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Contents

INDEPENDENT COMMUNICATIONS AUTHORITY OF SOUTH AFRICA

NO. 3242 **31 March 2023**

DISCUSSION DOCUMENT ON DYNAMIC SPECTRUM ACCESS AND OPPORTUNISTIC SPECTRUM MANAGEMENT

1. Pursuant to section 4B of the Independent Communications Authority of South Africa Act, 2000 (Act No. 13 of 2000), hereby issues a notice regarding its intention to conduct an inquiry into Phase 2 of the implementation of Dynamic Spectrum Access and Opportunistic Spectrum Management.

2. Interested persons and parties are hereby invited to submit written representations on the Draft Consultation Document on Dynamic Spectrum Sharing framework beyond TVWS, which must reach the Authority no later than 16h00 on 12 May 2023 by email (in Microsoft Word and PDF) or hand delivery and marked specifically for attention:

   Ms Pumla Ntshalintshali
   Delivery Address: 350 Witch-Hazel Road, Eco- Park; Centurion
   Email: DSA2023@icasa.org.za

3. Persons making representations are further invited to respond to the questions using the attached template which can be obtained on the ICASA website: www.icasa.org.za.

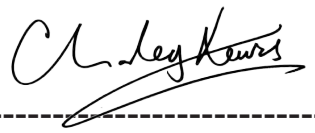
4. Enquiries should be directed to Ms Pumla Ntshalintshali at 0125684005 between 10h00 and 16h00, Monday to Friday.

5. All written representations submitted to the Authority pursuant to this notice will be made available on the ICASA website, and for inspection by interested persons

from 30 June 2023 at the ICASA Library, with copies of such representations and documents obtainable on payment of a fee.

6. Where persons making representations require that their representation or part thereof be treated as confidential, then an application 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 discussion document and plan. All confidential material must be pasted onto a separate annexure which is clearly marked as "Confidential". If, however, the request for confidentiality is not granted, the person making the request will be allowed to withdraw the representation or document in question.

7. The guidelines for confidentiality request are contained in Government Gazette Number 41839 (Notice 849 of 2018).



Dr Charles Lewis
Acting Chairperson
Date: 29**/03/2023**

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1 INTRODUCTION

In October 2015, the Independent Communications Authority of South Africa ("ICASA/the Authority") published a discussion document on Dynamic and Opportunistic Spectrum Management regime, the document led to the formulation and eventual publication of Regulations on the use of TV White Spaces of 2018 in Government Gazette Number 41512 (Notice 147 of 2018). These regulations came into force on the 1st of April 2021.

The TVWS spectrum is now being utilised by various network operators to provide affordable broadband services in underserved and unserved rural and township areas. Formulation of the TVWS regulatory framework was Phase one (1) of Authority's objectives to implement Dynamic and Opportunistic Spectrum Management regime.

This Dynamic Spectrum Access an Opportunistic Spectrum Management discussion document ("Discussion Document") will focus on Phase two (2) of the implementation of Dynamic and Opportunistic Spectrum Management regime beyond TVWS spectrum. Phase 2 of the Dynamic and Opportunistic Spectrum Management regime proposes formulation of a regulatory framework for enabling implementation of Dynamic spectrum Sharing (DSS) in the S and C bands in order to promote the emergence of new radio technologies, services and applications of the digital industrial revolutions and more importantly improving efficient use of radio frequency spectrum.

This discussion document is set out as follows:

First, the purpose of this document is discussed in Section 2 the underlying legislative mandate and regulatory framework are described in Section 3, while Section 4 discusses the broader national development plans and policy objectives. Section 5 discusses the state of the state of ICT sector and digital infrastructure. Section 6 discusses spectrum management regimes. Consideration for implementation of DSS in high demand spectrum bands is presented in Section 7, while the discussions on spectrum trading is presented in Section 8. Additionally, Annexure A of this document presents an extract of the national radio frequency plan indicating the C and S bands under consideration for DSS and a snapshot of simulation results for co-existence between IMT service and fixed satellite downlink are depicted in Annexure B. Each of the sections contain questions on which a response from the stakeholders

is required. These responses will guide the Authority in formulating regulatory framework for implementation of DSS in the C and S bands.

2 PURPOSE

The purpose of the inquiry is for the Authority to:

(a) consider the establishment of a regulatory framework through which the Authority may authorise the use of Dynamic Spectrum Sharing (DSS) assignment in the S and C frequency bands.

(b) consider the establishment of a regulatory framework through which the Authority may authorise implementation of Secondary spectrum markets in the S and C frequency bands.

(c) consider the establishment of the technical conditions under which the DSS must be implemented in accordance with the National Radio Frequency Plan.

(d) consider the establishment of mechanisms for ensuring the protection of primary users in the S and C bands from harmful interference.

