – 11700	FIXED FIXED-SATELLITE (space-to-earth)/(earth-to-space)	as-is	Migrate VSAT links into this band as per SADC FAP proposed common sub-

Frequency Band (MHz)	Existing Allocation in NRFP 2010 (Applications)	Proposed Allocation/ (Utilization)	Notes on migration/ usage
	(Ku-band satellite)		allocation/ utilization Other allocation remains as-is (refer to 4.11.36)
12290, 16420		Reserved for safety related calling as per WRC-03 Res. 352	
15400 – 15700		Radio location service as per WRC-07 Res. 614	
40000 – above		Allocate for high capacity PTP links	(refer to 4.11.37)

4.10 Current utilization / assignments of bands intended for migration

To be incorporated by reference to the Department of Communications Spectrum Audit Project.

4.11 Commentary on bands with respect to migration

4.11.1 75.2 – 87.5 MHz

The band is primarily used by Repeaters (Private, Communal) in several applications such as mining, farming and other small businesses. SABRE 1 had proposed migration of the dual-frequency alarms into this band. It is proposed to:

- Keep the DF/ SF radio links as-is.
- Allocate (81 – 81.625 MHz) BTX paired with (86.375 – 87 MHz) MTX for dual frequency (DF) alarms, and migrate-in DF alarms that may be operating in other bands.

4.11.2 138 – 144 MHz

The band is primarily used by Repeaters (Private, Communal) in several applications such as mining, farming and other small businesses along with SF alarms. In addition there is

an allocation for remote controlled industrial apparatus (ISM Licence exempt band 141 – 142)[16].

Within South Africa there has been a significant usage of alarms and this is forecast to continue to grow over the next decade. In this case the current band allocations for SF alarms at 140.5 – 141 MHz as well as at 152.05 – 152.55 MHz will be insufficient to meet this demand. At the same time modern alarm systems are more spectrally efficient, and if users migrate to such systems then it is probable that the current allocation is sufficient to meet South Africa's current and future needs. In order to meet this future need it is proposed to:

- Request proposals to determine whether new / current technologies can provide a mechanism for the users to use the current allocation in a more spectrally efficient manner.
- If this is not possible, consider migrating SF Mobile at 141 – 141.5 MHz out of this band. Timeline for this migration would be Year 5 – Year 7.
- Migrate in SF alarms into the band 141 – 141.5 vacated by SF mobile – allocating a total of 1 MHz for this application in the 140 MHz band. This would be the second step in a two stage process of allocating an SF alarm band. In the first stage all other users who are operating within the 152.05 – 152.55 MHz band allocated for SF alarms would be migrated out to free up spectrum for additional SF alarm assignments (Year 0 – Year 3).
- Migrate the remote controlled industrial apparatus out of the 141 -142 MHz band into a band dedicated for ISM. This is important since the alarms are sensitive and the remote controlled industrial apparatus devices may cause interference with the operation of these alarm systems.

It is therefore proposed to allocate this band in the following manner:

- Mobile 1 MTX 138 – 140.5 MHz paired with 141.5 – 144 MHz.
- SF alarms 140.5 – 141.5 MHz.

4.11.3 150.05 – 153 MHz

The current users may continue to operate in this band with the following exceptions:

- Channels 150.625, 150.650, 150.675 MHz are reserved for in-house paging. The demand for paging has shown a sharp decrease over the past decade and may only occupy a very niche segment (e.g. hospitals etc). If there are no current

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[16] Government Gazette No. 31290, Notice No. 926 of 2008 as amended.

assignments for paging it is proposed to de-allocate these channels for this purpose.

- SF Alarms are supposed to operate within the 152.05 – 152.55 MHz band on an exclusive basis. However, there are other users (SF Mobile etc) operating in this band. Given the growing demand from alarms (refer **4**.11.2) it is proposed to migrate these users out of this band (Year 0 – Year 3) and allocate it on an exclusive basis to SF alarms.

4.11.4 156.4875 – 156.5625 MHz

Although SF Mobile may continue to operate within 156.375 – 156.7625 MHz on a non interference basis and non protection basis to Maritime mobile services in inland areas, there are many occasions where these are situated in proximity (50km or less to water-bodies). This is as per ITU RR Article 31 and Appendix 18. It is therefore proposed to:

- Identify and migrate all SF Mobile users within close proximity (50 km or less) to water-bodies out of this band and/ or relocate the same.

4.11.5 156.875 - 174 MHz

The planned frequency allocation as per the NFRP in this band is as shown in Figure 3

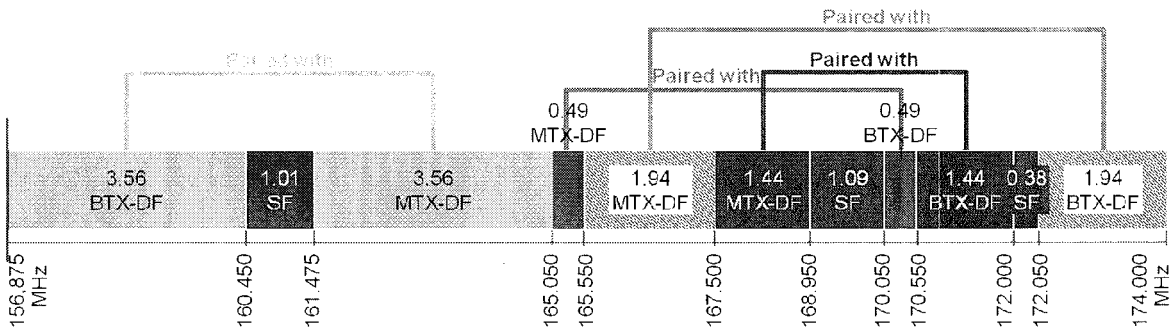

Figure 3 Proposed Allocation 156.875MHz – 174MHz

However at present the MTX-DF (165.55 – 167.5 MHz) and BTX-DF (172.05 – 174 MHz) are interchanged as indicated in Figure **4**.

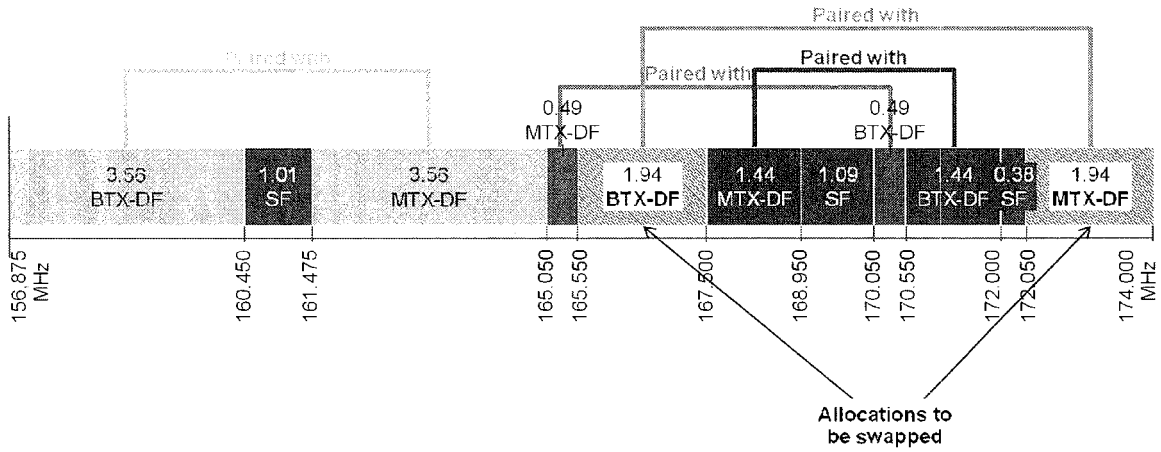

Figure 4 Current situation 156.875MHz – 174MHz

This has resulted in the situation that the BTX lies within the MTX allocation and vice-versa, leading to interference and other challenges during assignment.

It is therefore proposed to:

- Restore the allocation as proposed with immediate effect by swapping the MTX and BTX.

4.11.6 174 – 223 MHz

The VHF TV service currently operating in this band will be migrated to DTT by 2015 in line with GE-06 guidelines. The new allocation could be carried out in line with SADC FAP proposed common sub-allocation / utilization.

There are a few important points to consider here:

- T-DAB: in line with SADC proposed common sub-allocation/ utilization this service has been allocated to two bands (214 – 230 MHz) as well as (1452 – 1492 MHz). Depending upon the utilization of the service this band the allocation of two frequency bands would be re-evaluated. It may be sufficient to restrict allocation of T-DAB to 214-230 MHz and allocate the 1452 – 1492 MHz band for other uses.
- It is also recognized that although DAB is the standard proposed by SADC proposed common sub-allocation/ utilization there are other alternatives being proposed such as DMB, DVB-H etc.
- It is recognized that apart from selecting the technology based upon spectral efficiency itself, it is also important to be harmonized with the SADC region as well as consider the wide-spread availability and costs associated in using alternative standards.

It is therefore proposed that the allocation for this band be as follows:

- 174- 214 MHz TV Broadcasting.

- 214 - 230 MHz Terrestrial – Digital Audio broadcasting and comments and considerations for the technology standard(s) to be specifies for this purpose are invited.

4.11.7 223 – 230 MHz

The band is proposed to be allocated for T-DAB (refer to 4.11.6):

- 214 - 230 MHz T-DAB.

4.11.8 235 – 267 MHz

This band is currently being occupied by Analogue TV. Consequent to the planned migration in line with GE-06, the band can be used for the following purposes as per SADC proposed sub-allocation / utilization:

- 235 – 238 MHz TV Broadcasting.
- 238 – 242.95 MHz PMR including public trunking.
- 242.95 – 243.05 MHz International Distress.
- 243.05 – 246 MHz Low power devices ancillary to broadcasting services.
- 246.18 – 254.18 MHz TV Broadcast (Channel 13).
- 254 – 267 MHz PMR and/ or PAMR including public trunking.

4.11.9 335.4 - 387 MHz

Spectrum in this band could be freed up for rural broadband if equipment for FBWA in this band is available in the market. The current players have show indications that they may relinquish this spectrum due to spectrum fees imposed.

It is proposed that the band be allocated for one or more of the following uses as per SADC FAP proposed sub-allocation/ utilization:

- 335.4-336 MHz PMR and / or PAMR.
- 346.0-356.0 MHz PMR and / or PAMR.
- 366.0-380.0 MHz PMR and / or PAMR.
- 336-346 MHz paired with 356-366 MHz for Fixed Wireless Access/ PTP/PTMP rural system.

4.11.10 380 – 400 MHz

This band will be allocated as a contiguous block for public protection and disaster relief (PPDR) as well as public safety with users including SAPS, SANDF, the ambulance service, metro police and Fire-fighting services. All other users will migrate out of this

band. This allocation would recognize the importance having a band dedicated for public safety and free of any other potential sources of interference. In ideal circumstances, these users would make use of a common digital public trunking network which would also promote interoperability between such users in periods of emergency

It is also recommended that private establishments who work alongside and are responsible for public safety also operate within this band. This would allow interoperability with other public safety/ emergency services users.

The proposed allocation of this band would be as per SADC proposed sub-allocation/ utilization

- 380.0-387.0 MHz paired with 390.0-397.0 MHz for digital systems to be used for PPDR.
- 387.0-390.0 MHz paired with 397.0-399.9 MHz. To be used mainly for digital systems (PMR and/or PAMR).
- It is the New ICASA proposal that this band be exclusively reserved for public safety and all users (e.g. SAPS etc) migrate into this band.
- Considerations be made to adopt a common digital trunking technology standard which would allow:
  - Economic savings by operating and sharing a single network infrastructure
  - Improving effectiveness and promoting interoperability

4.11.11 405 - 430 MHz

This band is currently used for public trunking services. In addition there is a Mobile Data Service (WBS) operating in this band as well The SADC proposed sub-allocation/ utilization indicates use for PMR and/ or PAMR as well as PPDR. Given the NRFP allocation for Digital Trunked Mobile there is the possibility of other services (including those using FDMA) and other TDMA systems including DMR may be introduced in this band. ICASA proposes that:

- 410 – 430 MHz reserved for digital public trunking only.
- All other services apart from public trunking to be migrated out of the band.

It is important to note that although this band is allocated to Digital Trunking there are several different technologies which could suit this purpose, not all of which are interoperable with each other. In the present assignments there are several who are using TETRA, while other Digital Trunking technologies are also being proposed. Proposals are invited to determine the best way forward which would allow technology neutrality but however would ensure that interference between users using different technology standards (FDMA versus TDMA etc) is minimized.

4.11.12 440 - 450 MHz

This band is allocated for Short Range Business Radio (441 – 441.1 MHz) while the remaining portion is allocated for PMR (both UHF repeaters and DMR). The Short Range Business Radio has wide application in South Africa and is type approved (unlicensed). It is important to ensure that this sub-band is maintained for Short Range Business Radio purposes. There is no migration planned in the PMR sub-band.

It is hence proposed by ICASA that:

- 440 – 440.1 MHz be allocated to Short-range Business radio.
- 446 – 446.1 MHz be used for temporary assignments within PMR band.
- All other users migrate out of the band.
- The rest of the users in this band can stay as-is.

4.11.13 450 - 470 MHz

This band is currently used for Trunked Mobile with several users including the Railways (Transnet) and mines (Figure 5). The SADC FAP proposed common sub-allocation/ utilization seeks to allocate this spectrum for Mobile IMT. This is important to note that several adjacent countries (e.g. Mozambique) are moving to implement this proposal. Although the band has a large number of assignments, a recently concluded spectrum audit indicates that the spectrum usage is quite low – indicating inefficient spectrum use.

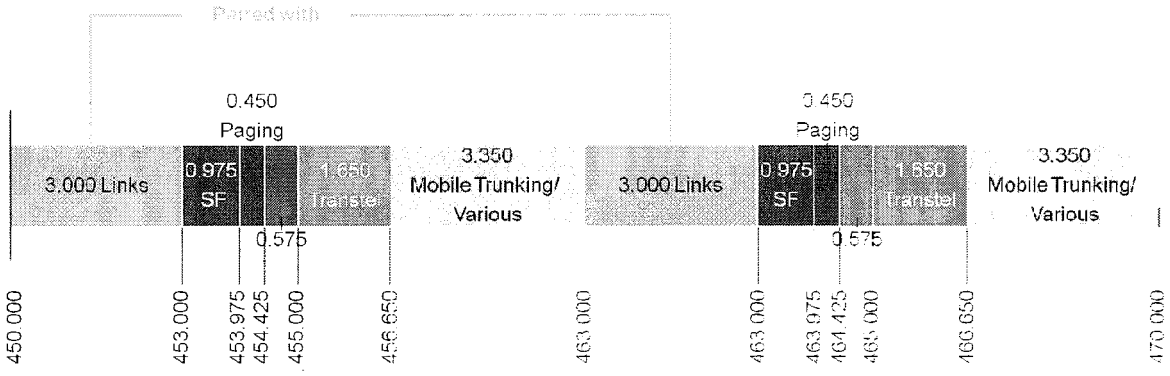

Figure 5 Current assignment 450 – 470 MHz

In view of the other spectrum that has been identified for IMT, it is proposed therefore:

- To migrate the current users out of this band into the radio frequency 3 GHz and above space
- To allocate this band to Mobile (IMT) as per Res. 224 of WRC-07.

In view however of the large number of assignments in this band, comments on this suggestion are particularly welcome

4.11.14 694 - 790 MHz

This band has been assigned for IMT (Terrestrial) for Region 1 countries at the WRC-12 (Table 2) and is often termed as Digital Dividend 2. Currently this band is occupied by UHF TV.

Given that there is a current planned migration underway in the 790 – 862 MHz band (due to be completed by 2015), a proposal would be to concurrently define and implement a migration plan for the 694 – 790 MHz band as well. The time-line to complete the migration could be staggered as compared to the 794 – 862 MHz band. This would ensure that no new services are allocated for this band and the existing users have a finite and defined period to migrate.

It is proposed that:

- The migration plan is aligned with the on-going efforts within the 800 MHz band as defined in Government Gazette 34872[17].
- With respect to the small number of Studio Links in this band; these must be migrated out and given point to point fixed assignments.
- Self Help Stations must be migrated out into the broadcast bands below 692 MHz.

4.11.15 790 - 862 MHz

This band has been allocated for IMT (Terrestrial) for Region 1 countries at WRC-07 (Table 2) and is often termed as Digital Dividend 1. Currently this band is occupied by UHF TV. Migration is planned to be completed by 2015.

It is proposed that:

- The migration plan is aligned with the on-going efforts within the 800 MHz band as defined in Government Gazette 34872[18].

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[17] Government Gazette 34872: Draft invitation to apply for Radio Frequency Spectrum Licence to provide mobile broadband wireless access service for urban and rural areas using the Complimentary Bands, 800 MHz and 2.6 GHz

[18] Government Gazette 34872: Draft invitation to apply for Radio Frequency Spectrum Licence to provide mobile broadband wireless access service for urban and rural areas using the Complimentary Bands, 800 MHz and 2.6 GHz

- With respect to the small number of Studio Links in this band; these must be migrated out and given point to point fixed assignments.
- Self Help stations must be migrated out into the broadcast bands below 692 MHz.

4.11.16 862 - 890 MHz

This band currently has several users including:

- Wireless audio (863-865 MHz).
- Fixed links (868.1–876 MHz).
- RFID (865 – 868 MHz), RFID (869.4- 869.65 MHz).
- Alarms (868.6 – 868.7 MHz, 860.25 – 869.3 MHz, 869.65 – 869.7 MHz).
- Wireless Access Services (824-849 MHz paired with 869-894 MHz).
- Mobile (880-890 MHz paired with 925-935 MHz) – currently assigned to Neotel.

It is essential to note that alarms were not part of the SABRE proposed allocations and may need to be consolidated within designated alarm bands. Additionally there is some level of confusion with regards to the Wireless Access Service (824-849 MHz paired with 869-894 MHz) as part of the NRFP – given that such an assignment would interfere with the Mobile band assigned to Netotel. It is proposed to:

- Align re-planning efforts within the 800 MHz band as defined in Government Gazette 34872[19].
- Remove the assignment for Wireless Access Services in this band.
- Re-plan the entire band to accommodate IMT (terrestrial) as per SADC FAP proposed common sub-allocation/ utilization.
- Migrate existing users out of this band.

4.11.17 890 - 942 MHz

This band currently has several users including:

- Mobile (890 – 915 MHz paired with 925 – 935 MHz) currently assigned to Cell C.
- Several RFID (short range applications) from 915.1 – 919.2 MHz.

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[19] Government Gazette 34872: Draft invitation to apply for Radio Frequency Spectrum Licence to provide mobile broadband wireless access service for urban and rural areas using the Complimentary Bands, 800 MHz and 2.6 GHz.

- GSM-R (921-925 MHz). However, it is important to note that GSM-R is not mentioned as an explicit service in the NRFP, while SABRE recommended that this band be allocated for digital trunking.

It is proposed that:

- 921-925 MHz is allocated for the purposes of GSM-R.
- The remaining allocations remain as-is.
- Spectrum re-farming, when deemed necessary is carried out based upon the principles and policies defined in section 4.13.

4.11.18 942 - 960 MHz

This band currently is allocated for GSM900 (Vodacom, MTN). There is currently no spare capacity left in this band.

It is proposed that:

- No migration is planned for the band, the allocations remain as-is.
- Spectrum re-farming, when deemed necessary is carried out based upon the principles and policies defined in section 4.13.

4.11.19 1350 - 1375 (1492- 1517)/ 1375 – 1400 (1427 – 1452) MHz

This band is currently allocated to low capacity PTP / DF links. Spectrum is available on a radio coordinated basis. Based upon availability of equipment as well as user demand, ICASA proposes that:

- Maintain existing links where required (too expensive to migrate etc).
- Allocation to rural broadband (BFWA) due to good propagation characteristics.

4.11.20 1452 - 1492 MHz

This band is currently allocated to T-DAB and S-DAB due to the current South African allocations of BROADCASTING and BROADCASTING-SATELLITE. Given the allocation of DAB in the VHF band (from 214 – 230 MHz) it is important to determine whether the frequency allocation is sufficient or additional spectrum in the L-band needs to be allocated for the purpose. Consideration of this depends upon:

- Whether there is sufficient and adequate demand for DAB services to require assignment in two bands.
- Whether equipment is readily available encompassing both bands.

Under the present and forecasted situation, it is believed that the DAB allocation in the VHF band is sufficient to meet the requirements of T-DAB. This would also result in lower equipment costs since any receiver would have to be designed to cover only a single

band rather than two distinct bands. In addition, S-DAB may have only very limited potential within South Africa and this spectrum may be better utilized for other purposes. It is there proposed by ICASA to:

- Modify the allocation in this band and align it with the ITU Region 1 to include FIXED, MOBILE except aeronautical mobile, BROADCASTING and BROADCASTING-SATELLITE.
- Allocate this band to PTP/ PMP/ BFWA depending upon the availability of equipment. Communal/ private repeaters could also operate in this band.

4.11.21 1518 - 1525 MHz

The band was allocated for both SF links as well as the IMT satellite component. However, this band remains unoccupied and there are views that the IMT (satellite) will have limited usage within South Africa.

Due to these factors, ICASA proposes to:

- Allocate this band for repeater links for land-mobile radio (LMR) and migrate such links into this band.
- Band could also be allocated for outside-broadcasting links currently operating in 2300 – 2450 MHz.

4.11.22 1525 - 1559 MHz

The band has been identified for IMT (satellite); Res. 225 (WRC applies). In the band 1530 – 1544 MHz priority for maritime mobile distress, urgency and safety communication (GMDSS); Res. 222 applies. The band is currently being used by INMARSAT.

Due to these factors, ICASA proposes to:

- Consider using the 1525 – 1530 MHz band for Fixed links (e.g. repeater links) and migrate such links into this band.
- Band could also be allocated for outside-broadcasting links currently operating in 2300 – 2450 MHz.
- Keep the remaining allocation (1535 – 1559 MHz) of the band as-is.

4.11.23 1668 – 1675/ 2483.5 - 2500 MHz

The band has been identified for the satellite component of IMT; Res 225 applies. However, the use of IMT (Satellite) within South Africa is limited and it is unclear whether this application would ever become significant for broadband with the strong growth of IMT (Terrestrial).

It is therefore proposed by ICASA to:

- Change the current allocation to be in line with ITU Region 1 allocations of:

- 1668 – 1668.4 MHz:
  - MOBILE-SATELLITE (earth-to-space)
  - RADIO ASTRONOMY
  - SPACE RESEARCH (passive)
  - Fixed
  - Mobile except aeronautical mobile
- 1668.4 – 1670 MHz:
  - METEOROLOGICAL AIDS
  - FIXED
  - MOBILE except aeronautical mobile
  - MOBILE-SATELLITE (earth-to-space)
  - RADIO ASTRONOMY
- 1670 – 1675 MHz:
  - METEOROLOGICAL AIDS
  - FIXED
  - METEOROLOGICAL SATELLITE (space-to-earth)
  - MOBILE
  - MOBILE-SATELLITE (earth-to-space)

- This change in allocation, in line with ITU region 1 would open up the possibilities of introducing Fixed links (PTP, PMP) into this band.

4.11.24 1880 - 1900 MHz

The band was allocated for cordless DECT by SABRE proposed allocation. This is being currently in use by Telkom to provide WLL services. Depending upon the current utilization of this band, as per SADC FAP proposed common sub-allocation/ utilization, ICASA proposes to:

- Allocate this band to BFWA.

4.11.25 1980-2010/ 2170-2200 MHz

The band has been identified for the satellite component of IMT; Res 225 applies. However, the use of IMT (Satellite) within South Africa is limited and it is unclear whether this application would ever become significant for broadband with the strong growth of IMT (Terrestrial). The band is also allocated for Fixed Links, but currently lies unused in the lower band and utilized by SANDF, Transnet amongst other users in the upper band; this is however under-utilized. It is therefore proposed to:

- Allocate for Fixed links and migrate in Fixed links (DF) from other bands.
- Allocate for BFWA depending upon availability of equipment in these bands (New ICASA proposal).

4.11.26 2025 – 2110 paired with 2200 - 2285 MHz

The band is currently allocated for fixed links – but is under-utilized. SABRE proposed use of 2075 - 2110 MHz for WLL was never implemented.

It is proposed to:

- Keep allocation for Fixed links and migrate in Fixed links (DF) from other bands.
- If band continues to remain under-utilized, then depending upon demand and availability of equipment, allocate for BFWA (New ICASA proposal).

4.11.27 2290 - 2300 MHz

Currently unused; In line with SADC proposed common sub-allocation/ utilization, ICASA proposes to

- Allocate this band to BFWA.

4.11.28 2300 - 2450 MHz

The band is currently in use for several services including:

- Fixed links – 2307 – 2387 MHz paired with 2401 – 2481 MHz.
- Outside broadcasting links (28 MHz) – primary basis at (2377, 2471 MHz), secondary basis at (2321, 2349 MHz, 2415, 2443 MHz).
- ISM – 2400 – 2483.5 MHz.

As per SADC FAP proposed common sub-allocation/ utilization, it is proposed to:

- Allocate 2300 – 2400 MHz for IMT (Terrestrial).
- Continue to retain allocation of 2400 – 2483.5 MHz for ISM.
- Existing Fixed links could be migrated above 3 GHz.
- Migrate outside-broadcasting links in line with the DTT migration (potentially to 1518 – 1559 MHz band).

4.11.29 2500 - 2690 MHz

This band is being used by Sentech (65 MHz) and WBS (15 MHz); 125 MHz is currently available for assignment. As per SADC FAP proposed common sub-allocation/ utilization this band has been allocated for Mobile IMT.

It is proposed to:

- Align re-planning efforts within the 2.6 MHz band as defined in Government Gazette 34872[20].
- Allocate the band to Mobile IMT.

4.11.30 3400 - 3600 MHz

This band is currently being utilized by:

- Sentech (national).
- Neotel (national).
- Telkom (national).
- USAL (regional).

In terms of WRC 07 decisions and as per SADC FAP proposed common sub-allocation/ utilization it is proposed to:

- Allocate for mobile service on a primary basis and use for Mobile IMT. This would also result in a harmonized Mobile IMT band across the entire SADC region.
- Migrate existing users out of the band.

4.11.31 3600 - 4200 MHz

This band (C-band) is currently being utilized for PTP links (terrestrial backhaul) and Satellite links including VSAT, Satellite downlink and tracking. The proposed allocation as per SADC proposed common sub-allocation/ utilization is:

- (3600-4200 MHz) Fixed services (PTP).
- (3600-4200 MHz) Fixed-satellite (space-to-Earth) (PTP/VSAT/SNG).
- (3600-3800 MHz) Broadband Fixed Wireless Access (BFWA).

The sub-band 3600-3800 MHz could be used for BFWA where frequency sharing with FS PTP and/or FSS is feasible. The channelling arrangement for PTP links in this band is based on ITU-R Recommendation F.635. The sub-band 3600-4200 is used for medium and high capacity PTP links and FSS. In the band 3600-3800 MHz, BFWA, FS PTP and FSS applications will have to operate on coordinated basis. However, considering the

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[20] Government Gazette 34872: Draft invitation to apply for Radio Frequency Spectrum Licence to provide mobile broadband wireless access service for urban and rural areas using the Complimentary Bands, 800 MHz and 2.6 GHz

difficulty in coordinating ubiquitous user terminals used for BFWA and VSAT, it is proposed that:

- VSAT systems should be migrated to the Ku-band (ref: 4.11.36).

4.11.32 5470 - 5725 MHz

As per as per SADC proposed common sub-allocation/ utilization, the band can be allocated for:

- Wireless Access Systems (WAS) / RLAN.

4.11.33 5725 - 5850 MHz

This band is currently being used for ISM, amateur and SRD services. As per ITU footnote 5.453 the band can also be allocated for fixed and mobile services on a primary basis. SADC FAP footnote SADC18 allocates this band for similar services in Swaziland and Tanzania. The NRFP can be updated to reflect the assignment if there is an interest within South Africa for this service in the band.

4.11.34 5850 - 5925 MHz

The upper C-band is currently being used for terrestrial backhaul and satellite (uplink, VSAT). As per the SADC FAP proposed common sub-allocation/ utilization outside broadcasting links could also be potentially migrated into this band with the proposed allocation as follows:

- Fixed-satellite uplinks (PTP/VSAT/SNG) (5850-6425 MHz) – this could also be used for temporary outside-broadcast links.
- FIXED links (5850-5925 MHz).
- ISM (5725-5875 MHz).

4.11.35 5925 - 6700 MHz

As per the SADC proposed common sub-allocation/ utilization the current band would be allocated as follows:

- 5925 – 6425 MHz Fixed links (lower 6 GHz in accordance with ITU-R Rec. F.383).
- 6425 – 7110 MHz Fixed links (upper 6 GHz in accordance with ITU-R Rec. F.384).
- 5850 – 6425 Fixed-satellite uplinks (PTP, VSAT, SNG).

4.11.36 10700 - 11700 MHz

This is the defined Ku band. VSAT links should be migrated into this band as per SADC proposed common sub-allocation/ utilization.

4.11.37 40000 MHz and above

Although out-migration is not an issue above 40GHz, the following comment should be made:

- Frequency bands above 40 GHz are relatively under-utilized. Equipment is available off the shelf for high bandwidth PTP links over distances of up to 5km. It is proposed that in the spectrum above 40GHz, allocations are made for Fixed Services such as PTP links – which would be useful especially in metropolitan areas for line-of-sight (LoS) high capacity data links.

4.12 Summary of New ICASA Proposals

The following table summarises the proposals ICASA is making regarding frequency migration (New ICASA proposals) as extracted from the previous section. These proposals are additional to those proposals made by SABRE and migrations stemming from the WRC and the SADC FAP.

Table 4 Consolidated list of New ICASA proposals for migration

Frequency Band (MHz)	Notes on migration/ usage
141 – 141.5	Migrate SF Mobile out of this band and allocate for SF alarms.
141 – 142	Migrate remote controlled industrial apparatus to ISM Band.
380 – 400	Allocated for public safety/ government services. Migrate all such users into this band.
410 – 430	Allocated for Digital Public Trunking.
440 – 440.1 paired with 445 – 445.1	Allocated for Short-range Business Radio; all other users migrate out of band.
921 – 925	Allocated for GSM-R; migrate other users out of this band.
1350 – 1375 paired with 1492-1517 1375 – 1400 paired with 1427 – 1452	Allocate for Rural BFWA; migrate existing fixed duplex links out of this band.

Frequency Band (MHz)	Notes on migration/ usage
1452 - 1492	Change allocation to include FIXED, MOBILE except aeronautical mobile. Use for BFWA/ PTP/ PMP depending upon availability of equipment.
1518 – 1559	Allocate for links for LMR repeaters; Migrate in outside-broadcasting links currently operating in 2300 – 2450 MHz.
1668 – 1675	Change allocation in line with ITU Region 1 allocations to include FIXED and Mobile except aeronautical mobile within the allocations.
1980 – 2010 paired with 2170-2200	Migrate in Fixed links (DF) from other bands; allocate for BFWA.
2025 – 2110 paired with 2200 - 2285	Migrate in Fixed links (DF) from other bands; allocate for BFWA.
2300 – 2450	Migrate outside broadcasting links to the 1518 – 1559 MHz band.

4.13 Commentary on Spectrum Re-farming

4.13.1 Definition of spectrum re-farming

Spectrum re-farming can be defined as a process of changing the conditions of frequency usage in any part of the radio spectrum[21]. This may include:

- Change of the technical conditions of the frequency assignment.
- Change of the application.
- Change of allocation to a different telecommunications service.

4.13.2 Need for Re-farming in GSM / Mobile bands

Frequency bands in the sub- GHz range are attractive to operators since it offers better propagation characteristics leading to better coverage at lower cost as well as indoor coverage in comparison to higher frequency bands.

At the same time mobile broadband subscriptions and traffic continue to grow at a rapid rate and is expected to reach over 5 billion devices by 2016, worldwide. This is mainly due to a shift towards mobile-broadband enabled smart phones over voice centric phones

[21] ICT Regulation Toolkit

in the mass market coupled with a rapid declining price for the same. However, in order to provide a good quality of mobile broadband service requires better network quality. This can be achieved either through:

- Enhancements in technology (MIMO, Adaptive techniques etc) or.
- Additional spectrum dedicated to mobile broadband either via new carriers or new bands.

This trend also leads to the phenomenon that as a larger number of users migrate to smart-phones the incumbent 'voice only' bands i.e. GSM 900 and 1800 MHz in this case will have spectrum which is being inefficiently utilized (due to fewer users). However, as these bands have been allocated for a particular application the incumbent licensees are not able to use the same band for other purposes (e.g. mobile broadband)

At the same time, it is important that the spectrum being allocated/ dedicated have as wide a regional footprint as possible – this will drive down device costs due to economies of scale. The legacy GSM bands at 900 MHz and 1800 MHz fall into this category. For e.g. the GSM 1800 MHz band is used by over 350 operators in 148 countries around the world[22].

The result is that in order to be able to better utilize the currently assigned frequencies and maximize the social impact by leveraging economies of scale it may be necessary to consider spectrum re-farming, especially in the heavily used GSM bands.

4.13.3 Points of consideration for GSM / Mobile Bands

- South Africa still retains a large number of its subscriber base for Voice with the current 2G GSM spectrum (900 MHz and 1800 MHz) being fully utilized by the current license holders. This subscriber base would to a large extent be represented by lower income groups and it would be important to maintain the voice service for their benefit.
- Until such a stage is reached that the subscriber base using the existing 2G spectrum is reduced in size to a level where the existing 2G bands have spare capacity, the issue of spectrum re-farming should not be allocated high priority. Instead efforts should be focused towards locating additional bands for IMT as per WRC and SADC proposed spectrum allocation/ utilization.
- However, it should be noted that in some cases, such spectrum re-farming may also be in the interest of the current licensee (e.g. the operator) since it allows him to change the allocation/ technical conditions in order to better serve his customer base.

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[22] Delivering the best mobile broadband experience: the 1800MHz spectrum 're-farming' opportunity (Ericsson)

- The GSM 900 MHz and 1800 MHz frequencies are currently occupied by the incumbent mobile operators who have nationwide assignments. If there is a case to inject competition in this market, a re-farming exercise would also need to consider ways and means to re-allocate spectrum between the incumbents and new entrant(s) so as to facilitate free and fair competition. Such an exercise could be carried out for both 900 and 1800 bands at the same time in conjunction with assignments in other bands allocated to IMT to allow existing operators to maintain their existing level of service.

5 Potential Impact of Spectrum Migration

5.1 Bands planned for IMT

One of the critical issues under public debate in South Africa is the availability of spectrum for mobile broadband wireless access.

A total of 649 MHz of spectrum can be made available for IMT following SADC FAP proposed common sub-allocation and WRC resolutions, as-is indicated by the following table.

Table 5 Bands planned for IMT

Frequency Band (MHz)	Bandwidth (MHz)	Current Allocation	Notes
450 – 470	20	Various allocations (Fixed, Mobile)	Enabled for IMT as per WRC-7, Res. 224 applies
694 – 792	98	TV Broadcasting	Enabled for IMT as per WRC-12, Res. 232 – Digital Dividend 2
790 – 862	72	TV Broadcasting	Enabled for IMT as per WRC-7, planned for 2015 – Digital Dividend 1
862 – 876	14	Fixed, Alarms, Mobile Wireless Access	Enabled for IMT as per SADC FAP proposed common sub-allocation/ utilization
1880 – 1920	40	DECT/ Extended DECT (Telkom National License)	Enabled for IMT as per SADC FAP proposed common sub-allocation/ utilization
2010 – 2025	15	FIXED / MOBILE	Enabled for IMT as per SADC FAP proposed common sub-allocation/ utilization

2500 – 2690	190	MOBILE	Enabled for IMT as per SADC FAP proposed common sub-allocation/ utilization
3400 – 3600	200	BFWA	Enabled for IMT as per WRC-07, effective Nov. 2010

This does not include the frequency already allocated and assigned to GSM / UMTS.