3 LEGISLATIVE MANDATE AND THE REGULATORY FRAMEWORK

The Electronic Communications Act 36 of 2015 as Amended

The Electronics Communication Act, 2005 (Act No. 36 of 2005), as amended (ECA) governs overall usage of spectrum in South Africa. The ECA empowers the Authority, to formulate regulations necessary for the management of radio frequency spectrum. The ECA recognizes that the spectrum is a precious national ICT infrastructure resource. Therefore, it mandates for equitable and efficient utilisation of it to reap maximum benefit for the entire population. Additionally, the Act ensures that the country complies with relevant international bodies and standards.

The Radio Frequency Spectrum Regulations

The Radio Frequency spectrum regulations[1] are formulated by the Authority as stipulated in the ECA. One of the main purposes of the regulations is to establish the framework through which the Authority may allocate and assign RF spectra under the national RF spectrum plan. This includes but is not limited to:

[1] ICASA. Radio Frequency Migration Regulation and Frequency Migration Plan. Government Gazette 36334, Notice 352 of 2013. Independent Communication Authority of South Africa, 2013.

(a) Creating technical regulations
(b) Formulating mechanisms for issuing RF spectrum licensing exemptions
(c) Formulating mechanisms for issuing RF spectrum licenses.

4 NATIONAL DEVELOPMENT PLANS AND POLICY OBJECTIVES

The National Development Plan (NDP)

The National Development Plan (NDP) is a broad, all-embracing framework document that envisions a prosperous and developed South African society by the year 2030. The NDP sets out several strategic objectives to meet the targeted developmental goals. Among others, the plan has identified advances in the field of ICT as the key enabler to provide all inclusive, universally available, and affordable broadband connectivity. This will help to transform the country into a modern digital information society driven by innovation and the knowledge economy. The World Bank (WB) estimates that a 10% increase in broadband penetration will result in an increase of up to 1.38 % in the national Gross Domestic Product (GDP). The following subsections outline ICT related policy frameworks that feed into the NDP 2030[2].

The National Broadband Plan (South Africa Connect)

The national broadband plan (NBP) was published on 6 December 2013 in Government Gazette No. 37119. The NBP lays out strategies to electively address the issue of all-inclusive, universally available and affordable broadband connectivity to all South Africans. In line with the NDP, the plan has set-out incremental broadband connectivity targets to bridge the digital inclusion gap. That is, to ensure universal access to broadband services to the low-income population by the year 2030[3].

5 OVERVIEW OF THE STATE OF ICT SECTOR AND DIGITAL INFRASTRUCTURE

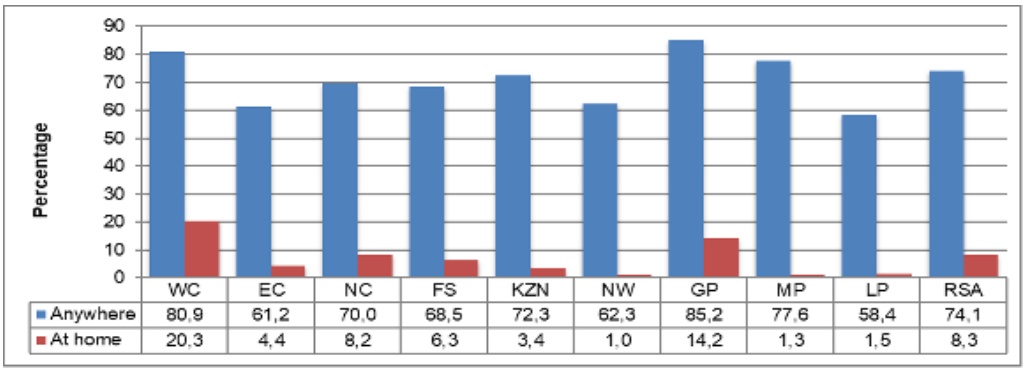
According to the General Household Survey for 2020[4], the general state of the local ICT sector and digital infrastructure in South Africa, Mobile Network Operators (MNOs) remain the dominant force in the rolling-out of digital infrastructure and provision of ICT services. Over 96% of the population is covered by 4G networks. Furthermore, the country has over 700,000 Fibre subscriptions. The country possesses about 8 Earth orbiting satellites of different types[5],

[2] NPC. National Development Plan 2030: Our future-make it work. Public Document. National Planning Commission, RSA, 2010.
[3] DoC. National Broadband Policy. Government Gazette 37119, Notice of 2013. Department of Communications, RSA, 2013.
[4] Statistics South Africa General Household Survey Report, 2011 and 2020.
[5] https://www.n2yo.com/satellites/?c=&t=country

with slightly over 6000 subscriptions to satellite broadband services. Of a particular interest, the national percentage of Internet penetration is approximated at 74.1%, majority of these are through mobile broadband. In a sharp contrast, the national proportion of households with access to fixed Internet is approximated slightly over 8% as follows: (14% of households in urban areas, 7% in sub-urban areas and 0.8% in rural areas). At the provincial level, fixed Internet penetration at home in majority of provinces is below 10% with the exception of Gauteng and the Western Cape provinces. These statistics are a clear indication that wireless networks play a critical role in the provision of ICT services in the country of which availability of spectrum is a key enabler. To begging with this discussion, the Authority would like to get your views on the following demographic questions.