5.2 Other Migration issues

The table below summarises other migration issues that have been highlighted.

Table 6 Summary of migration issues

Frequency Band (MHz)	Current Allocation	Proposed Allocation	Notes
380 – 400	Public Safety (SAPS, DoD etc)	Public Safety only	Consolidate all public safety related services in this band; move other users out of the band
410 – 430	Government services, Mobile Data and Trunking	Digital Trunking only	Reserve for Digital Trunking use only; migrate mobile data, ESKOM, SAPS out of the band
440 – 450	Short range business radio/ PMR/ other links	Short Range business Radio, PMR only	Should be cleared of all other users; Communal repeaters can be allocated in this band
450 – 470	FIXED, MOBILE	IMT	Should be cleared of all other users
790-862	BROADCAST	IMT	Studio Links need to be migrated out to enable efficient allocation for IMT. Self Help stations need to migrate to below 692 MHz.
921 – 925		GSM-R	Originally allocated by SABRE 1 for digital trunking – currently unused
1350 – 1375 paired with 1492 – 1517	Shared duplex band	BFWA	Could be a consideration for rural BFWA

1375 – 1400 paired with 1427 – 1452	Shared duplex band	BFWA	Could be a consideration for rural BFWA
2025 – 2110 paired with 2200 – 2285	Fixed links (DF)	BFWA	Fixed links currently underutilized
3600 – 4200	Satellite (VSAT, downlink), Terrestrial backhaul	3600 – 3800 MHz BFWA 3600 – 4200 MHz PTP and FSS	Migrate VSAT from C to Ku Band
5850 – 6425	Fixed/ Satellite uplinks	Fixed/ Satellite uplink/ Outside Broadcast links	Migrate outside-broadcast from 2300 – 2450 MHz into upper C band
40000 and above		Allocate for PTP links	For local high-speed PTP data links (up to 5 km)

6 Future trends

THIS SECTION IS FOR INFORMATION PURPOSES ONLY – NO COMMENTS ARE INVITED AT THIS STAGE.

This section highlights a few key trends that may have a significant impact to the current allocation in the mid - long term future. Although no immediate measures are recommended as of now it is important to track and carefully monitor these trends in order to be able to take pro-active measures.

6.1 Overall trends in broadband

There is a general movement world-wide to allocate an increasing amount of spectrum in the sub 5 GHz range for IMT. This move is driven by the fact that an increasing number of applications including alarms, mobile radios etc can be served by IMT. Even typical fixed allocations such as BFWA could be subsumed as a variant of IMT – leaving it to the customer to determine whether he would like to operate the device in a mobile or fixed manner.

Another reason is that new and emerging technologies (e.g. LTE and LTE-Advanced) need an increasing amount of bandwidth in order to be able to achieve high data rate speeds. This can only be possible if spectrum in bands with good propagation characteristics is allocated for this purpose.

The ITU through the WRC's is actively looking into this need and each upcoming WRC may allocate additional spectrum for this purpose. Depending upon current utilization levels in these bands, South Africa would in principle be aligned with allocations made for Region 1. This would extend the spectrum used for mobile broadband and existing services of the type mentioned above could be served by different niche mobile broadband applications rather than being migrated out to dedicated bands.

6.2 Cognitive radios

The ITU (Report ITU R SM.2152) defined cognitive radios as

'a radio system employing technology that allows the system to obtain knowledge of its operational and geographical environment, established policies and its internal state; to dynamically and autonomously adjust its operational parameters and protocols according to its obtained knowledge in order to achieve predefined objectives; and to learn from the results obtained'

The ITU study determined that while Cognitive Radio System (CRS) technologies may yield significant benefits by providing increased spectral efficiency of existing spectrum and mitigate the problem of congestion additional studies needed to be carried out to:

- Ensure the protection of existing services from potential interference from the services implementing CRS technology, especially from the dynamic spectrum access capability of CRS.
- Ensure that any system of a specific service using CRS should be operated in accordance with the provisions of the Radio Regulations and administration rules.

The recently concluded WRC-12 conference advised that administrations continue active participation in ITU-R studies conducted under Resolution ITU-R 58 which seeks to:

- *To continue studies for the implementation and use of CRS in Radiocommunication services;*
- *To study operational and technical requirements, characteristics, performance and possible benefits associated with the implementation and use of CRS in relevant Radiocommunication services and related frequency bands;*
- *To give particular attention to enhancing coexistence and sharing among Radiocommunication services;*
- *To develop relevant ITU-R Recommendations and/or Reports based on the aforementioned studies, as appropriate*

It is therefore proposed that ICASA carefully watch and participate in these studies. At present cognitive radios have not had any wide-spread commercial success, and is still in the feasibility stage. Once this technology is proven and appropriate ITU resolutions have been passed advocating for the same, South Africa could align itself with the applicable resolutions for Region 1.

6.3 White-space devices

White spaces is defined as

"a label indicating a part of the spectrum, which is available for a Radiocommunication application (service, system) at a given time in a given geographical area on a non-interfering / non-protected basis with regard to other services with a higher priority on a national Basis" [Source: CEPT Report 24]

Terrestrial TV networks have traditionally been planned as Multi-frequency networks (MFN) to support regional TV planning and frequency coordination[23]. This planning leads to locations in the country where particular UHF channels are unused either to avoid interference or simply because there are no broadcasting stations in the area. These channels are known as UHF White-spaces and are currently in used by broadcasters for lower power applications such as wireless-microphones (referred to as Program Making

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[23] Sharing the Broadcasting Spectrum: digital dividend, white spaces, power line telecommunication (PLT) system - (by Mr. N. Venkatesh, Counsellor ITU-R Study Group 6)

and Special Events (PMSE) applications). The criteria for the interference-free operation of such equipment are provided by:

- ITU-R BT.1368 - 'Planning criteria for digital terrestrial television services in the VHF/UHF bands'.
- ITU-R BS.1786 - 'Criterion to assess the impact of interference to the terrestrial broadcasting service (BS)'.

These unused channels are now being proposed to be used for mobile broadband using a combination of either spectrum sensing via Cognitive Radios (6.2) or geo-location (via a database of channel usage). The spectrum is being proposed to be allocated on an unlicensed basis. Although the ITU has yet to come up with specific resolutions on the subject, it is currently investigating the use of Cognitive Radios with White Spaces as one of the primary beneficiaries. A few countries in the world have trialled White Space Devices (WSD) including:

- OFCOM (U.K) – The regulator has stated the intention (September 2011) to allow WSD on a license exempt basis on the proviso of no harmful interference to existing services. Rather than use Cognitive Radios the proposition was based up the use of a geo-location database.
- FCC (U.S.A) – The FCC with FCC-10-174 memorandum (September 2010) allowed the use of unlicensed white space spectrum including:
    - Protection criteria for Incumbent Authorised Services
    - Technical rules for TV band devices
    - Database Requirements for TV band devices
    - Channels that can be used by TV band devices (e.g. fixed devices cannot operate on channels adjacent to occupied TV channels)
    - Technical requirements and cognitive capabilities. It is important to note that the FCC, through this order has eliminates the requirement that radios (incorporating geo-location and database access) must first sense TV broadcast signals. This eliminates the mandatory requirement for cognitive radios in this space.
    - Separate channels were allocated for wireless microphones and other devices; in case these devices wanted to use the UHF channels due to unavailability or any other reason they would then need to be registered in the database.
    - The FCC, via (Order DA 11-131) in February 2011 has also registered 9 entities as database administrators.

  It is important to align the approach to WSD with its overall mobile broadband as well as DTT strategy. It is therefore proposed that ICASA continue to conduct its own feasibility studies in this area as well as follow international activities in this area.

6.4 The 'internet of things' – M2M considerations

Another emerging trend is in the fast growing sector of machine-to-machine communications. Although primarily in the region of low data rate communications, the world-wide market is projected to grow and exceed over 50 billion connected devices[24] by 2020. This would necessitate spectrum allocated for this purpose – either shared via Managed Spectrum Parks or by some other means.

It is proposed that ICASA keep this trend under careful watch to determine the size and opportunity for these services in South Africa.

6.5 Potential alternative licensing models

Various alternative models of licensing which could be termed 'Spectrum Management by Intermediaries' are being assessed on a worldwide basis.

The reason for inclusion here is that the adoption of these models could require the change of existing individual assignments and consequent in-band migration

6.5.1 • Wholesale open access

The principle of Wholesale Open Spectrum Access is where the entity to whom the spectrum is assigned, then sub-leases it to other entities that may then use it for providing services to retail service providers such as Internet Service Providers (ISP's), either individually or collectively.

The wholesale spectrum licensee may also install and operate the network infrastructure which is then used by the retail service. The presumed advantage of this arrangement is that the wholesale spectrum manager is able to operate far more flexibly than the national regulator in ensuring that spectrum is used efficiently by a far larger body of retail service providers.

The wholesale spectrum manager will be able to assign frequency more flexibly in terms of the bands used and coverage. Depending on the model adopted, the retail service providers may also not need to install their own radio equipment.

6.5.2 • Managed Spectrum Park

The managed spectrum park approach is an experience learned from New Zealand. It is intended for local and regional broadband services, and seeks to encourage a flexible, cooperative, low cost and self-managed approach to allocation and use of radio spectrum.

Furthermore, it is catering for a situation in which a nationwide spectrum right is not required, but where services require some self-coordination and sharing in a harmonise manner

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[24] Ericsson: The M2M 50B Connected Devices Opportunity, Middle East Telco World Summit 2011

"It is intended for local and regional services, and seeks to encourage a flexible, cooperative, low cost and self-managed approach to allocation and use".

The basic principle is that the licence holders are expected to sort out issues of sub-assignment and interference between themselves and the onus is on the licensees in the spectrum park to behave like responsible and cooperative citizens.

The application of the Managed Spectrum Park model may not necessarily be the same as in New Zealand. A key issue is whether a Managed Spectrum Park should be defined at national level, regional and or local level and the principles on exactly how it should be managed should be established.

Annex International Best Practice Benchmark

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1 International Best Practices

According to some predictions, the Middle East and Africa will have the strongest mobile data traffic growth of any region at 104 percent Compound Annual Growth Rate[25], indicating strong demands for spectrum, particularly in Africa. The availability of spectrum in the appropriate bands and amount will be a key success factor for South Africa to unlock the potential of the digital economy. The Internet economy requires a broad availability of broadband internet access at affordable rates and this increasingly requires radio spectrum.

According to Section 34 (16) of the ECA 2005, ICASA is charged with the authority to "migrate users to such other radio frequency bands in accordance with the national radio frequency plan". Special procedures apply to radio frequency bands used by governmental entities or organisations.

In order to develop that frequency migration procedures it helps to look at international best practices and assess whether valuable conclusions for an appropriate and fitted approach to the South African situation applies. Therefore, a review will be made of selected international best practice approaches from which conclusions can be drawn for South Africa.

1.1 International Best Practice Examples

1.1.1 Background

The seemingly never ending demand of spectrum driven by an ever faster uptake of mobile data services makes it increasingly necessary to make more and more spectrum available for 'commercial' (especially mobile) use. According to a recent CISCO study, Global mobile data traffic will increase 18-fold between 2011 and 2016. Mobile data traffic will grow at a compound annual growth rate (CAGR) of 78 percent from 2011 to 2016, reaching 10.8 exabytes per month by 2016.[26] These growth rate forecasts are supported by other studies world-wide.[27]

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[25] See Cisco Visual Networking Index: Global Mobile Data Traffic Forecast, 2011-2015, available at http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.pdf

[26] See Cisco Visual Networking Index: Global Mobile Data Traffic Forecast, 2011-2015, available at http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.pdf ; further predictions of the study: Two-thirds of the world's mobile data traffic will be

This demand for mobile broadband capacity was triggered by the arrival of internet-ready smartphones and tablets such as Apple's iPhone and iPad and the technological improvement on wireless capacity management. It has brought a paradigm shift from voice and text communication services to high data demand services (e.g. Internet, online games, online music, online video streaming, social networks, cloud applications, Email). Thus, internationally the topic of allocating spectrum to these users becomes a key success factor for the economic development of a country.

The topic of spectrum allocation is described by a range of different terminologies: 'Re-allocation', 're-farming', 'clearing up or freeing up spectrum', 'restacking'. When each term is used depends on the context and terms can have different meanings in different contexts and different countries. As a general notion all these activities aim at facilitating the movement of spectrum to its highest value use for the society.

The term **reallocation** is often used loosely to describe both the process of changing the allocation of spectrum bands and making new assignments. The need can arise in several circumstances, i.e. by a change in the international (ITU) table of frequency allocation requiring an adaptation of the national frequency plan, by an imbalance in spectrum usage that requires the reallocation / reassignment of spectrum for higher demand uses, or by technological advancements that allow a more efficient spectrum use and / or enable to free up some spectrum for other uses.[28]

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video by 2016. Mobile video will increase 25-fold between 2011 and 2016, accounting for over 70 percent of total mobile data traffic by the end of the forecast period. Mobile-connected tablets will generate almost as much traffic in 2016 as the entire global mobile network in 2012. The average smartphone will generate 2.6 GB of traffic per month in 2016, a 17-fold increase over the 2011 average of 150 MB per month. Aggregate smartphone traffic in 2016 will be 50 times greater than it is today, with a CAGR of 119 percent. The Middle East and Africa will have the strongest mobile data traffic growth of any region at 104 percent CAGR.

[27] The ITU predicts that the total worldwide mobile data traffic would grow from around 450 Petabytes in 2008 to around 1,000 Petabytes in 2015 with a Compound Annual Growth Rate of 12%, see Report ITU-R M.2243, Assessment of the global mobile broadband deployments and forecasts for International Mobile Telecommunications, available at ITU webpage.

Ericsson predicts Mobile Data Traffic to grow 10-fold by 2016, see http://www.ericsson.com/news/1561267?idx=50 ; Nokia Siemens Networks estimates expect personal data consumption to exceed 1 GB per user per day by 2020. Within a decade we can expect ten times more mobile broadband users, each using 100 times more data. This translates into up to about a thousand-fold growth, see http://www.nokiasiemensnetworks.com/news-events/publications/unite-magazine-issue-10/10-x-10-x-10-the-formula-for-beyond-4g

[28] The term is not used consistently. For a generally accepted definition see ICT Regulatory Toolkit, 2.4.9 available at http://www.ictregulationtoolkit.org/en/index.html

The digitalisation of TV broadcast has made it possible to reduce the amount of spectrum required to broadcast a TV channel. The newly available spectrum is termed the digital dividend as digitalisation of TV broadcast makes it possible to reallocate the spectrum for purposes other than broadcast, particularly for wireless broadband uses. Therefore the term "digital dividend" is used around the world in the context of using spectrum currently occupied by analogue TV channels and potentially reallocating it for other uses. The digital dividend opens up the opportunity to clear a large and contiguous block of spectrum. The spectrum is located in the ultra-high frequency (UHF) band[29] and has propagation characteristics that make it highly valued for deploying a wide range of mobile and fixed communications services.[30] It is specifically valuable to bring broadband services to rural and remote areas at an affordable cost as fewer base stations are needed to build a network and thus significantly reduce the costs for operators.

Moreover, broadcasters in general usually have a generous amount of assigned MHz in high value bands that could be used for the wireless data demand of the future. In principle, there are always two options in order to make the spectrum available for other uses: Either taking spectrum away due to, for instance, public interest concerns, or, freeing it up by introducing voluntary systems.

The process of freeing up spectrum frequencies from existing uses and reallocating (or even reassigning) them for new uses is called **re-farming**.[31] . The principle of re-farming from the point of view of the regulator is that it serves the public interest when spectrum is opened up for higher value uses.

Restacking is used in the context of digital TV services when freeing up spectrum for re-use for mobile broadband when switching from analogue to digital television (digital

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[29] E.g. usually in the 700 or 800 MHz range. The European digital dividend ranges between 790-862 MHz, the US digital dividend in the 698-806 MHz, the Australian in the 694-820 MHz and Asia, Pacific and part of Middle East digital dividend most likely in the 698-806 MHz bands. The UHF spectrum has been originally assigned under international agreement for analogue television broadcasting. The ITU World Radiocommunications Conference (WRC-07) devised a new framework for the UHF spectrum.

[30] E.g. fixed wireless broadband services, mobile broadband, mobile communications services, security and public safety, smart meters, smart grids.

[31] Nokia Siemens Networks estimates that refarming all 900 and 1800 MHz bands for mobile broadband would give a total of 340 MHz of spectrum. With 800 MHz and 2600 MHz allocations, the total spectrum will be 600 MHz. These spectrum blocks are already available in a few countries and will be widely available by 2015. The entire spectrum so far available for mobile communications is more than 1,100 MHz, in addition to a large amount (about 500 MHz) of unlicensed spectrum at 2.4 GHz and 5 GHz. See http://www.nokiasiemensnetworks.com/news-events/publications/unite-magazine-issue-10/10-x-10-x-10-the-formula-for-beyond-4g

dividend). Digital TV services are moved from the upper end of the UHF television band to the lower end of the band.

The **assignment** of reallocated spectrum can be done by the regulatory authority following one of three approaches:

- **Administrative approaches** where the licensing authority assigning rights on the basis of a number of criteria (called 'beauty contests').
- **Market based approaches** (particularly auctions) where the licence being assigned to the highest bidder.
- A **hybrid approach** that combines elements of the two main approaches in such that the regulatory authority first selects a short-list of bidders based on administrative criteria and then holds an auction to assign the licence between the bidders.

1.1.2 U.S.A.

The Federal Communications Commission (FCC) regulates the use of radio frequency bands of the electromagnetic spectrum by a spectrum management process called frequency allocation.

The USA is faced with high spectrum congestion particularly caused in the spectrum bands assigned to mobile phone uses due to the popularity of smartphones.[32] High-speed wireless data services are expanding at a continually high rate of growth.[33] At the same time, the available spectrum is very limited; according to the FCC there is only 50 MHz in inventory at the moment.[34] As spectrum continues to be a key enabler of future innovative broadband services[35] , it is a major input for providers of broadband service. As the FCC has only a small fraction of the amount available that will be necessary to match the growing demand, a more efficient allocation and assignment of spectrum is called for that will reduce deployment costs, drive investment and benefit consumers through better performance and lower prices.[36] A huge potential lies in the spectrum currently assigned

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[32] A recent report stated that data more than doubled 4 years in a row, Smartphones generate 24X data of basic - feature cell phones, Tablets create 5X more traffic than smartphones, see http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast_spectrum_may25.pdf

[33] See, for instance, Spectrum 101 by the CTIA, http://files.ctia.org/pdf/Spectrum_Brochure_111111.pdf, also containing the references: Americans used more than 340 billion MB of wireless data in the first half of 2011. That was a 111 percent increase from the first half of 2010. According to Cisco Visual Networking Index (Cisco Visual Networking Index: Global Mobile Data Traffic Forecast, 2011-2015, available at http://www.cisco.com/en/US/solutions/collateral/ns341/ns525/ns537/ns705/ns827/white_paper_c11-520862.pdf), the monthly mobile data traffic in 2015 in the U.S. will be about 982 billion MB, and the annual traffic will be nearly 12,000 billion MB.2 That is almost 20 times more than today's data usage.

[34] The FCC says that it currently has only 50 megahertz in inventory, see FCC, National Broadband Plan, Executive Summary, p. XII.

[35] See also examples of the two reallocations of spectrum: 1988 spectrum originally allocated to TV channels 70-83 was reallocated to build the first cellular networks; 2008 spectrum in the 700 MHz bands originally allocated to ultra high frequency (UHF) TV bands was reallocated with a 10 years transition period. FCC, National Broadband Plan, Chapter 5, p. 78.

[36] See FCC, National Broadband Plan, Executive Summary, p. XII.

to the broadcast sector that has almost 300 MHz of spectrum of which a large portion is unused. Reform of spectrum policies has been felt to be essential.[37]

Therefore, in 2009, Congress directed the FCC, to develop a National Broadband Plan (NBP) to ensure every American has "access to broadband capability."[38] This plan was then developed under the auspice of the FCC[39] and presented to the public on March 16, 2010.[40]

The NBP is a key input for the ongoing rulemaking process at the FCC, in Congress and across the Executive Branch.

The recommendations on spectrum policy include the following[41]:

- **Make 500 megahertz of spectrum newly available** for broadband within 10 years, of which 300 megahertz (between 225 MHz and 3.7 GHz) should be made available for mobile use within five years.
- **Enable incentives and mechanisms to "repurpose" spectrum to more flexible uses**. Mechanisms include incentive auctions, which allow auction proceeds to be shared in an equitable manner with current licensees as market demands change. These would benefit both spectrum holders and the American public. The public could benefit from additional spectrum for high-demand uses and from new auction revenues. Incumbents, meanwhile, could recognize a

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[37] See for instance the paper by Richard Bennett, Spectrum Policy for Innovation, ITIF, September 2011.

[38] FCC, National Broadband Plan, Executive Summary, p. XI: Congress also required that this plan include a detailed strategy for achieving affordability and maximizing use of broadband to advance "consumer welfare, civic participation, public safety and homeland security, community development, health care delivery, energy independence and efficiency, education, employee training, private sector investment, entrepreneurial activity, job creation and economic growth, and other national purposes."

[39] The FCC started the process of creating this plan with a Notice of Inquiry in April 2009. Thirty-six public workshops held at the FCC and streamed online, which drew more than 10,000 in-person or online attendees, provided the framework for the ideas contained within the plan. These ideas were then refined based on replies to 31 public notices, which generated some 23,000 comments totalling about 74,000 pages from more than 700 parties. The FCC also received about 1,100 ex parte filings totalling some 13,000 pages and nine public hearings were held throughout the country to further clarify the issues addressed in the plan. See http://www.broadband.gov/plan/executive-summary/#preface

[40] FCC, Connecting America : The National Broadband Plan, available at http://www.broadband.gov/download-plan

[41] See for the following: FCC, National Broadband Plan, Executive Summary, p. XII.

portion of the value of enabling new uses of spectrum. For example, this would allow the FCC to share auction proceeds with broadcasters who voluntarily agree to use technology to continue traditional broadcast services with less spectrum.

- **Ensure greater transparency** of spectrum allocation, assignment and use through an FCC-created spectrum dashboard[42] to foster an efficient secondary market.
- **Expand opportunities for innovative spectrum access models** by creating new avenues for opportunistic and unlicensed use of spectrum and increasing research into new spectrum technologies.

Spectrum availability is clearly a key driver for nationwide broadband and subsequent innovative services and the current spectrum management regime is seen unfit to meet the future demands. In the U.S.A., the reallocation of spectrum currently used by licensees is done on a case-by-case basis when specific requests are made for the spectrum. The disadvantage of the current system is that it is often contentious as licensees have certain rights and expectations that can make it difficult and time-consuming for the FCC to reclaim and relicense occupied spectrum for other purposes.[43] Though the FCC does not explicitly address the issue of whether licensees have a recognizable positions or expectation of reallocation in case of expiry of a license or spectrum assignment, it clearly indicates that at least for the case of

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[42] The FCC has created an online base Spectrum Dashboard that allows in a transparent and easy way to find out how spectrum is being used, who owns spectrum licenses around the country, and what spectrum is available in each county. See http://reboot.fcc.gov/reform/systems/spectrum-dashboard

[43] See reasoning of the Omnibus Broadband Initiatives (OBI) established as part of the implementation efforts of the National Broadband Plan, in: SPECTRUM analysis: OPTIONS FOR BROADCAST SPECTRUM, OBI TECHNICAL PAPER NO. 3, June 2010 (hereinafter OBI Technical Paper No. 3), p. 24, "Historically, the FCC has approached the allocation of spectrum on a band-by-band, service-by-service basis, typically in response to specific requests for particular service allocations or station assignments to meet specified uses. This approach complicates efforts to respond to changing market needs and the emergence of new technologies. Attempts to reallocate spectrum under this approach have often been contentious, as licensees possess certain rights and expectations that can make it difficult, in practice, for the FCC to reclaim and re-license that spectrum for another purpose. Contentious spectrum proceedings can be time-consuming, increasing the opportunity cost of delayed reallocation of licenses to other uses. One way to address this challenge is through voluntary reallocation mechanisms, such as incentive auctions, which can transform a contentious process into a cooperative one." The FCC Omnibus Broadband Initiative (OBI) Working Reports Series and Technical Paper Series present analysis and research by FCC staff members. These papers reflect work performed in support of the National Broadband Plan and provide context for the Plan.

withdrawal of spectrum before expiry of the assignment period there are rights and expectations that cannot be ignored.[44] The reason for this is that in general, under the Takings Clause of the Fifth Amendment[45] of the U.S. Constitution, compensation is required if property is taken away for public uses. At least for the case of non-expiry of license the application of the clause could be argued.

- **The expectation of renewal of a (spectrum) license**

The radio spectrum is owned by the federal government, some spectrum is used by the military and other federal agency. The FCC assigns the spectrum for commercial use. Usually licenses are limited in time, in the USA the usual spectrum license is issued for 10-15 years. Though the FCC does not explicitly grant spectrum holders property rights[46], and restricts their use of spectrum to certain applications the argument is often raised, particularly in the context of broadcasting.[47] The expectation of renewal can be based upon the fact that in the past spectrum licenses were never revoked for other reasons than repeated negligence or wilful misuse.[48] It has been suggested that this has sent a signal to financial markets that a spectrum licensee can

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[44] See FCC, National Broadband Plan, Chapter 5, p. 81; OBI Technical Paper No. 3, p. 24 for further reasoning.

[45] The clause states: "nor shall private property be taken for public use, without just compensation"

[46] The Communications Act of 1934 explicitly denies property rights to license holders and clearly bans private ownership of radio spectrum: It is the purpose of this chapter, among other things, to maintain the control of the United States over all the channels of radio transmission; and to provide the use of such channels, but not the ownership thereof, by persons for limited periods of time, under licenses granted by Federal authority, and no such licenses shall be construed to create any such right, beyond the terms, conditions and period of the license. See 47 U.S.C. § 301 (2006). In the context of broadcasting, the Communications Act remains somewhat open for interpretation as section 204 implies that licenses will be renewed absent violation of terms.

[47] See for instance, J. Armand Musey, Broadcasting Licenses: Ownership Rights and the Spectrum Rationalization Challenge, 13 Colum. Sci. & Tech. L. Rev. (forthcoming Mar. 2012) (Feb. 29 manuscript at p. 4 et seq.), elaborating in detail on the issue of property rights in spectrum and the specific case of broadcasting: The uncertainty of broadcasters' property rights clearly complicates the process of spectrum reallocation, as any compensation for broadcasters potentially increases the costs for the U.S. government dramatically. The uncertainty surrounding license rights also impacts the revenue raised for spectrum at future auctions.

[48] See Section 312 of the Communications Act 1934, 47 USC 312. See also Richard Bennett, Spectrum Policy for Innovation, ITIF, September 2011, p. 21.

de facto be treated as perpetual. However, there is no sound legal basis for these expectations.[49]

- **Clearing up and reusing spectrum**

The FCC when asking Congress for special authority to reallocate spectrum in its NBP does not propose a "one fits all"-solution. In contrast, it points out that for some bands reallocation may not be an appropriate action, e.g. because there are international obligations or other constrains. The FCC favours to have the option to choose between basically three methods[50]:

1) **Traditional auction** is deemed the appropriate and efficient method for the reallocation of spectrum that the government is able to reclaim.
2) **Incentive auctions** are favoured if spectrum is needed that is currently occupied by incumbent licensees.
3) **Secondary market approaches** are considered useful for some particular bands.

Notably, in the NBP the **FCC also proposes to free up a new, contiguous nationwide band for unlicensed use** which represents a departure from the approach it currently follows. Under the current practice, unlicensed devices can operate on any spectrum that is not specifically designated as restricted. Moreover, the burden is on them to ensure that they are not causing any harmful interference and they must themselves accept harmful interferences caused by operators in other bands. Under the FCC proposals these unlicensed device uses would be protected within the special nationwide frequency band assigned to them. The FCC argues that innovations have been evolved in this area pointing out e.g. garage door openers, Bluetooth, Wi-Fi, Near-Field communication devices.[51]

From the three proposed options for making spectrum available to address future needs, the FCC in the NBP favours incentive mechanisms to reallocate spectrum currently occupied by incumbent licensees. In Recommendation 5.4 the FCC asks Congress for the authority to conduct incentive auctions in which incumbent licensees

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[49] See e.g. Richard Bennett, Spectrum Policy for Innovation, ITIF, September 2011, p. 21, and for further details on the U.S. situation on property rights J. Armand Musey, Broadcasting Licenses: Ownership Rights and the Spectrum Rationalization Challenge, 13 Colum. Sci. & Tech. L. Rev. (forthcoming Mar. 2012) (Feb. 29 manuscript at p. 4 et seq.)

[50] FCC, National Broadband Plan, Chapter 5, p. 85.

[51] FCC, National Broadband Plan, Chapter 5, p. 95.

may relinquish rights in spectrum assignments to other parties or to the FCC and receive a portion of the proceeds realized in the auction in return.[52] The FCC argues that this would be an enhancement of the existing auctioning system but requiring special authority from Congress as sharing of proceeds between the U.S. Treasury and the relinquishing incumbent spectrum licensees is not allowed under the current U.S. law.

- **Voluntary reallocation of spectrum based on incentive auctions**

  Instead of forcing incumbents to give up spectrum assigned to them, the FCC opts for a voluntary, cooperative approach. Though it does not negate its authority to reclaim and relicense spectrum, it does not favour it because it can be quite time consuming and incur significant opportunity costs.

  Basically the FCC sees **three modes to free up spectrum for voluntary reallocation through incentive auctions**. The details are not yet fully developed and rule-making procedures need to be conducted. The FCC has started to describe some cornerstones of this voluntary reallocation process in the NBP and supplementary material:[53]

  - **Two-step incentive auction**: Under this option, the incumbents as spectrum holders would commit to release spectrum at a given price, which is then assigned through a conventional auction.

    As the first step, incumbent spectrum holders would be given an opportunity to commit, through a bidding process, the minimum price at which they would voluntarily return their license to the FCC.[54] On the second step, upon the conclusion of the first step, the FCC would conduct a "repacking analysis" using a new model described as the Allotment Optimization Model (AOM)[55]

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[52] FCC, National Broadband Plan, Chapter 5, p. 81. This authority has now been given to the FCC by Congress.

[53] See FCC, National Broadband Plan, Chapter 5, p. 81 et seq. and for further details and examples in the case of broadcasting: OBI Technical Paper No. 3, p. 25. As pointed out, these are not yet finalized and rulemaking procedures have to be conducted.

[54] An alternative would be to offer fractional channels by agreeing to share a channel with other licensees in the same market. For further details for this alternative see OBI Technical Paper No. 3, p. 25.

[55] The Allotment Optimization Model (AOM) is a new methodology that will allow the FCC to optimize channel assignments for various objectives and to set constraints on those objectives, in a much faster, more accurate and more user-friendly way than is currently possible. See OBI Technical Paper No. 3, p. 5, 12 and particularly Appendix C for the technical details.

currently being developed. The model could determine the minimum cost of clearing alternative amounts of contiguous (paired) spectrum nationwide. The FCC could use this information to determine the amount of cleared spectrum that would be available in the second step. Alternatively, the FCC might design the second-step auction to permit the amount of spectrum cleared to depend on both the bid prices for cleared spectrum and the cost of clearing. This methodology would be spelled out in advance. After the conclusion of the second auction, the current holder of the spectrum would be compensated as established in the first step.[56]

Another alternative is to grant flexible rights: i.e. the FCC could grant incumbents more flexible rights to use the re-purposed spectrum as long as they agreed to participate in the auction. Requiring licensees to participate in the auction as a pre-condition for acquiring enhanced rights forces them to consider the opportunity cost of holding the repurposed licenses, since in the auction they will actually observe what other bidders are willing to pay for their licenses.[57]

- **Exchange or two-sided auction**: The FCC under this option would conduct an exchange to simultaneously clear incumbents and sell cleared spectrum.

  This option would combine the separate two-step incentive auction for cleared spectrum into a single market. In an exchange spectrum sellers would simultaneously offer spectrum while those seeking cleared spectrum would bid on 'unencumbered' licenses. In contrast to a two-step auction, the amount of spectrum cleared would be determined simultaneously.[58]

- **Overlay auction**: Under the overlay auction authority, the FCC auctions 'encumbered' overlay licenses and lets the new overlay licensees negotiate with incumbents to clear spectrum. Here the FCC would play a more passive role and auction overlay licenses. It would divide the bands into large, contiguous blocks and auction all or a portion of those blocks as overlay licenses with flexible use. It would then be up to the new overlay licensee to negotiate directly to clear spectrum and pay each other's relocation costs. The FCC has already used this approach in the past as it does not require additional authority for it. The disadvantages of this option are that incumbents might decide not to clear spectrum or it may take a long time to negotiate a clearing of spectrum. In addition, the proceeds from the overlay option would

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[56] See OBI Technical Paper No. 3, p. 25.

[57] See FCC, National Broadband Plan, Chapter 5, p. 81 et seq., Endnote 38.

[58] See OBI Technical Paper No. 3, p. 25.

be significantly lower than proceeds from an incentive auction as the price paid might be less due to the uncertainty and timing involved under this option.[59]

In sum, the FCC favours a market-based approach to spectrum reallocation where spectrum is not taken away by governmental authority but via a voluntary, incentive based approach. It is ground on the strong belief that the market will solve the issues.[60]

- **Voluntary reallocation of current broadcast spectrum based on incentive auctions**

A characteristic of radio frequency spectrum in the U.S.A. is that a large amount of spectrum is currently held by broadcasters. This spectrum could be used for mobile broadband or data services. To a large degree that spectrum is used very inefficiently as not even 20% of the 294 MHz currently allocated to broadcast television is actually used.[61] Broadcasters simply hold on to it. In addition, 90% of U.S. households get their TV broadcast not via spectrum but other means like cable, satellite or Internet-based services.[62] The question arises as to how to utilize that spectrum, either to incentivise broadcasters to give it up for reallocation, or take it away due to non-use. In the case of spectrum currently held by broadcasters the USA faces a lock-in situation: Broadcasters cannot take advantage of it for other then TV services as it has been assigned to them for this purpose only. And the FCC may not take it away as they claim to have property rights to it or at least some expectations. Even if this is not the

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[59] See OBI Technical Paper No. 3, p. 25. See also See FCC, National Broadband Plan, Chapter 5, p. 82.