Discussion Questions

1	If you are an active ECNS, ECS license holder, what is your market size and how many customers are currently using your services? Please provide supporting information.
Comment:	
2	Which industries use your services extensively?
Comment:	



	WC	EC	NC	FS	KZN	NW	GP	MP	LP	RSA
Anywhere	80,9	61,2	70,0	68,5	72,3	62,3	85,2	77,6	58,4	74,1
At home	20,3	4,4	8,2	6,3	3,4	1,0	14,2	1,3	1,5	8,3

Figure 1: Percentage of households with access to internet at home, or for which at least one member has access to or used the internet by province, 2020

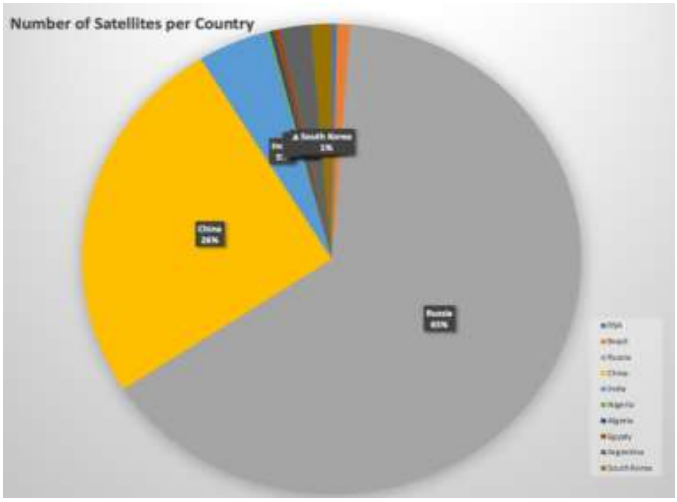


Figure 2:Number of Satellites owned by the country RSA in comparison with BRICS and other select countries (Source: https://www.n2yo.com/satellites/?c=&t=country)

6 SPECTRUM MANAGEMENT REGIMES

Radio Frequency Spectrum is a precious limited resource required to build, maintain, and expand the Information and Communications Technology (ICT) infrastructure of any nation[6].

[6] Mfupe et al, Multicriteria Decision Analysis of Spectrum Management Frameworks for Futuristic Wireless Networks: The Context of Developing Countries, Mobile Information Systems, 2017

Flexible spectrum management regulatory frameworks and practices are the key ingredients to cater for the exponential growth of broadband users and demand of data-hungry wireless services and applications fuelled by the advent of rapid advances in wireless technologies. Traditionally, National Regulatory Authorities (NRAs) are employing diverse spectrum management regimes including the following:

(a) **Exclusive licensing (Command and Control)**

In the exclusive licensing, command-and-control (CC) approach, a spectrum license is issued for a limited time, subjected to renewals. A license-holder is restricted to deploying only the prescribed radio-based services and technologies, as well as to comply with site and device standards (e.g., cellular communications).

(b) **Lightly managed**

This is a license-based approach which offers exclusivity, that is a license-holder is free to deploy any radio-based service and technology of their choice in the given geographical license area, (e.g., mobile phone services). Additionally, this approach opens an avenue for primary - secondary and co-primary spectrum sharing scenarios, as well as the prospect of secondary spectrum trading. For example, spectrum access rights can temporarily be transferred to a secondary user for an agreed form of payment.

(c) **License-exempt (spectrum Commons)**

In this approach, users share the specified license-exempt spectrum bands, (e.g., the Industrial, Scientific, and Medical (ISM) band). However, they are required to adhere to pre-set minimal operational conditions such as a geographical network coverage area The major drawbacks of the spectrum commons approach include, but are not limited to, the following:

a. The rules of co-existence may limit the kind of technology that can be deployed. Currently there are no limitations on the number of devices sharing the spectrum. Such lack of limitation more often degrades the quality of service (QoS) to the network's users (a problem known as the tragedy of commons).

The following Sub-sections below further describe spectrum sharing frameworks categorized under the above-described spectrum management regimes.

6.1 RADIO FREQUENCY SPECTRUM SHARING FRAMEWORKS

Implementation of spectrum sharing techniques have great potential to improve spectrum utilization efficiency by providing more opportunities for network operators to expand network infrastructure, deployment of innovative applications and services by new entrants and more broadly for easing of the perceived spectrum crunch. Spectrum sharing can be implemented in a co-primary, primary-secondary, and primary-secondary-secondary bases with the core tenant of not causing harmful interference amongst the participant radio services. The ITU-R SM.1132-2[7] provides an insightful description of various principals to spectrum sharing, nevertheless, in this section we categorize spectrum sharing approaches as follows:

6.2 STATIC SPECTRUM SHARING FRAMEWORKS

As the name suggests, these spectrum sharing frameworks are characterized by the administrative prescribed semi-exclusive spectrum access rights that are heavily technology dependent. The approach may vary from enabling spectrum sharing in the frequency domain through Frequency Divisional Multiple Access (FDMA) techniques, sharing in the signal domain through Code Divisional Multiple Access (CDMA) techniques and sharing in the time domain through the Time Divisional Multiple Access (TDMA) techniques. Notable examples are the recently introduced Ofcom's Shared Access License Framework[8] and the Local Access License Framework[9] briefly described below:

(a) ***Shared Access License Framework***

The Ofcom's shared access licence framework is intended to promote and enable individual users and enterprises to obtain spectrum licenses for a various use cases and applications under simplified technical conditions. This framework is currently available in the following four spectrum bands which support existing mobile technologies:

- 1800 MHz, 1781.7 - 1785 MHz paired with 1876.7 - 1880 MHz;
- 2300 MHz, 2390 to 2400 MHz;
- 3800 to 4200 MHz, and
- 24.25-26.5 GHz. This band is only available for indoor low power licences.

[7] ITU-R SM.1132-2, General principles and methods for sharing between radiocommunication services or between radio stations
[8] https://www.ofcom.org.uk/__data/assets/pdf_file/0035/157886/shared-access-licence-guidance.pdf
[9] https://www.ofcom.org.uk/__data/assets/pdf_file/0035/157886/shared-access-licence-guidance.pdf

Ofcom has specified two types of licences under this framework as follows:

- **Low power licence:** This license type authorises users to deploy as many base stations as they require within a circular area with a radius of 50 metres as well as the associated fixed, nomadic or mobile terminals connected to the base stations operating within the area. This license type is suitable for deployment of private networks.
- **Medium power licence:** This licence type authorises a single base station and the associated fixed, nomadic or mobile terminals connected to the base station. This license type is suitable for deployment of broadband services in rural areas.

(b) ***Local Access License Framework***

The Ofcom's local access licence framework is intended to promote and enable users and enterprises to obtain access to spectrum that has already been licensed to MNOs but not being utilised/or underutilised in geographical areas of interest. More specifically, this framework is implemented under the secondary spectrum market framework which allows licence holders to lease their spectrum access rights with third parties. This framework is currently available in various spectrum bands which support existing mobile technologies ranging between 900 MHz band to 3.4 GHz band. The main conditions attached to this license are such that it is only available in a local area and the default lease period of three (3) years.

It is important to note that Ofcom is currently in the process of transforming the implementation of above-described static shared access license frameworks into Dynamic Spectrum Sharing (DSS) frameworks.

6.3 DYNAMC SPECTRUM SHARING FRAMEWORKS

Dynamic Spectrum Sharing (DSS) is an advanced form of spectrum sharing categorized under the light-managed spectrum management regime. DSS is characterized by the ability of a user to gain an instantaneous access to spectrum opportunities of interest in multiple dimensions (i.e., time, frequency, or space domain). DSS coupled with innovative technique such as Radio Machine Learning (RFML) promises to unlock the full potential of future wireless networks in 5G, 6G and beyond by making possible for spectrum to be efficiently shared to support a diverse range of innovative use cases and applications such as small cells for private industrial and residential networks, agritech, rural broadband, healthcare, community

networks etc. The Authority has already implemented the first phase of DSS in the Television broadcasting band 470 – 694 MHz through the Regulations on the Use of TV White Spaces of 2018. This has promoted growth of Small and medium Enterprises (SMMEs)-owned, low-cost broadband network operators in rural and township communities of the Republic. More broadly, Generally, Dynamic Spectrum Sharing can be grouped in two types:

6.3.1 Technology-Dependent Dynamic Spectrum Sharing Techniques

These are commonly found in the license-exempt spectrum management approach, more specifically this may include the following techniques: Dynamic Frequency Selection (DFS) used by Wi-Fi radios to enable sharing without interfering radar services in the 5GHz band, Spectrum Sensing techniques used by Cognitive Radio Networks (CRNs) to share spectrum in any band of interest.