[60] Historically, the USA moved from a strict command and control approach to a more market based approach to spectrum management. For an overview on the development, see Jeffrey A. Eisenach, Spectrum Reallocation and the National Broadband Plan, 88 FEDERAL COMMUNICATIONS LAW JOURNAL, Vol. 64. (available at http://www.law.indiana.edu/fclj/pubs/v64/no1/Vol.64-1_2011-Dec_Art.-03_Eisenach.pdf)

[61] See J. Armand Musey, Broadcasting Licenses: Ownership Rights and the Spectrum Rationalization Challenge, 13 Colum. Sci. & Tech. L. Rev. (forthcoming Mar. 2012) (Feb. 29 manuscript at p. 2 with further references)

[62] See J. Armand Musey, Broadcasting Licenses: Ownership Rights and the Spectrum Rationalization Challenge, 13 Colum. Sci. & Tech. L. Rev. (forthcoming Mar. 2012) (Feb. 29 manuscript at p. 3 with further references); see also Richard Bennett, Spectrum Policy for Innovation, ITIF, September 2011, p. 18.

case a long legal battle in court can be expected.[63] Therefore FCC could now make that spectrum available by either giving broadcaster the right to use the spectrum i.e. for mobile data services or 'redesignating' the spectrum to make it accessible for trading. Or it could take the spectrum away due to it not being used. The FCC favours

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[63] For a good line of argument: See J. Armand Musey, Broadcasting Licenses: Ownership Rights and the Spectrum Rationalization Challenge, 13 Colum. Sci. & Tech. L. Rev. (forthcoming Mar. 2012) (Feb. 29 manuscript at p. IV), basically stating that though from a legal point of view there are no property rights in spectrum, due process rights allow broadcasters to significantly delay the reallocation process, putting it under legal risks: Courts are unlikely to find that the television broadcasters have property rights to the spectrum they use, even for the currently-licensed lower-value television broadcast use. The FCC grants spectrum licenses to companies for periods of limited duration, usually 5-15 years, with some expectation of renewal, assuming the license holder complies with the terms of the license. The Communications Act of 1934 is clear that spectrum licenses do not confer permanent property rights. Over time, however, the broadcasters' renewal expectations have become stronger due to FCC actions, judicial precedents, and regulatory changes. Broadcasters and their investors have taken significant actions based on the assumption that the licenses will be renewed, including making large investments in their broadcast businesses and regularly selling licenses to third parties for considerable amounts. Nevertheless, broadcasters are ultimately unlikely to be able to assert legally protected property interests in their licenses. Supreme Court precedent dealing with regulatory changes and an analogous line of cases dealing with grazing permits demonstrate that any broadcaster's claims for property rights are weak. The broadcasters' strongest argument would be one of promissory estoppel, based on their recent investment in digital transmission equipment as part of the digital television conversion in 2009 and the license renewal expectations that were written into the 1996 Amendment to the Telecom Act. However, even these arguments would likely fall short under prevailing law. Despite their weak property rights claim, the broadcasters have significant due process rights that could make the government's reacquisition and reallocation of their spectrum highly expensive and time consuming. Absent the recent legislation authorizing incentive auctions to reallocate broadcast spectrum, the FCC would not only have had to engage in a rulemaking process, but also may have had to hold individual adjudications for each license it seeks to revoke or deny renewal. In addition, each television broadcaster that receives an unfavourable decision will have the option of seeking judicial review. These procedures would significantly drain government resources and tremendously delay the spectrum reallocation process. In recognition of broadcasters' vast political power and the government's desire to avoid protracted litigation and maximize revenue from upcoming spectrum auctions, the government's more practical and expedient option was to agree to not contest the existence of the broadcasters' property rights. Rather, the government shifted the debate from whether broadcasters possess property rights in the spectrum, to the type and amount of compensation to be awarded to the broadcasters. This may have been the most efficient way to clear the spectrum and maximize the value of future spectrum auctions while satisfying the interests of the broadcasters, the U.S. Treasury, and society as a whole.

the incentive auction option where the incumbent licensees agree to relinquish their licenses in return for receiving revenues generated by an auction.

Though under the incentive auction mechanism, not all funds will go to the U.S. Treasury department; the FCC believes that incentive auctions still have a net-positive revenue impact for a variety of reasons: accelerated clearing, more certainty about costs, and the ability to auction adjacent spectrum that, due to technical rules, is not currently licensed.[64]

Clearly the idea is that incumbents are encouraged to cash-in on the value of their unused spectrum by participating in these voluntary market based mechanisms.

The authority to carry out incentive auction authority was given to the FCC in February 2012 by Congress after passing appropriate legislation.

The attractiveness of the incentive auction approach is that is based on voluntariness and the movement of user to other frequencies does not require an intensive regulatory process. However, one has to note that the USA is a highly competitive market with many players competing for the customers.

- **Spectrum for Government Services[65]**

Governmental authorities use a large amount of spectrum in the USA. It therefore is a valuable resource of which some could be freed-up and designated for non-governmental uses. In December 2004 the Commercial Spectrum Enhancement Act (CSEA)[66] was signed into law in order to provide a legal basis for reallocating spectrum used by federal authorities. It created the Spectrum Relocation Fund (SRF) to provide a centralized and streamlined funding mechanism through which Federal agencies can recover the costs associated with relocating their radio communications systems from certain spectrum bands, which were authorized to be auctioned for commercial purposes. The CSEA appropriated such sums as are required for

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[64] See FCC, National Broadband Plan, Chapter 5, p. 82.

[65] In the U.S.A. spectrum for federal governmental use is not managed by the FCC. The National Telecommunications and Information Administration (NTIA) is an executive branch within the Department of Commerce and manages the Federal government's use of spectrum, ensuring that America's domestic and international spectrum needs are met while making efficient use of this limited resource. For further details see http://ntia.doc.gov/category/spectrum-management and http://ntia.doc.gov/about

[66] See Commercial Spectrum Enhancement Act (CSEA), Pub. L. No. 108-494, 118 Stat. 3986, Title II (2004)

relocation costs, which are financed by auction proceeds.[67] The FCC proposes to expand the CSEA as it has proven successful and further spectrum may get available for non-federal use.[68] Clearly, federal agencies are compensated for the cost of relocating.

In a recent study presented by non-telecommunications providers including Google, Microsoft and venture capitalists to the President's Council of Advisors on Science and Technology (PCAST) in May 2012 the idea of a Federal Spectrum Access Regime was promoted. The authors claim that because of the cost of clearing and reallocating Federal Spectrum any federal band that needs to be cleared would not have a high commercial value.[69] Instead they assert that federal spectrum can be more efficiently used by sharing models implementing new computer-based technologies that allow the renting or leasing of spectrum for periods of time as short as seconds. Whether this idea will find the broad support of the Government / FCC and the industry remains to be seen. It also has to be evaluated whether this is a general solution approach or whether it may be used to "bridge" gaps in spectrum for a limited period of time. Nevertheless it presents an interesting idea of the Government renting or leasing spectrum instead of reallocating it which should be considered.

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[67] See Commercial Spectrum Enhancement Act, Report to Congress on Agency Plans for Spectrum Relocation Funds, 16 February 2007, p. 3.

[68] See FCC, National Broadband Plan, Chapter 5, p. 82, citing different examples where governmental spectrum has been successfully made available for commercial use. The final report is expected to be published in June 2012.

[69] See http://www.whitehouse.gov/sites/default/files/microsites/ostp/pcast_spectrum_may25.pdf

1.1.3 Hong Kong

Hong Kong's spectrum policy framework was promulgated in 2007 after a three month public consultation conducted by the Commerce, Industry and Technology Bureau.[70] It is administered by the Office of the Communications Authority (OFCA)[71] (which will be termed 'Authority' in this section).

- **Right to vary or withdraw frequencies assigned to a licensee before the expiry**

  In the consultation process a major point of discussion was whether or not the spectrum regulator has the right to vary or withdraw frequencies assigned to a licensee before their expiry.

  The Authority decided that it in general has the statutory **power to vary or withdraw any spectrum assigned as long as it gives reasonable notice.**[72]

  It goes a step further and expands this power to vary or withdraw spectrum regardless of whether the assignment expired or not. However, **before expiry it only exercises the power in exceptional circumstances.**[73] These exceptional circumstances can be summarized as follows:

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[70] For details see: http://www.cedb.gov.hk/ctb/eng/telecom/topical_b.htm

[71] Note: With effect from 1 April 2012, all duties and powers of the Telecommunications Authority (TA) are conferred on the Communications Authority (CA), and all duties and powers of the Office of the Telecommunications Authority (OFTA) are conferred on the Office of the Communications Authority (OFCA), the executive arm of the CA. Thus, in quotes references to TA and OFTA shall be construed as CA and OFCA respectively. For further information see http://www.ofca.gov.hk/en/home/index.html.

[72] Radio Spectrum Policy Framework (April 2007), Annex A, File Ref: CTB (CR) 7/4/16(06), LEGISLATIVE COUNCIL BRIEF, PROPOSED SPECTRUM POLICY FRAMEWORK – OUTCOME OF CONSULTATION, Sec. 4.1.: "TA is empowered to vary or withdraw any spectrum assigned by reasonable notice under sections 32H (3) and (4) of the TO."

[73] Radio Spectrum Policy Framework (April 2007), Annex A, File Ref: CTB(CR) 7/4/16(06), LEGISLATIVE COUNCIL BRIEF, PROPOSED SPECTRUM POLICY FRAMEWORK – OUTCOME OF CONSULTATION, Sec. 4.1.: "Without affecting the generality of the powers which TA has, the policy inclination is that the said statutory power will be exercised only in exceptional circumstances before the expiry of a spectrum assignment under the TO, including where the public interest or international obligations of the Government so require, there is a serious breach of spectrum assignment conditions or serious interference between legitimate spectrum users has to be resolved or minimized."

- ☐ public interest concerns or
- ☐ international obligations
- ☐ serious breach of spectrum assignment conditions
- ☐ serious interferences

Some of the exceptions were heavily contested as they were criticized as being too vague; instead, an exhaustive list triggering the circumstances was requested by some submissions.[74] However, the Authority stated that it does not consider it possible to list out all triggering circumstances exhaustively.[75]

Others asserted that in the case of withdrawal of an assignment before expiry would require compensation[76], but the Authority negates that request pointing out that there is no legal basis for that and the relevant section of the law prohibits refunding in case of varying or withdrawal.[77]

In the opinion of CA, neither the licensee nor the spectrum assignee can reasonably expect that its rights are renewed:

> "4.2 There is no legitimate expectation that there will be any right of renewal or right of first refusal of any licence or spectrum assignment upon the expiry of a licence or spectrum assignment under the TO. The decision whether a new

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[74] See File Ref: CTB (CR) 7/4/16(06), LEGISLATIVE COUNCIL BRIEF, PROPOSED SPECTRUM POLICY FRAMEWORK – OUTCOME OF CONSULTATION, Sec. 12.

[75] See File Ref: CTB (CR) 7/4/16(06), LEGISLATIVE COUNCIL BRIEF, PROPOSED SPECTRUM POLICY FRAMEWORK – OUTCOME OF CONSULTATION, Sec. 13.

[76] See File Ref: CTB (CR) 7/4/16(06), LEGISLATIVE COUNCIL BRIEF, PROPOSED SPECTRUM POLICY FRAMEWORK – OUTCOME OF CONSULTATION, Sec. 12: "Some existing spectrum users also raise the issue of compensation should the assignment be withdrawn before expiry."

[77] See File Ref: CTB (CR) 7/4/16(06), LEGISLATIVE COUNCIL BRIEF, PROPOSED SPECTRUM POLICY FRAMEWORK – OUTCOME OF CONSULTATION, Sec. 14: "14. Aside from the fact that the TO is silent on the issue of compensation, section 34(5) provides that no part of any fee or sum paid, including any spectrum utilisation fees paid pursuant to section 32I of the TO, shall be refunded in the event of any cancellation, withdrawal or suspension of any licence etc. Furthermore, for all telecommunications licensees which are subject to the powers of the TA to vary or withdraw any of the assigned spectrum by reasonable notice under sections 32H(3) and (4) of the TO, the holders of such licences cannot claim any compensation or other remedies pursuant to the Basic Law against the Government or the TA for any variation or withdrawal of frequencies which they have been using, whether the variation or withdrawal is intended to take place before or upon the expiry of their licences and irrespective of the reason for the variation or withdrawal, provided that the notice to be given by the TA under section 32H(4) of the TO is reasonable in the circumstances of each case."

spectrum assignment, with the same or varied radio frequencies, should be given to the spectrum assignee would be made and notified to the spectrum assignee within a reasonable time before the expiry of its spectrum assignment or after receipt of its application by TA as it is applicable in the circumstances, after taking into account the spectrum policy objectives [...] as well as all other relevant factors, including but not limited to any other public interest considerations."[78]

As can be expected, most existing spectrum assignees (including fixed carriers, mobile carriers, satellite operators and a TV broadcaster) disagreed with that view. They argued that the longer the period of assignment, the greater the expectation for renewal upon expiry. They also claimed that the proposal departs from international best practice and could undermine the incentives of investors to invest after the initial licence period. One assignee argued that if spectrum was fully liberalised, the market would lead the assignee to dynamically reallocate spectrum to an alternative, more economically efficient, use, without involving the regulatory authority in another re-allocation or re-assignment exercise. Some suggested that the circumstances where spectrum assignment is not renewed should be limited to exceptional circumstances and prescribed explicitly, similar to withdrawal of assignment before expiry.[79]

None of these arguments were accepted by the Authority. Without explicitly stating, the reasoning thus puts emphasis on the argument that an expiry date is a clear sign that there can be an end to an assignment and thus an expectation that the license or spectrum assignment gets renewed automatically cannot reasonably be established.[80]

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[78] Radio Spectrum Policy Framework (April 2007), Annex A, File Ref: CTB (CR) 7/4/16(06), LEGISLATIVE COUNCIL BRIEF, PROPOSED SPECTRUM POLICY FRAMEWORK – OUTCOME OF CONSULTATION, Sec. 4.2.

[79] See File Ref: CTB (CR) 7/4/16(06), LEGISLATIVE COUNCIL BRIEF, PROPOSED SPECTRUM POLICY FRAMEWORK – OUTCOME OF CONSULTATION, Sec. 16.

[80] See File Ref: CTB (CR) 7/4/16(06), LEGISLATIVE COUNCIL BRIEF, PROPOSED SPECTRUM POLICY FRAMEWORK – OUTCOME OF CONSULTATION, Sec. 17. The CA though in general accepting the argument that the value of the spectrum would be negatively affected and the effectiveness of spectrum trading might be hampered, it did not follow it: "We accept that the absence of automatic right of renewal may affect the value of spectrum when auctioned, and potentially hamper the effectiveness of spectrum trading and spectrum liberalisation as possible market tools. Once spectrum trading and/or spectrum liberalisation is implemented, the issue of spectrum rights at the end of a spectrum assignment should be revisited." And Sec. 22: "On spectrum already assigned with an expiry date, since there should be no legitimate expectation of renewal upon expiry [...] TA should be able to consider their future use after expiry and include them in the spectrum release plans, if appropriate."

As far as the issue of the **reasonableness of the notice period** is concerned, the Authority proposes to give a minimum notice period for the exceptional case of a variation or withdrawal before the natural end of the assignment term of the license or spectrum. The **duration of that notice period may vary depending on the types of the spectrum assignment and its linkage to a service license**.

When determining the appropriate minimum notice periods the Authority will take into consideration:

- ☐ the economic life of the equipment installed,
- ☐ the timeframe to migrate existing customers and
- ☐ the duration of the spectrum assignments.

The minimum notice periods should then be published by the Authority for public information and conveyed to the affected party where practical.[81]

In the **case of a carrier license for the provision of mobile or wireless services, the** Authority **considers a notice period of no less than three years before the variation or withdrawal sufficient**.[82] This notice period is in line with the time horizon for the proposed spectrum release plan.[83]

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[81] See File Ref: CTB (CR) 7/4/16(06), LEGISLATIVE COUNCIL BRIEF, PROPOSED SPECTRUM POLICY FRAMEWORK – OUTCOME OF CONSULTATION, Sec. 15.

[82] Radio Spectrum Policy Framework (April 2007), Annex A, File Ref: CTB (CR) 7/4/16(06), LEGISLATIVE COUNCIL BRIEF, PROPOSED SPECTRUM POLICY FRAMEWORK – OUTCOME OF CONSULTATION, Sec. 4.3: "4.3 If a spectrum assignment is to be varied or withdrawn before the assignment expires, the spectrum assignee to be affected will be notified before the variation or withdrawal is to take place in accordance with sections 32H (3) and (4) of the TO. For this purpose, the TA may state minimum notice periods for different types of spectrum assignments. In the case of spectrum assignment to a carrier licensee for the provision of mobile or wireless carrier services, a notice period of not less than three years before the date of variation or withdrawal would be given insofar as it is practicable in the circumstances. If a spectrum assignment is to be renewed with different radio frequencies assigned, or not renewed upon the expiry of an assignment, notification would be given as mentioned in paragraph 4.2 above. If the circumstances permit, the minimum notice periods to be stated by TA would also apply in relation to these changes or non-renewal."

[83] See File Ref: CTB(CR) 7/4/16(06), LEGISLATIVE COUNCIL BRIEF, PROPOSED SPECTRUM POLICY FRAMEWORK – OUTCOME OF CONSULTATION, Sec. 15, citing its handling of migration periods given to the two mobile carrier licensees when their second-generation (2G) mobile carrier licenses were not renewed in 2005.

With this ruling, the Authority decided on a notice period that is clearly shorter than the notice period of five years that many submissions were asking for.[84]

Looking at the application of these rules to actual cases, it has to be pointed out that the Authority has never withdrawn spectrum where a long duration carriers license was concerned and only very rarely in short term duration assignments spectrum in order to make available spectrum for other uses.

- **Spectrum Re-farming**

For the case of re-farming of spectrum, the Authority requires an impact assessment which has to include the option of "do nothing" before taking away spectrum. A notice period depending on the type of spectrum is also required.[85]

- **Spectrum for Government Services**

As far as spectrum for governmental or public services is concerned, the Authority deviates from the market-based approach and manages it administratively under the command and control approach subject to triennial review.[86]

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[84] See File Ref: CTB(CR) 7/4/16(06), LEGISLATIVE COUNCIL BRIEF, PROPOSED SPECTRUM POLICY FRAMEWORK – OUTCOME OF CONSULTATION, Sec. 12.: "On the appropriate notice period to be given to the affected parties in such a case, a couple of submissions suggest five years for spectrum assignment for carrier licenses."