6.3.2 Technology-Agnostic Dynamic Spectrum Sharing Techniques

Technology-agnostic DSS is arguably the most preferred approach by NRAs due to its reliability and flexibility in terms of spectrum management function. The technique entails implementation of Geo-location spectrum databases (GLSDs) for enabling automated spectrum assignment in the frequency band of interest, control and management of radio devices in the network. GLSD's calculation engine determines availability of channels and their corresponding permitted transmit power levels by taking into consideration several key parameters such as location of transmitters and receivers, their antenna heights, antennae directivity, transmitting power levels, terrain and regulatory co-existence ruleset constraints. Different forms of GLSDs have been implemented by NRA across the world to support DSS in various frequency bands of interest. Below are the three (3) forms of the GLSD-driven techniques for DSS[10].

(a) **TV White Spaces (TVWS): 470 – 694 MHz**

The TV White Spaces (TVWS) DSS approach is intended to promote secondary spectrum sharing by low-power radio devices in the TV broadcasting band 470 - 694 MHz (excluding the Radio Astronomy sub-band and 606 -614 MHz) without causing harmful interference to receivers of the incumbent TV broadcasters and Radio Astronomy Services.

(b) **License Shared Access (LSA): 3 GHz**

The Licensed Shared Access (LSA) DSS approach aiming to promote the introduction of radiocommunication systems operated by a limited number of licensees under an individual

[10] Dudla, Mfupe, Mekuria, Overview of spectrum sharing models: a path towards 5G spectrum toolboxes, 2018, Springer Int.

licensing regime in a frequency band already assigned or expected to be assigned to one or more incumbent users. Under the Licensed Shared Access (LSA) approach, the additional users are authorized to use the spectrum (or part of the spectrum) in accordance with sharing rules included in their rights of use of spectrum, thereby allowing all the authorized users, including incumbents, to provide a certain Quality of Service (QoS). This approach was initially conceived in Europe to encourage Mobile Network Operators (MNOs) to share the 2.3 GH frequency band. The ITU-R SM.2404-0 further describes this approach[11].

(c) **Spectrum Access System (SAS): 3.55 – 3.7 GHz**

The Spectrum Access System (SAS) DSS approach is a three-tier system defined by the Federal Communications Commission (FCC) of the US to promote spectrum sharing in the frequency sub-band 3.55–3.7 GHz. This frequency band popularly known as the Citizen Band Radio Services (CBRS). The three SAS tiers are arranged as follows:

- Tier one (1) : Incumbent user.
- Tier two (2): The Priority Access Licence (PAL)
- Tier three (3): The General Authorised Access (GAA)

Furthermore, the SAS is supplemented by the spectrum sensing technique to ensure no harmful interference coexistence with off-shore military radar systems. The above-mentioned tiered system ranks the priority order of the level of protection of interference to participant network users in a to-down approach. Figure 3 below depicts the three GLSD driven DSS approaches.

[11] ITU-R SM 2404-0 Regulatory tools to support enhanced shared use of the spectrum

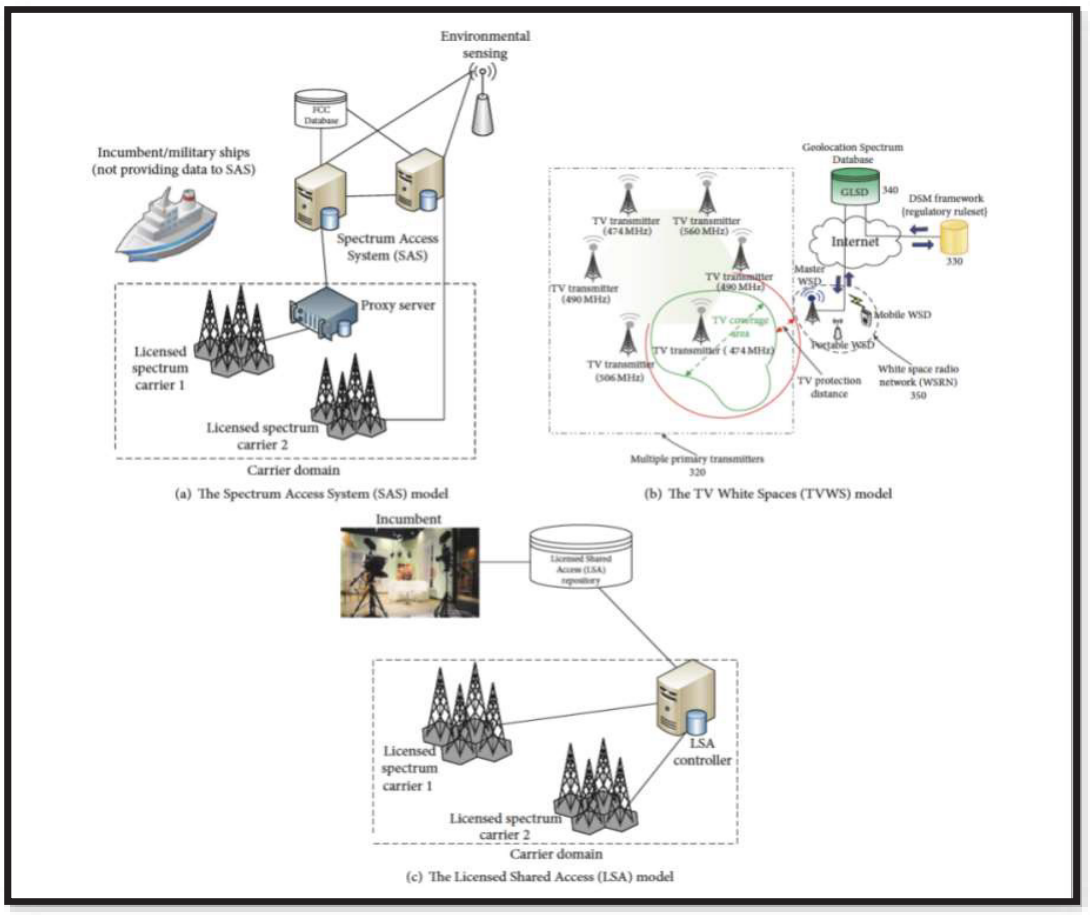


Figure 3: (a) the three tier dynamic spectrum sharing framework through the database system known as Spectrum Access System (SAS). The framework enables creation of broadband small cells networks by sharing spectrum in the Citizen Radio Band (i.e., 3.55GHz to 3.7GHz). (b)the Television White Spaces (TVWS) spectrum sharing framework. Secondary users are allowed to dynamically share the locally unused broadcast spectrum and form affordable long-range broadband networks through the Geolocation Spectrum Database (GLSD). Figure (c)the authorised spectrum sharing framework in the licensed band/Licensed Shared Access (LSA). The holder of the spectrum license can temporarily dynamically share the portions of underutilised spectrum with the secondary user. This framework is enabled by the LSA repository and is preferred by Mobile Network Operators (MNOs) due to the guaranteed QoS

7 CONSIDERATIONS FOR IMPLEMENTATION OF DYNAMIC SPECTRUM SHARING IN THE HIGH DEMAND SPECTRUM BANDS

The perceived scarcity of high demand spectrum and the consequential fact that implementation of the static spectrum sharing approach in certain sub-bands such as Radio Astronomy are non-negotiable[12]. However, the Authority is considering implementation of the DSS approach in other various frequency bands and sub-bands ranging from 3.3 - 7 GHz (technically known as S and C bands respectively) within which assignments of various incumbents' services do currently exist and as well as where future assignments are being considered. Based on the above consideration, the Authority would like to get your views on the following interrelated questions.

Discussion Questions

3	Which specific frequency bands are you particularly interested in, within the 3 GHz to 7 GHz range, that you would like the Authority to consider for the implementation of DSS approach?
Comment:	
4	Do you currently use or intend to use unlicenced spectrum such as TVWS and the ISM band in your services?
Comment:	
5	What has the impact of the existing static radio frequency spectrum assignment regime been on your business?
Comment:	

[12] https://www.icasa.org.za/uploads/files/Protection-of-Karoo-Central-Astronomy-Advantage-Areas-Regulations-2017.pdf

Furthermore, most of the frequency assignments in the bands under consideration for the implementation of the DSS approach are currently been utilised by licensees on fixed-known geographical locations which brings the opportunity to implement one or a combination of the above-described DSS technique, a Unified Spectrum Sharing Framework (USSF) to improve spectrum utilisation efficiency, bridging of the digital inclusion gap and enabling the introduction of new innovative applications and services. Figure 4 depicts the existing locations of assignment in the S and C bands of interest.