[85] Radio Spectrum Policy Framework (April 2007), Annex A, File Ref: CTB (CR) 7/4/16(06), LEGISLATIVE COUNCIL BRIEF, PROPOSED SPECTRUM POLICY FRAMEWORK – OUTCOME OF CONSULTATION, Sec. 4.4.: "4.4 Before the conduct of a spectrum refarming exercise, an appraisal of the impacts of different options, including an option of "do nothing", will be undertaken by TA before a decision is taken. The same minimum notice periods described in paragraph 4.3 above will be given to the affected spectrum assignees insofar as it is practicable in the circumstances." See also File Ref: CTB (CR) 7/4/16(06), LEGISLATIVE COUNCIL BRIEF, PROPOSED SPECTRUM POLICY FRAMEWORK – OUTCOME OF CONSULTATION, Sec. 18.

[86] Cf. Radio Spectrum Policy Framework (April 2007), Annex A, File Ref: CTB (CR) 7/4/16(06), LEGISLATIVE COUNCIL BRIEF, PROPOSED SPECTRUM POLICY FRAMEWORK – OUTCOME OF CONSULTATION, Sec. 6: "Spectrum to be used by or on behalf of government will continue to be managed administratively. The market-based approach will not be applied. 6.2 The efficiency of the use of those spectrum will be reviewed by TA every three years."; see also File Ref: CTB (CR) 7/4/16(06), LEGISLATIVE COUNCIL BRIEF, PROPOSED SPECTRUM POLICY FRAMEWORK – OUTCOME OF CONSULTATION, Sec. 17: "all spectrum for providing government services should continue to be subject to the command and control approach but be subject to regular administrative review by the TA."

1.1.4 Australia

The Australian Communications and Media Authority (ACMA) is responsible for managing the radiofrequency spectrum in accordance with section 9 of the *Australian Communications and Media Authority Act 2005* (the ACMA Act) and the *Radiocommunications Act 1992* (the Act). It administers the Australian Radiofrequency Spectrum Plan (spectrum plan) as the highest-level spectrum planning document in Australia. It divides the Australian radiofrequency spectrum into a number of frequency bands and specifies the general purpose for which each band may be used.[87]

- **No automatic renewal after expiry of licence period**

  Section 65(3) of the Australian Radiocommunications Act stipulates that a spectrum license may be issued for any period of up to 15 years. The usual spectrum license has a 15-year duration period[88] and will expire at the end of this period.[89] As a general rule there is no automatic right of renewal under the Act. However, the Act contains certain provisions for cases when a re-issuance of the spectrum license is in the public interest.[90]

  Many of the current spectrum licenses are close to their expiry period. Most of them expire during 2012-2016 and respective spectrum has to be allocated, converted, reissued and reallocated.[91]

  To prepare for the time after expiry of the current spectrum allocations, the ACMA is currently undergoing a range of activities, including preparation for consultation processes[92] to address the issues associated with the expiry of spectrum licenses.[93]

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[87] See ACMA, Five-year spectrum outlook 2012–2016, The ACMA's spectrum demand analysis and indicative work programs for the next five years, MAY 2012 (hereinafter referred to as ACMA Five-year spectrum outlook), p. 14.

[88] Most spectrum licenses have 15 years duration period. A few have 10 years as they were issued under the old Radiocommunications Act 1992. See Spectrum reallocation in the 700 MHz digital dividend band, discussion paper, October 2010, p.34

[89] For an overview on the details of expiring licenses, see http://www.acma.gov.au/WEB/STANDARD/pc=PC_410295; see also http://www.dbcde.gov.au/radio/radiofrequency_spectrum/spectrumlicences. the first of the spectrum licenses will expire in 2013, the remainder by 2017.

[90] See Radiocommunications Act, Sections 80 et seq.

[91] See ACMA, Five-year spectrum outlook 2012–2016, p 32.

Two options are available under the Australian Radiocommunications Act for handling spectrum licenses upon expiry:

Option 1: Undertake a **re-allocation process** according to Section 60 of the Act, thus applying a price-based allocation process[94] Part 3.6 of the act contains detailed provisions for the reallocation of 'encumbered' spectrum. In brief, for reallocation, the Minister has to issue a written spectrum reallocation declaration specifying the spectrum that is subject for reallocation,[95] stipulate a reallocation period setting the timeframe during which the reallocation process is to be completed[96] and specify a reallocation deadline [97] . The action of the Minister is conditional upon a recommendation by the ACMA to make a spectrum reallocation declaration.[98]

Option 2: **Re-issue spectrum** licenses under special circumstances for which two cases are described: [99] Either, the Minister basically makes a public interest determination for a class of services[100], or special circumstances exist that satisfy that

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[92] For an overview see ACMA, Five-year spectrum outlook 2012–2016, p 33 and 37-41.

[93] For instance, the ACMA updates the spectrum licensing framework to incorporate the experiences in the past and update and future-proof the spectrum licensing framework for the next 15-year license period. Most of these proposed changes are administrative in nature or address certain technical issues. See for further details: Proposed updates to the spectrum license framework, Consultation paper, MARCH 2012

[94] See Radiocommunications Act, Sections 80, 60, 153A et seq. Price based allocation of spectrum is the allocation of a license by auction, tender, pre-determined price and not by other means like lottery, first-come, merit-based administrative system (not price, but e.g. social benefit).

[95] See Radiocommunications Act, Section 153B

[96] See Radiocommunications Act, Section 153B (1), (4) stipulates that the re-allocation period must: (a) begin within 28 days after the declaration is made; and (b) run for at least 2 years.

[97] See Radiocommunications Act, Section 153B (5): That time must be at least 12 months before the end of the re-allocation period. This means that ACMA must allocate at least one license before the deadline, otherwise the Minister's declaration is taken to be revoked according to Section 153(K) of the Radiocommunications Act; see also Draft spectrum reallocation recommendations for the 700 MHz digital dividend and 2.5 GHz bands, Information paper, MAY 2011, p. 10, 12.

[98] See Radiocommunications Act, Section 153E, 153F

[99] See Radiocommunications Act, Section 82(1)

[100] See Radiocommunications Act, Section 82(1)(a), (3). In February 2012, the Australian Minister has made such a class of service determination for mobile voice and data communications services in the 800 MHz, 1800 MHz and 2 GHz bands; wireless broadband services in the 2.3 GHz, 3.4 GHz bands; and satellite services in the 27 GHz band.

it is in the public interest that existing licensee continues to hold the license.[101] In case of a class of service determination by the Minister, Section 82(1) (a) of the Act allows ACMA to begin the re-issue consideration. As part of this process, ACMA will evaluate whether the spectrum license has been used or not. The license holder of the spectrum proposed for reissuance has to submit evidence that they have satisfied the public interest, the proposed use and a statement on what they are willing to pay as spectrum access charges for reissue of spectrum licenses. All proposals will be evaluated by an inter-departmental committee.[102]

The ACMA's policy is to **inform the spectrum holder approximately 18 months before the expiry whether the occupied spectrum is to be re-issued or re-allocated**.[103] This should give the current spectrum holder certainty.

- **Varying of spectrum licenses**

Section 72 of the Radiocommunications Act gives ACMA the authority to vary a spectrum license either by agreement or without agreement. In the latter case, ACMA has to give written notice to the licensee.

- **Resuming spectrum licenses – withdrawal of spectrum before expiry**

Under Sections 89 et seq. of the Radiocommunications Act, ACMA also has the authority to 'resume' the spectrum license before expiry in whole or in part. As with the variation authority the resumption can take place by agreement or in a compulsory process. Any compulsory action requires a written approval of the Minister and requires compensation.[104]

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[101] The Act does not define "public interest". However, after a consultation in 2009 the Minister listed five criteria to be assessed. These criteria are: Promoting the highest value use for spectrum, investment and innovation, competition, consumer convenience, determining an appropriate rate of return to the community. See Australian Government, Department of Broadband, Communication and Digital Economy, Fact sheet: reissue of 15-year spectrum licenses (hereinafter Fact sheet).

[102] This Evaluation Committee is comprised of senior officials from the Department of Broadband, Communication and Digital Economy, Treasury and Department of Finance and Deregulation. See Fact sheet, p. 2.

[103] See http://www.acma.gov.au/WEB/STANDARD/pc=PC_410295; See also ACMA, Five-year spectrum outlook 2012–2016, p 35.

[104] See Radiocommunications Act, Sections 91(2), 93

- **Spectrum cleared for digital dividend**

  In July 2010, the Minister for Broadband, Communications and Digital Economy of Australia directed the ACMA to clear 126 MHz of spectrum in the 700 MHz band (694-820 MHz).[105] The ACMA applied a three step process in order to realise the digital dividend:[106]

  - Step 1 – Digital switchover:

    Conversion of analogue television broadcasting to digital transmission in order to permit re-farming of spectrum for alternative uses

  - Step 2 – Restack:

    Clearance of a contiguous block of spectrum to derive maximum public benefit. This will require retuning of services at TV broadcasting sites.

  - Step 3 – Reallocation:

    Allocation of the cleared spectrum. This process is based on Part 3.6 of the Radiocommunications Act designed for the reallocation of 'encumbered' spectrum.[107]

- **Government Spectrum**

  There are currently no plans to actively include spectrum currently occupied by governmental agencies in the reallocation.

1.1.5 European Union

The allocation and management of radio spectrum in the European Union is administered by national administrations as radio spectrum remains principally the responsibility of Member States.

- **The role and initiatives of the European Union in spectrum management**

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[105] Authority based on Sec. 14(1) oft eh Australian Communication and Media Authority Act.

[106] See Spectrum reallocation in the 700 MHz digital dividend band, discussion paper, October 2010, p.5

[107] It consists of six steps. For the details of the reallocation process, see: Spectrum reallocation in the 700 MHz digital dividend band, discussion paper, October 2010, p.14-17.

The European Commission does not manage radio spectrum directly; its task is to ensure that the use and management of radio spectrum in the EU takes into account all relevant EU policies. Therefore the Commission addresses a number of specific goals that can only be achieved at EU level.[108]

A framework for Radio Spectrum Policy in the EU was launched by the 2002 regulatory framework for electronic communications, and particularly by the Radio Spectrum Decision (676/2002/EC). The Radio Spectrum Decision defines the policy and regulatory tools to ensure the coordination of policy approaches and harmonised conditions for the availability and efficient use of radio spectrum for the internal market.[109]

Based on the EU's regulatory framework for electronic communications, the modernisation of spectrum management is aimed at facilitating spectrum access through more flexibility in usage conditions and market-led mechanisms to manage spectrum usage rights, such as spectrum trading as well as through the introduction of more efficient or intelligent technologies that can share frequencies and the well targeted re-allocation/re-purposing of spectrum for the internal market.[110]

The Radio Spectrum Policy Programme (RSPP) was approved in March 2012 by the European Parliament and Council. It defines the roadmap of how Europe can translate political priorities into strategic policy objectives for radio spectrum use.[111] It defines key policy objectives and sets up general principles for managing the radio spectrum.

The European Union (EU) released its initiative "Digital Agenda for Europe: 2010-2020" in May 2010 with the objective to make the best use of information and communication technologies (ICT) to speed up economic recovery and lay the foundations of a sustainable digital future.[112] It identified seven priority areas where Europe should focus on. One of these priorities is making available high speed internet access to most European citizens by 2020. In order to reach this goal a European Spectrum Policy Programme has been established to create a co-ordinated and strategic spectrum policy at EU level in order increase the efficiency of radio

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[108] http://ec.europa.eu/information_society/policy/ecomm/radio_spectrum/eu_policy/index_en.htm

[109] See http://ec.europa.eu/information_society/policy/ecomm/radio_spectrum/eu_policy/index_en.htm

[110] See http://ec.europa.eu/information_society/policy/ecomm/radio_spectrum/index_en.htm#approach

[111] http://ec.europa.eu/information_society/policy/ecomm/radio_spectrum/rspp/index_en.htm

[112] See European Commission Information Society, Digital Agenda for Europe: 2010-2020, May 2010, available at http://ec.europa.eu/information_society/digital-agenda/publications/index_en.htm

spectrum management and maximise the benefits for consumers and industry.[113] The European Spectrum Policy Programme coordinates the technical and regulatory conditions applying to spectrum use and, where necessary, harmonise spectrum bands to create economies of scale in equipment markets and allow consumers to use the same equipment and avail themselves of the same services across the EU.[114]

- **Reallocation of spectrum**

  On the level of the European Union, two initiatives have been started to reallocate certain spectrum, though as stated earlier, the actual reallocation remains in the responsibility of the individual member states:

  - The **169 MHz frequency** band from the pan-European land-based public radio paging service (known as ERMES[115]) to a number of other services including radio paging[116],
  - The **digital dividend spectrum** in the UHF band that will become available when the switchover to digital television broadcasting is completed in 2012

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[113] See Digital Agenda for Europe: key initiatives, MEMO/10/200, 19 May 2010.

[114] See Communications from the Commission, A Digital Agenda for Europe, COM(2010) 245, p. 14

[115] ERMES (European Radio Messaging System) was a pan-European radio paging system that was deemed to operate in the frequency band of 169.4125-169.8125 MHz. However, ERMES was not developed further and its frequencies became available for reassignment. See Council Directive 90/544/EEC of 9 October 1990 on the frequency bands designated for the coordinated introduction of pan-European land-based public radio paging in the Community, Official Journal L 310, 09/11/1990 P. 0028 – 0029.

[116] See 2005/928/EC: Commission Decision of 20 December 2005 on the harmonisation of the 169,4-169,8125 MHz frequency band in the Community, Official Journal L 344, 27/12/2005 P. 0047 – 0051: The following reassignment was proposed in the decision: The 169,4 – 169,8125 MHz band shall be divided into a low power part and a high power part. The low power part of the 169,4 – 169,8125 MHz radio spectrum band shall accommodate the following preferred applications: (a) exclusive use for hearing aids; (b) exclusive use for social alarms; (c) non-exclusive use for meter reading systems; (d) non-exclusive use for low power transmitters for tracking and asset tracing systems. The high power part of the 169,4 – 169,8125 MHz band shall accommodate the following preferred applications: (a) high power transmitters for tracing and asset tracking systems; (b) existing paging systems or paging systems relocating from other channels in the radio spectrum band. Alternative applications for the 169,4 – 169,8125 MHz radio spectrum band may be implemented provided that they do not constrain the harmonised implementation of the preferred applications. These alternative applications shall be: (a) hearing aids, for the non-exclusive, low power part of the radio spectrum band; (b) tracing, paging, temporary use or private mobile radio communications on a national basis in the high power part of the band.

The member states of the European Union have already made a big step forward in moving to digital TV: By the end of 2012, television broadcasting services across the EU will have completed the transition from analogue to digital technology.[117] The technical switchover will make a significant amount of spectrum available for other uses and can then be reallocated.[118]

In the following chapters, we will therefore look at examples of some selected EU members states:

1.1.6 United Kingdom

Ofcom is the regulatory authority for the whole communication sector (TV and radio sectors, fixed line telecoms, mobiles, postal services), plus the airwaves over which wireless devices operate. It derives its authority from the Communications Act 2003.

Ofcom is also charged with managing the radio spectrum for non-military purposes[119] to ensure that it is used in the most efficient and effective way. There are two main bodies of law – The Communications Act 2003 (CA 2003) and the Wireless Telegraphy Act 2006 (WTA 2006). Whereas the CA 2003 deals more with Ofcom's duties, the WTA 2006 contains most spectrum provisions.[120] As in other member states of the European Union a license is no longer required to run a telecommunications service, but the use of spectrum requires a spectrum license under the WTA 2006.

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117 http://ec.europa.eu/information_society/policy/ecomm/radio_spectrum/sectorial/reallocation/dividend/index_en.htm

118 See Commission Decision to harmonize the 800 MHz spectrum, Official Journal L 117 , 11/05/2010 P. 0095 – 0101.

119 Spectrum for military purposes is managed by the Ministry of Defence.

120 The Government oversees spectrum issues through a Cabinet Committee. The Military spectrum is managed solely by MOD, but does not have the power to grant spectrum licences in the UK which lies within the exclusive power of Ofcom. The Communications Act has placed responsibility for managing other spectrum to Ofcom, although the Secretary of State may from time to time make directions to Ofcom. Ofcom must therefore work closely with Government in planning spectrum use. But it remains independent in such matters as licensing; see http://licensing.ofcom.org.uk/radiocommunication-licences/regulations-technical-reference/rules/policy-manual/freq_planning; the MOD is currently reviewing its spectrum holdings to release any surplus to the market in 2013, see Britain's Superfast Broadband Future, December 2010, p.19.

- **Revocation of licenses**

  Ofcom can revoke spectrum licenses for a number of different reasons:

  - Breach of license conditions. The severity of the breach will determine the extent of the actions
  - Use in an irresponsible manner
  - Direction of the Secretary of State
  - Use of radio equipment causes undue interference
  - Non-payment of license fee at renewal. Ofcom sends a reminder letter six weeks before license becomes due for renewal.

  The **notice period** for the revocation as well as for any variation is **generally a month.**[121] It can be given in writing or by general notice applicable to the licenses of the class.[122]

  Acting under the direction of the Secretary of State[123], in case of 2G and 3G licenses, Ofcom applied an indefinite license period, but subject to a **revocation at 5 years' notice for spectrum management reasons, as a condition of the license** that can be executed after an initial period of 15-20 years.[124]

- **Variation of licenses**

  Apart from revoking a license, it may be varied. These variations can be initiated by either the licensee or by Ofcom if it wishes to make some changes.

  In general there are two types of changes giving rise to variations, changes of information that is related to the licensee (so called customer details) i.e. legal name and address, bank details etc. Other changes are due to technical reasons (so called

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[121] See Schedule 1, Section 7, Wireless Telegraphy Act 2006: The notification must state the reasons for the proposed revocation or variation, specify the period in which the person can make a representation or comply with the term, provision or limitation. The period can be longer if Ofcom thinks fit.