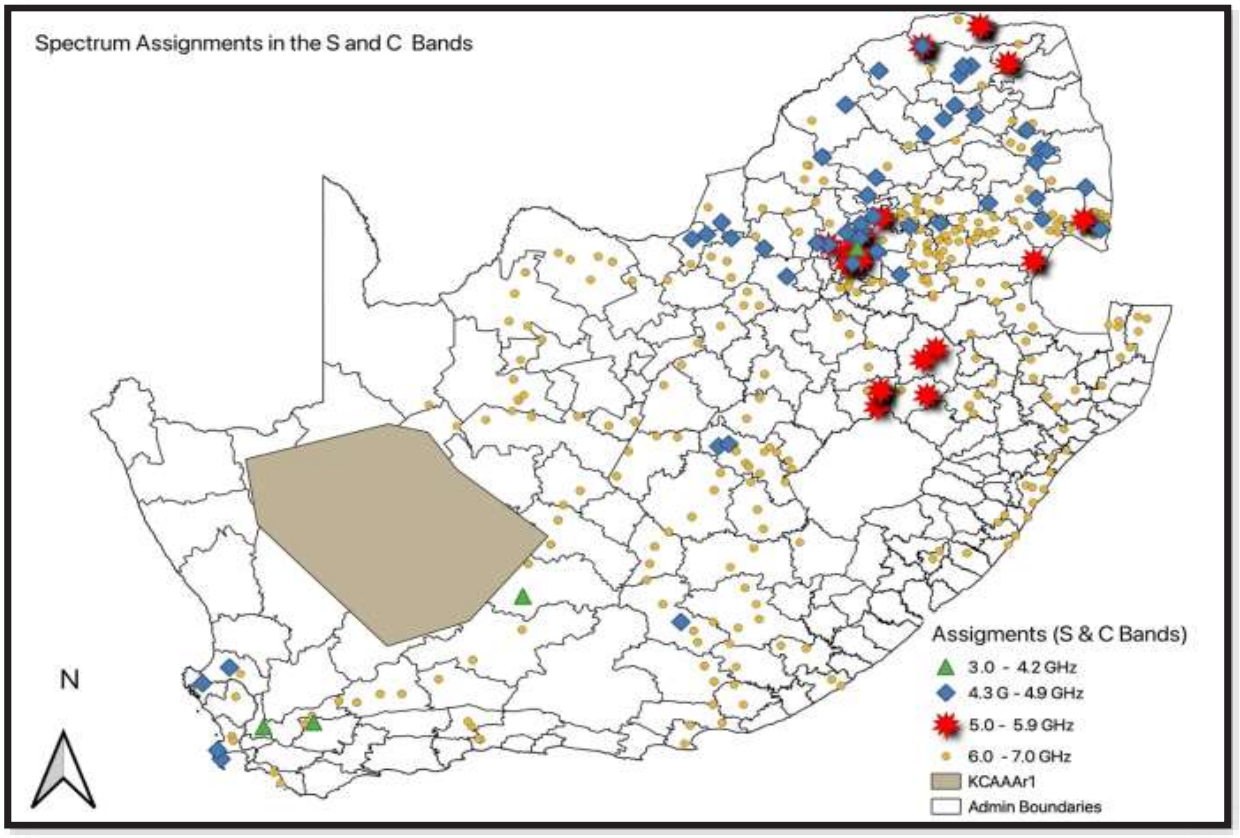


Figure 4: Location of existing Spectrum assignments in the S and C bands

More broadly, the implementation of DSS techniques in the S and C bands would necessitate a careful enforcing of co-existence mechanisms to ensure no harmful interference to incumbent services such as uplink and downlink fixed satellite (Earth Exploration Satellites), and radars. It is important to note that the sub-bands 3.4 – 3.6 GHz and 3.6 – 3.8 GH have received overwhelming support from members of the Communications Regulatory Authorities of Southern Africa (CRASA) to be considered for Fixed Wireless Access (FWA) and fixed

satellite links[13]. The ECC Report 302[14] and ECC Report 254[15] outlines possible approaches for NRAs to consider for protecting incumbent fixed satellite and radar services. Consequently, the Authority considers implementation of DSS based on the database-driven USSF approach using protection zones and permitting secondary spectrum users variable (low - medium) transmit power levels to protect incumbents in the S and C bands. Based on this consideration, the Authority would like to get your views on the following interrelated questions.

Discussion Questions

6	What kind of DSS approaches or a combination thereof (i.e., USSF), described above would you prefer to be considered by the Authority to enable sharing within the 3 – 7 GHz band? Motivate your response with reasons and examples if relevant.
Comment:	
7	Which category of wireless network operators would you prefer a dynamic spectrum sharing regime be applicable to? Motivate your response with reasons and examples if relevant. Options: Small operators with no dominant market share, Established operators with dominant market share, rural and township operators, All operators
Comment:	
8	When would you like to see a dynamic spectrum sharing regime been introduced in South Africa? Motivate your response with reasons and examples if relevant. Options: Immediately, in 1 year time, in 2 to 3 years' time, in 5 years' time, there is no need for it
Comment:	

[13] Extract from the CRASA Electronic Communications Committee meeting, 2015.

[14] Sharing and compatibility studies related to Wireless Access Systems including Radio Local Area Networks (WAS/RLAN) in the frequency band 5925-6425 MHz

[15] ECC Report 254, operational guidelines for spectrum sharing to support the implementation of the current ECC framework in the 3600-3800 MHz range

8 RADIO FREQUENCY SPECTRUM TRADING

Frequency Spectrum trading can be categorized under two kinds of spectrum market scenarios as described below:

8.1 PRIMARY SPECTRUM MARKETS

Radio Frequency Spectrum Auctions are the most known forms of primary spectrum trading (Primary market) employed by NRAs designed to enable exclusive licensed access rights to a winning bidder of a spectrum block(s) of interest. Traditionally, spectrum auctions have been performed in a static manner, that is, such events only take place in discrete-time intervals supposedly under two key conditions: (i) when there is sufficient demand for spectrum and, (ii) when a regulatory authority has identified frequency spectrum to be put up for auction. Recently (in 2022), the Authority conducted a spectrum Auction of which 306 MHz of prime spectrum was successfully auctioned to six (6) Mobile Network Operators[16].