[122] See Schedule 1, Section 6, Wireless Telegraphy Act 2006.

[123] See Department for Business Innovation and Skills, Digital Britain Report 2009: A consultation on a direction to Ofcom to implement the wireless radio spectrum modernisation program.

[124] For existing 2G/3G licenses the initial period was 15 years. Licences for newly awarded spectrum (800 MHz and 2.6 GHz) and relinquished and re-awarded 900 and 1800MHz spectrum (2G) will be for an indefinite term (subject to revocation after 20 years with 5 years' notice).

technical amendments) relating to the use of spectrum like the change of equipment move of base stations, request of new channel etc.

As with the revocation, the notice period is not less than one month, in writing or by general notice.

- **Digital dividend**

Ofcom follows a three step migration process in the context of moving digital terrestrial television to a different spectrum band to clear the 800 MHz band in the UK.[125] These steps are:

- No material effect on the digital switchover
- No bearing of costs reasonably incurred
- Solution is consistent with existing policy objectives (e.g. coverage) and aims at minimising impact on consumers.

- **Government Spectrum**

Spectrum reallocation will be an issue to meet the growing demand of mobile data services in the future. The British government has recognized that, for instance, in order to bring broadband services to rural areas it is required to utilise the white space or interleaved spectrum that is unused spectrum between TV channels. It plans to release at least 500 MHz spectrum below 5 GHz currently occupied by the public sector for mobile communications by 2020.[126] As the WTA 2006 does not apply to governmental authorities an alignment between Ofcom and governmental users is required.[127]

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[125] See Ofcom, Digital dividend: clearing the 800 MHz band, 30 June 2009, p. 24.

[126] See Britain's Superfast Broadband Future, December 2010, p.19 and p. 53. The Ministry of Defence, for instance, has undertaken consultations in the past to make spectrum available for public use, see i.e. UK Defence Spectrum Management, A Consultation on: An Implementation Plan for Reform, May 2008.

[127] The WT Act does not bind the Crown so Crown bodies like the MOD do not require authorisation to use spectrum. However, other arrangements are in place to plan and manage the spectrum used by the Crown which respects the rights of authorised non-Crown users.

1.1.7 Germany

Spectrum is regulated by the Federal Network Agency (Bundesnetzagentur) in Germany. As it is a scarce resource a spectrum assignment is required based the national spectrum plan.[128]

- **Revocation of spectrum before expiry**

  The German telecommunications act (Telekommunikationsgesetz – TKG)[129] gives the Federal Network Agency (Bundesnetzagentur) **discretionary authority to revoke spectrum usage right** in any of the following cases **even though the assignment period has not yet expired**:

  - Non-use of frequency spectrum within one year after allocation
  - Use that deviates from the intended allocation purpose for more than one year
  - One of the conditions for allocation are no longer met. Those conditions are i.e. the use is stipulated in the spectrum plan; spectrum is available; compatible use of spectrum; no interferences with other uses.[130]
  - Repeated violation or non-fulfilment of an obligation arising from the assignment despite repeated requests for fulfilment
  - Probability of distortion of competition after spectrum allocation
  - Change of ownership of licensee that may give rise to a distortion of competition

  The period of time until revocation becomes effective shall be appropriate[131], which means that it is in the discretion of the regulatory authority **to set a period taking into**

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[128] Based on European directives, in Germany and the other member states of the European Union, telecommunications services do not require a license. A license as a governmental act is only required for areas where there is a scarcity of resources, international obligations or protection of rights of third mandatorily require protection.

[129] For an English translation of the German Telecom Act (Telekommunikationsgesetz – TKG) see http://www.bmwi.de/BMWi/Redaktion/PDF/Gesetz/tkg-aend-2007,property=pdf,bereich=bmwi,sprache=de,rwb=true.pdf . Note: This version is not being the most current one of the Act.

[130] Cf § 55(5) TKG.

[131] Section 63(1) TKG

account the fair balance of interests. The periods can be different depending in particular on the type and scope of spectrum use.[132]

The revocation is in the discretion of the regulatory authority that has to follow a due process. **A fair balance of interest is required that includes the assessment whether an amendment to the existing spectrum assignment is possible as a least intrusive measure** (*ultima ratio* principle). An amendment can then be achieved via Section 60(2) that entitles the Federal Network Agency to retrospectively change the type and scope of spectrum use, i.e. to significantly improve on the efficiency of spectrum use.[133]

One of the conditions for allocation is that the intended use by the licensee is in line with the regulatory objectives listed in section 2 of the Act. Thus, if one of the regulatory objectives is not met, the Federal Network Authority has the discretion to refuse the allocation of spectrum or refuse to renew the license. Section 2 requires, among others, to secure efficient and interference-free use of frequencies. If the conditions for allocation are no longer met then the spectrum holder can no longer secure an efficient and interference-free use of spectrum and thus would no longer be entitled to the spectrum allocated.

If the legal conditions for revocation of spectrum are given, spectrum can be revoked **without creating an obligation to compensation as there is no ground for expectation** and the period until the revocation becomes effective gives the licensee appropriate time to prepare.[134]

Frequencies are typically assigned for a limited period, with the possibility of extension. The time limit shall be appropriate to the service concerned and must appropriately consider the amortisation of required investments.[135]

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[132] For instance, the period must be longer in case of commercial use than in case of use for own purposes.

[133] See translation of TKG: Where, after assignment, it is established that usage is being significantly restricted on account of increased use of the radio spectrum or that considerable efficiency gains are possible on account of technological advance, the type and extent of the frequency usage [...] may be subsequently modified.

[134] See Section 63(3) TKG excluding the rules of the general administrative procedure law under which a revocation of an administrative act may give rise to compensation. Though a clear stipulation in the assignment contract is not required, it may be useful for transparency reasons.

[135] Section 55(9) of TKG.

- **Right for renewal**

  In principal, there is a right to renewal as the law does not give the Federal Network Agency discretion to renew the spectrum. However, there is no automatic renewal as the condition of the renewal is that the general conditions for allocation of spectrum are fulfilled.[136] The discretion of the authority is just limited in this case.

- **Governmental spectrum**

  The Federal Network Agency also assigns spectrum for governmental use in a special proceeding and in close consultation with the governmental authority. In the past, it has cleared up spectrum in governmental use (i.e. by the Ministry of Defence) to open it for commercial uses.[137]

- **Relinquishment of spectrum rights**

  Another option for spectrum to become available is by a relinquishment of spectrum usage right by the current holder.[138]

- **Cases**

  There have been several cases were spectrum was reallocated in Germany, for instance:

  - **Revocation of 3G license awarded to Quam by the Federal Network Agency in 2004**

    In 2000, spectrum for UMTS/IMT-2000 was auctioned and, among others, awarded to Quam[139]. The license contained certain roll-out obligations and a revocation clause in case of non-fulfilment of obligations. However, the company did not roll-out a network and in 2002 declared that it was stopping any UMTS activities in Germany. The company laid off its employees and ceased operations. In 2004 after hearing, the Federal Network Agency revoked the spectrum license based on non-fulfilment of license obligations.

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[136] See section 55(9) of TKG.

[137] In this process the spectrum band plans is changed i.e. from military use to commercial use.

[138] See section 63(5) TGK: Relinquishment is to be declared to the Regulatory Authority in writing, with the exact designation of the frequency assignment being stated.

[139] Quam was a joint venture company of Telefonica from Spain and Sonera from Finland.

The company went to court to claim back the license fee of 8.4 billion EURO but the Federal Administrative Court ruled in 2011 that the revocation was lawful as Quam violated the roll-out obligation as a condition of the spectrum license and thus a recovery of the paid license fee lacks a legal basis.

- **Migration order to E-plus and O2 Germany to move from 1800 MHz to 900 MHz**

  After spectrum previously used by the German military was cleared up, it was possible to revisit the whole spectrum assignment for mobile use. As a consequence, the German Federal Network Agency, after a public consultation, passed a new GSM-Concept in 2005.[140] As part of this effort, E-Plus and O2 Germany, the providers holding spectrum in the 1800 MHz band, were ordered to migrate to the 900 MHz band in 2006[141] and at the same time return 1800 MHz spectrum it currently holds which was then assigned to the two bigger operators T-Mobile and Vodafone. The reason for that migration was to facilitate better coverage for E-Plus and O2 Germany in rural areas and to provide them with additional capacity in urban areas. The FNA assigned the spectrum in the 900 MHz band under the condition of relinquishment of the spectrum currently held in the 1800 MHz band. In the same order, it terminated the use of the 1800 MHz band taking effect eleven months after the order. But this part of the order was unconditional. Therefore, both operators relinquished their 1800 MHz spectrum because they would have otherwise lost it without receiving the alternative 900 MHz spectrum. All other conditions of the licenses remained unchanged. The Federal Network Authority declared that a migration is required to ensure competition and enable efficient use of spectrum as a general condition under section 2 of the Act.[142] In addition, spectrum holders have no right to use a specific band and thus a migration is possible by law. Section 55 (6) of the German Telecommunications Act clearly stated that the spectrum holder has not right to a specific spectrum band. The reason for that is that the migration of uses in other frequency bands is a common instrument of spectrum regulation and spectrum planning to ensure efficient spectrum utilisation. In this case a migration concept has to be developed ensuring a continued service for the existing customers.

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[140] See Vfg. 88/2005, Amtsblatt 23/2005 vom 30. November 2005, Seite 1852.

[141] E-Plus and O2 Germany were assigned 2x5 MHz by the Federal Network Agency.

[142] As the other mobile operators used spectrum in the 900 MHz band with better propagation characteristics it was considered fair to migrate to the same frequency band.

- **C-Netz spectrum in the 400 MHz band**

  After relinquishment of spectrum used for the C-Netz[143] the spectrum was cleared and reallocated.

[143] The C-Netz utilized the C450 standard and was the first generation analogue cellular phone system deployed in Germany in 1985

1.2 Conclusions: Relevance for South Africa

The international experience can be summarised in relevant recommendations for South Africa in the context of spectrum reallocation and the involved migration of current uses in specific spectrum bands to new spectrum bands.

- **Non-renewal of spectrum license or assignment should be limited to exceptional cases where overarching legitimate public interest concerns are present.**

  Although there is generally no sound legal basis for an expectation for an unlimited renewal of a spectrum license or assignment that has come to a natural end of its term, international practise shows that non-renewal is limited to exceptional cases. Compensation is generally not required. However it should be evaluated whether there is a least intrusive measure available such as offering the spectrum holder available spectrum in other bands. In addition, a reasonable notice must be given in order to allow the current spectrum holder to relocate. The duration of that notice period varies widely and also depends on the specific uses in the respective spectrum band. In general, a 5 years notice period before expiry seems to be generally considered as being appropriate.

- **Revocation of license before expiry of spectrum license or assignment should be limited to mainly two cases, the material breach of license conditions and overarching public interest concerns in enabling the highest value use of spectrum.**

  In case of revoking or withdrawing a spectrum assignment before the expiry of the assignment term is an encroachment into a legal position of the affected spectrum holder and its users. It should only be justified for exceptional cases of wilful conduct or public interest concerns. If the licensee breaches some of the conditions of the license or assignment he or she has usually wilfully committed a breach of obligations which give due course for action. After applying a due process giving the licensee in breach the opportunity to heal the breach or present reasons not within his or her sphere of influence and no action has been undertaken to heal the breach, the spectrum license or assignment can be revoked. In this case, compensation is not required as the cause is within the influence of the spectrum holder. However, if the license is revoked before expiry in the case of overarching public interest concerns such as an international obligation out of e.g. the ITU, then a revocation would require compensation covering the cost of relocation or clearing up the radio frequency spectrum.

- **Governmental spectrum should be made available for commercial use, where possible.**

Governments worldwide are assessing and freeing up spectrum currently held by governmental authorities such as the military services and make it available for commercial use. This should be closes assessed in South Africa as well.

1.3 Summary Table: Reallocation in benchmarked countries

The following table gives an overview on the status of various reallocation issues analysed in detail in the previous chapters:

Country / Reallo-cation issue	USA	Hong Kong	Australia	UK	Germany
Right to revoke/ withdraw/vary spectrum at expiry	✓	✓	✓	✓	✓
Right to revoke/ withdraw/vary <u>before</u> expiry	✓ but limited to cases of wilful conduct	✓	✓	✓	✓
Notice period	n.a.	Depends on type of spectrum; for long term license ~ 3 years	18 months	Law: 1 month License condition: usually 5 yrs before expiry	Appropriate after fair balance assessment
Compensation	✓ for governmental spectrum	✗	✓ if compulsory process is applied	✗	✗
Expectations on renewal of spectrum	✓	✗	✗	✗	✗

Government spectrum available for reallocation	✓	No plan	No plan	✓	✓
Reallocation mode	Voluntary, by incentive auction	Market-based	Market-based, unless Minister issues public interest declaration	Market-based	Market-based

Appendix A Glossary

Act	means the Electronic Communications Act, 2005 (Act No. 36 of 2005);
Authority	means ICASA is the Independent Communications Authority of South Africa;
3G	means 3G or 3rd generation mobile telecommunications is a generation of standards for mobile phones and mobile telecommunication services fulfilling the International Mobile Telecommunications-2000 (IMT-2000) specifications by the ITU
Amateur	means a person who is interested in the radio technique solely for a private reason and not for financial gain and to whom the Authority has granted an amateur radio station licence and shall mean a natural person and shall not include a juristic person or an association: provided that an amateur radio station licence may be issued to a licensed radio amateur acting on behalf of a duly founded amateur radio association;
Assignment	means the authorization given by the authority to use a radio frequency or radio frequency channel under specified conditions;
Base station	means a land radio station in the land mobile service for a service with land mobile stations;
BS	means Broadcast Service
BTX	means Base Transceiver;
Burglar alarm service	means a land mobile service installed, maintained and operated to monitor burglar alarm signals of clients by means of a signal forwarded from a radio transmitter to a central position;
Burglar alarm transmitter	means a transmission radio station in the land mobile service that is intended to transmit automatic alarm signals to a central position;
CDMA	means Code Division Multiplex Access
CEPT	means Conference of European Posts and Telecommunications Authorities;
Citizen-band radio service	means a private, two-way, limited coverage speech communication service in the land mobile service to personal and business operations, which may also be used as a paging system;
Communal radio repeater station service	means a land mobile service installed, maintained and operated via repeater stations that are available for communal use;
Cordless Phone	means a portable telephone with a wireless handset that communicates via radio waves with a base station connected to a fixed telephone line, within a limited range of its base station;
DAB	means Digital Audio Broadcasting is a digital radio technology for broadcasting radio stations
DECT	means Digital Enhanced Cordless Telecommunications is a digital communication standard, which is primarily used for creating cordless phone systems
DECT-	means Digitally Enhanced Cordless Telephone 1880 - 1900MHz;
DF	means Dual Frequency
DTT	means Digital Terrestrial Television
DTT Mobile	means Digital Terrestrial Television for Mobile services
e.i.r.p	means effective isotropically radiated power;
e.r.p	means effective radiated power, is the product of the power supplied to an antenna and its gain relative to a half wave dipole in a given

	direction;
EBU	means European Broadcasting Union
ECA	means Electronic Communications ACT of South Africa
ECNS	means Electronic Communications Network Services;
ECS	means Electronic Communications Services;
EDGE	means Enhanced Data rates for GSM Evolution is a digital mobile phone technology that allows improved data transmission rates as a backward-compatible extension of GSM
EMC	means Electromagnetic Compatibility;
ETSI	means European Telecommunications Standards Institute
FDMA	means Frequency Division Multiplex Access
FLEX	means paging software originally developed for Motorola;
FMP	means Frequency Migration Plan
FPLMTS	means Future Public Land Mobile Telecommunications System also called IMT-2000
FTBFP 2008	means Final Terrestrial Broadcast Frequency Plan of 2008
FWBA	Fixed Wireless Broadband Access
GHz	means Gigahertz of Radio Frequency Spectrum;
GE06	means Digital Broadcast Conference held in Geneva, Switzerland in 2006.
GMDSS	means the Global Maritime Distress and Safety System is an internationally agreed-upon set of safety procedures, types of equipment, and communication protocols used to increase safety and make it easier to rescue distressed ships, boats and aircraft.
GSM	means Global System for Mobile Communications,(originally Groupe Spécial Mobile), is a standard set developed by the European Telecommunications Standards Institute (ETSI) to describe technologies for second generation (2G) digital cellular networks
GSM-R	means GSM for Railways
HF	means High Frequency;
IMT	International Mobile Telecommunications
IMT	means International Mobile Telecommunications
Inductive Loop Systems	means radio apparatus which operates by producing a controlled magnetic field within which a predetermined recognisable signal is formed;
INMARSAT	means International Maritime Satellite
ISM	means Industrial, Scientific and Medical;
ITU	means International Telecommunications Union
ITU RR	means International Telecommunications Union Radio Regulations
KHz	means Kilohertz of Radio Frequency Spectrum;
Land mobile service	means a mobile radio-communication service between fixed stations and mobile land stations, or between land mobile stations;
LEO	means Low Earth Orbit satellites
LMR	means Land Mobile Radio
Low Power Radio	means radio apparatus, normally hand-held radios used for short range two-way voice communications;
LTE	means Long Term Evolution is a standard for wireless communication of high-speed data for mobile phones and data terminals. It is based on the GSM/EDGE and UMTS/HSPA network technologies
M2M	means Machine to Machine
MFN	means Multiple Frequency Networks
MHz	means Megahertz of Radio Frequency Spectrum;

MIMO	means Multiple-Input and Multiple-Output is the use of multiple antennas at both the transmitter and receiver to improve communication performance
Mobile station	means a radio station that is intended to be operated while it is in motion or while it is stationary at an unspecified place;
Model Control apparatus	means radio apparatus used to control the movement of the model in the air, on land or over or under the water surface;
MTX	means Mobile Transceiver;
Non specific Short Range Devices	means radio apparatus used for general telemetry, telecommand, alarms and data applications with a preset duty cycle (0.1% :S duty cycle< 100%);
NRFP	means the National Radio Frequency Plan 2010 for South Africa
PAMR	means Public Access Mobile Radio
PMR	means Private Mobile Radio or Professional Mobile Radio
PMR	means Public Mobile Radio is radio apparatus used for short range two-way voice communications;
PPDR	
PTM	means Point to Multipoint
PTP	means Point to Point
Radio trunking	means a technique by means of which free channels out of a group of radio frequency channels allocated to a base station are automatically made available for the establishment of a connection between the stations of a user;
Radio-beacon station	means a radio station whose radiation is intended to enable a mobile station to fix its position or obtain its bearing with regard to the radio beacon;
Radio-communication	means all electronic communication by means of radio waves;
Relay or repeater station	means a land station in the land mobile service;
RFID	means Radio Frequency identification is a wireless system that uses radio frequency communication to automatically identify, track and manage objects, people or animals. It consist of two main components viz, tag and a reader which are tuned to the same frequency;
RLAN	means Radio Local Access Network is the high data rate two way (duplex) wireless data communications network;
SABRE	means South African Band Re-planning Exercise
SADC	means Southern African Development Community
SADC FAP	means Southern African Development Community Frequency Allocation Plan 2010
SAPS	means South African Police Service
SATFA	means South African Table of Frequency Allocations 2004
Self Helps	means repeater stations rebroadcasting television channels to limited areas on a low power basis
Service licence	means a BS, ECS or ECNS licence;
SF	means Single Frequency
SFN	means Single Frequency Network
Ship station	means a mobile station in the maritime mobile service that has been erected
SNG	means Satellite News Gathering
Spread spectrum	means a form of wireless communications in which the frequency of the transmitted signal is deliberately varied, resulting in a much

	greater bandwidth than the signal would have if its frequency were not varied;
SRD	means Short Range Device is a piece of apparatus which includes a transmitter, and/or a receiver and or parts thereof, used in alarm, telecommand telemetry applications, etc., operating with analogue speech/music or data (analogue and/or digital) or with combined analogue speech/music and data, using any modulation type intended to operate over short distances;
Studio Links	means point to point links in the broadcasting frequency bands used to connect studios to transmitters
STB	means Set Top Box for DVB-T2 reception
T-DAB	means Terrestrial Digital Audio Broadcasting
TDMA	means Time Division Multiplex Access
Telemetry	means the transmission of remotely measured data;
TETRA	means Terrestrial Trunked Radio is a professional mobile radio [2] and two-way transceiver specification. TETRA was specifically designed for use by government agencies, emergency services, (police forces, fire departments, ambulance) for public safety networks, rail transportation staff for train radios, transport services and the military. TETRA is an ETSI standard.
TPC	means Transmitter Power Control is a technical mechanism used within some networking devices in order to prevent unwanted interference between wireless networks;
UHF	means Ultra High Frequency;
UMTS	means Universal Mobile Telecommunications System is a third generation mobile cellular technology for networks based on the GSM standard
VHF	means Very High Frequency;
Video Surveillance Equipment	means radio apparatus used for security camera purposes to replace the cable between a camera and a monitor;
VSAT	means Very Small Aperture Terminal is a two-way satellite ground station that is smaller than 3 meters diameter
WAS	means Wireless Access Systems is end-user radio connections to public or private core networks;
Wideband Wireless Systems	means radio apparatus that uses spread spectrum techniques and has high bit rate;
WRC 2007	means World Radio Conference 2007 held in Geneva
WRC 2012	means World Radio Conference 2012 held in Geneva

Appendix B ECA – Article 34

Radio frequency plan

34.

(1) The Minister, in the exercise of his or her functions, represents the Republic in international fora, including the ITU, in respect of—

(a) the international allotment of radio frequency spectrum; and

(b) the international coordination of radio frequency spectrum usage, in accordance with international treaties, multinational and bilateral agreements entered into by the Republic.

(2) The Minister must approve the national radio frequency plan developed by the Authority, which must set out the specific frequency bands designated for use by particular types of services, taking into account the radio frequency spectrum bands allocated to the security services.

(3) The Authority must assign radio frequencies consistent with the national radio frequency plan for the use of radio frequency spectrum by licence holders and other services that may be provided pursuant to a licence exemption.

(4) The Authority must, within 12 months of the coming into force of this Act, prepare the national radio frequency plan or make appropriate modification to any existing radio frequency plan to bring it into conformity with this Act.

(5) The national radio frequency plan must be updated and amended when necessary in order to keep the plan current. When updating and amending this plan due regard must be given to the current and future usage of the radio frequency spectrum.

(6)The national radio frequency plan must—

(a) designate the radio frequency bands to be used for particular types of services;

(b) ensure that the radio frequency spectrum is utilised and managed in an orderly, efficient and effective manner;

(c) aim at reducing congestion in the use of the radio frequency spectrum;

(d) aim at protecting radio frequency spectrum licensees from harmful interference;

(e) provide for flexibility and the rapid and efficient introduction of new technologies;

(f) aim at providing opportunities for the introduction of the widest range of services and the maximum number of users thereof as is practically feasible.

(7) In preparing the national radio frequency plan as contemplated in subsection (4), the Authority must—

(a) take into account the ITU's international spectrum allotments for radio frequency spectrum use, in so far as ITU allocations have been adopted or agreed

upon by the Republic, and give due regard to the reports of experts in the field of spectrum or radio frequency planning and to internationally accepted methods for preparing such plans;

(b) take into account existing uses of the radio frequency spectrum and any radio frequency band plans in existence or in the course of preparation; and

(c) consult with the Minister to—

(i) incorporate the radio frequency spectrum allocated by the Minister for the exclusive use of the security services into the national radio frequency plan;

(ii) take account of the government's current and planned uses of the radio frequency spectrum, including but not limited to, civil aviation, aeronautical services and scientific research; and

(iii) co-ordinate a plan for migration of existing users, as applicable, to make available radio frequency spectrum to satisfy the requirements of subsection (2) and the objects of this Act and of the related legislation.

(8) The Authority must give notice of its intention to prepare a national radio frequency plan in the Gazette and in such notice invite interested parties to submit their written representations to the Authority within such period as may be specified in such notice.

(9) The Authority may, after the period referred to in subsection (8) has passed, hold a hearing in respect of the proposed national radio frequency plan.

(10) After the hearing, if any, and after due consideration of any written representations received in response to the notice mentioned in subsection (8) or tendered at the hearing, the Authority must forward the national radio frequency plan to the Minister for approval.

(11) The Minister must, within 30 days of receipt of the national radio frequency plan, either approve the plan, at which time the plan must become effective, or notify the Authority that further consultation is required.

(12) Upon approval of the national radio frequency plan by the Minister, the Authority must publish the plan in the Gazette.

(13) Any radio frequency plan approved in terms of this section and all the comments, representations and other documents received in response to the notice contemplated in subsection (8) or tendered at the hearing must be—

(a) kept at the offices of the Authority; and

(b) open for public inspection by interested persons during the normal office hours of the Authority.

(14) The Authority must, at the request of any person and on payment of such fee as may be prescribed, furnish him or her with a copy of the radio frequency plan.

(15) The provisions of subsections (6) to (14) apply, with the necessary changes, in relation to any amendment made by the Authority to the radio frequency plan.

(16) The Authority may, where the national radio frequency plan identifies radio frequency spectrum that is occupied and requires the migration of the users of such radio frequency spectrum to other radio frequency bands, migrate the users to such other radio frequency bands in accordance with the national radio frequency plan, except where such migration involves governmental entities or organisations, in which case the Authority—

(a) must refer the matter to the Minister; and

(b) may migrate the users after consultation with the Minister

Appendix C SABRE 2 – 2001

SABRE 2[144] was a programme to replan the radio frequency spectrum from 3GHz to 70 MHz, partly driven by the need to in-migrate fixed-links from below 3Gz.

SABRE 2 made the following comment on migration issues above 3 GHz.

Above 3 GHz the cost of backbone infrastructure equipment is borne by one or a few organisations. Band reallocation and spectrum use migration activities have to carefully consider industry's return on investment over pre-planned equipment life cycles. Ideally any additionally identified SABRE 2 band migrations will be voluntary and will occur within the constraints of the infrastructure life cycle.

.....A number of bands were identified during the SABRE 2 project that requires consideration due to anticipated future congestion and reallocation. Three types of migration are recommended; band, equipment, and channels. These migrations are viewed as voluntary because they are expected to occur as part of the natural system life cycle.

Band	Migration Objective	Target Date
3600-4200 MHz	Analogue to digital terrestrial systems	31 December 2005
5925-6425 MHz 6425-7110 MHz	Analogue to digital systems	31 December 2005
7110-7425 MHz 7425-7750 MHz	Analogue to digital systems	31 December 2005
7110-7425 MHz 7425 - 7750 MHz	Digital systems to channel plan	Not specified
10.7- 11.7 GHz	Analogue to digital systems	31 December 2005
21.4 22 GHz	FS reverts to secondary service 22-22.6 GHz // 23.0 23.6 GHz, 26 GHz and 38 GHz bands also available	1 April 2007

Operators are expected to identify all migration links, plan their migration, and coordinate their schedule with ICASA. at least three years before the deadline. The 2 1.4 - 22.0 GHz band will revert from Fixed, Mobile and Broadcasting Satellite Services to the Broadcast Satellite Service application in the year 2007. Currently, there is a limited set of licences in the band according to ICASA records. Operators intending to maintain FS links in the 21.4-22 GHz band will be accommodated with no protection after 1 April 2007. Another migration issue is the "opening of the 38 GHz band." Prior to making assignments in this portion of the spectrum, it is recommended that a migration of 20-24 GHz FS

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[144] Radio frequency spectrum band plan covering the range 3 GHz to 70 GHz – (SABRE-2) Notice 1920 of 2001

assignments be established. The primary criteria for migration would be link distance associated with specific frequency assignments, once the band is released to the public.

Appendix D SATFA – 2004

The South African Table of Frequency Allocations 2004[145] consolidated SABRE 1 and SABRE 2 in one plan covering the range 20MHz to 70 GHz.

Regarding migration, the following points were made:

The migration process has had its successes and failures. Some migration time-frames have been revised whilst others are maintained at their original deadlines. One can mention that the 2008 deadline for current public trunking operators has been reviewed at the request of the public trunkIng operators. The use of the band 406.1 - 407.625 // 416.1 - 417.625 MHz by the national electricity utility has been re-instated.

The changes implemented in SATFA 2004 were listed as:

- *The Radio Frequency Identification systems (RFID) allocation in the 900 MHz band*
- *Pre-programmed low power PMR446 two way radios.*
- *Allocation of Broadband FWA in the 2.6GHz band,*
- *Public Protection and Disaster relief (PPDR) bands which includes 380 -385//390-395MHz.*
- *Full allocation of 2x10MHz E-GSM spectrum. Previously the E-GSM allocation was 2 x 400 kHz short because of an allocation to a now defunct two-way paging service.*
- *Allocation of the 5GHz band to "mobile" so as to enable wireless LAN "Hotspots".*
- *Allocation of the band 14-14.5 GHz to aeronautical mobile to enable broadband internet access by aircraft passengers.*
- *At the WRC03 the South African delegation added the country name to an ITU Radio Regulation footnote which seeks to protect future radio astronomy activities in the 14GHz band.*

[145] The South African Table of Frequency Allocations (SATFA) – Notice 1442 of 2004.

Appendix E National Radio Frequency Plan – 2010

The National Radio Frequency Plan 2010[146] updated SATFA 2004[147] and extended the frequency range covered (now 9kHz – 3000 GHz[148]). Its stated aim was to incorporate the decisions taken by WRC and include updates on the Table of Frequency Allocations extending up to 3000GHz.

The fundamental objectives informing the National Radio Frequency Plan were to:

- *To effect .... policy directives published in Government Gazette No. 30308 of 17 September 2007 which states that the Authority should take into account the results of WRC 2007 when revising the national radio frequency plan*
- *To update the table with changes made by WRC 97, WRC 2000, WRC03, and WRC07*
- *To allocate spectrum that was previously not allocated by extending the range to cover 9 kHz to 3000 GHz in line with the Act and ITU-R*
- *To make spectrum available for new radio interfaces such as WIMAX, which were included as the newest member of the IMT family of standards*
- *To facilitate future identification of spectrum for very low power fixed links in the spectrum below 1 GHz in order to promote small medium and micro enterprises in the communications industry.*
- *To facilitate developments of the frequency migration strategies and to facilitate migration of high capacity fixed links to higher frequency bands*
- *To facilitate the development of a framework for usage of ISM frequency bands to support rural development objectives*
- *To promote access to lower frequency bands for broadband wireless access to support rural development*
- *To promote access to frequency bands below 1 GHz such as the 790 – 862 MHz band which offers both coverage and capacity to help bridge the "digital gap" between*

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[146] The National Radio Frequency Plan – Notice 727 of 2010.

[147] The main reason for the name change is that the term National Radio Frequency Plan is used in the ECA.

[148] Although 1000 – 3000 GHz is not allocated.

sparsely-populated and densely-populated areas and to increase universal service and access in the country.

The following changes were implemented:

- *Identification and allocation of spectrum for IMT - spectrum has been allocated in line with WRC 07 in the bands 790 - 862 MHz, 2300 – 2400 MHz, 2500 - 2690 MHz, 3400 - 3600 MHz, 1518 -1525 MHz and 1668-1675 MHz. Where there are existing services that need to be protected such provision has been made.*
- *Allocation of spectrum for amateur radio - spectrum has been allocated in line with WRC 07 and previous WRCs in the bands 135.7 - 137.8 kHz, 2300 - 2450 on secondary basis.*
- *Addition of a proposal to change DTH from secondary to primary status in the 10.7-11.7 GHz*
- *National footnote NF 49 of SATFA 2004 has been replaced by national footnote NF 2 addressing the Astronomy Geographic Advantage Act, 2007 (Act No. 21 of 2007)*
- *Updated ISM frequency bands in line with GG No. 31321 Notice No. 944 of 08 August 2008*
- *Updated the 5725 - 5850 MHz band in line with GG No. 31290 Notice No.926 Of 29 July 2008.*
- *Added allocations for inductive loop and RFiD in line with GG No. 31290 Notice No. 926 of 29 July 2008*
- *Added new maritime, aeronautical allocations below 20 MHz and new satellite allocations above 70 GHz*

The Plan did not specify any migration activities, although the plan includes the WRC mandated allocation of the 800 MHz to IMT (digital dividend 2).

Appendix F World Radio Conference 2012

For WRC 12, South Africa joined together with other SADC countries to adopt a common position on 30 agenda items related to frequency allocation and frequency sharing for the efficient use of spectrum and orbital resources.

Key issues with potential implications for spectrum migration are:

Additional Spectrum for Mobile Broadband

WRC-12 allocated frequency band 694 – 790 MHz to IMT in Region 1 (for terrestrial mobile broadband) on top of the 790-862 MHz allocated in WR07. For South Africa this means that that the digitalisation of the TV bands will have to be modified to concentrate the VHF TV bands in

Increase efficiency in the use of the spectrum/orbit resource

No direct implication for frequency migration

Early warning, disaster mitigation and relief operations

WRC-12 urged the use of identified frequency bands (such as IMT) for purposes

of achieving regionally harmonized frequency bands or ranges.

No direct implication for frequency migration

Recognition of Earth observation's societal and economic value

WRC-12 urged administrations to protect the Earth observation systems in the related frequency bands.

No direct implication for frequency migration

More bandwidth for Meteorological-satellite service

WRC-12 has allocated additional spectrum to the meteorological-satellite service.

Satellite remote passive sensing

The spectrum use aimed at the future of Earth observation applications with the development of passive sensors flying on meteorological and environmental satellites to monitor water vapour and oxygen spectral lines was updated. These are required for ice cloud and precipitation measurements and for storm monitoring and climate studies.

Adaptation of relevant protection oceanographic radars

No direct implication for frequency migration

The relevant protection levels for interference caused by oceanographic radars were adopted These radars operate using ground-waves that propagate over the sea to measure coastal sea surface conditions in support of environmental, oceanographic, meteorological, climatological, maritime and disaster mitigation operations and for the surveillance of coastal

Maritime services

No direct implication for frequency migration

The maritime communication requirements to support safety systems for ships and port operations were addressed. The conference included new provisions in the WRC 12 Final acts to improve satellite detection of automatic information systems using VHF channels.

Transmitting frequencies in the VHF maritime mobile band

No direct implication for frequency migration

The conference considered the use of new technologies in the maritime service to fulfil the requirement in the "Table of transmitting frequencies in the VHF maritime mobile band". The table defines the channel numbering for maritime VHF communications based on 25 kHz channel spacing as well as where digital technologies could be deployed.

Aeronautical services

Additional spectrum has been made available for the introduction of applications and concepts in air traffic management that can support data links carrying safety-critical aviation information.

Aviation safety

No direct implication for frequency migration

The growth in the aviation industry calls for expanded capacity of mobile communication links that can operate over the horizon. The conference invited notifying administrations of mobile-satellite service networks to accommodate the spectrum needed for distress, urgency and safety communications of the global maritime distress and safety system (GMDSS) and for the aeronautical mobile-satellite (route) service communications.

Aeronautical mobile (route) service

The frequency band 960–1164 MHz has been allocated to the aeronautical mobile (route) service intended to support the introduction of applications and concepts in air traffic management which are data intensive and which could support data links that carry safety critical aeronautical data.

Aeronautical mobile to protect other primary services in 37–38 GHz band

The aeronautical component of the mobile service allocation in the band 37–38 GHz has been excluded to ensure proper protection of space research and mobile services.

Aerospace surveillance

An additional allocation in the frequency band 154–156 MHz to the radiolocation service in some countries has been made.

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