8.2 SECONDARY SPECTRUM MARKETS

Secondary spectrum trading/leasing (Secondary markets) are the most flexible forms of spectrum trading employed among network operators to exchange access rights to spectrum. Secondary markets are a key enabler to unlock the potential of the DSS approach through establishment of dynamic secondary spectrum exchange markets. There exist three (3) main practices to Secondary markets as described below:

(a) **Spectrum trading:** A primary holder of spectrum license (network operator) trades part/or all their exclusive rights to spectrum block(s) of interest with another network operator in need for the remainder period of their license condition.

(b) **Spectrum leasing:** A primary holder of spectrum license (network operator) enables another network operator in need to gain a non-exclusive, short-term access rights to their spectrum block(s) of interest in a geographical area of interest[17].

(c) **Spectrum pooling:** Primary holders of spectrum licenses enter into bilateral agreements to create a common pool of their spectrum assets to expand coverage or to improve Quality of Service in geographical areas of interest.

[16] https://tinyurl.com/mpnkuh94
[17] https://www.fcc.gov/wireless/bureau-divisions/technologies-systems-and-innovation-division/spectrum-leasing

Limited success[18] has been achieved by Secondary spectrum markets due to various reasons chiefly being the following: (i) Primary holders of spectrum hordes spectrum to preserve their dominant market powers (ii) Lack of incentive to primary holders of spectrum to trade (iii) Absence of enabling regulatory framework to support secondary spectrum markets (iv) Absence of trading platform to support secondary spectrum markets.

It has been reported that Federated Wireless Inc, a US based company has built such a trading platform to enable dynamic secondary spectrum exchange market among CBRS users[19]. To this end, the Authority considers formulating a regulatory framework for dynamic secondary spectrum market to enable implementation of DSS in the S and C bands. Based on the above consideration, the Authority would like to get your views on the following interrelated questions.

Discussion Questions

9	How often do you need new spectrum assignment for your business?
Comment:	
10	Would you prefer a dynamic spectrum sharing market exchange platform to be introduced, and in which frequency band(s)? Motivate your response with reasons and examples if relevant.
Comment:	
11	Are you willing to dynamically share/or lease part of your spectrum assignment? Motivate your response with reasons and examples if relevant.
Comment:	

[18] https://www.tele2.com/media/news/2009/tele2-and-telenor-to-build-joint-4g-network-in-sweden/
[19] https://www.federatedwireless.com/products/private-wireless/

12	What kind of dynamic spectrum lease and trading regime would you prefer: spectrum leasing and trading of licensed spectrum among operators or spectrum leasing and trading of unlicensed spectrum by the Authority? Motivate your response with reasons and examples if relevant.
Comment:	
13	Would you prefer the dynamic spectrum lease and trading price to be determined by the market or set by the Authority? Motivate your response with reasons and examples if relevant.
Comment:	
14	What would you prefer to be the minimum and maximum dynamic spectrum lease periods? Motivate your response with reasons and examples if relevant.
Comment:	

ANNEXURE A: SNAPSHOT OF COEXISTENCE SIMULATION RESULTS

Monte Carlo simulation analysis to determine co-existence of Fixed IMT service and Fixed Satellite service in the 3 GHz band.

Simulation Scenario

An interfering fixed terrestrial broadband service (FTBS) operating at 3.4 GHz with and bandwidth of 10 MHz a transmitting power of 45 dBm bandwidth of 10 MHz is placed adjacent to a victim interfering generic fixed satellite (FS) downlink system operating at 3398.5 MHz with bandwidth of 1 MHz. Tables 3 and 4 provide simulation parameters, while Figure 6 provides preliminary results.

Table 1: Parameters of a generic FS downlink

Victim System (FS Downlink)

Parameter	**Value**	**Unit**
Centre Frequency Band	3398.5	MHz
Channel Bandwidth	1	MHz
Noise Floor	-107	dBm
Receiver sensitivity	-98	dBm
Noise Figure	-5	dBm

Table 2: Simulation parameters of a generic FTBS downlink

Interfering System (FTBS – OFDMA Downlink)

	Value	**Unit**
Centre Frequency Band	3400	MHz
Channel Bandwidth	10	MHz
BS Tx Power	+45	dBm
Antenna Height	30	m
Situation	100% Outdoor/Sub urban	-

Preliminary Results Discussion

The preliminary simulation results depicted in Figure 5 below indicate that the coexistence between the two fixed radio systems improves with increased separation distances and adjustment of transmission power levels. Considering the fact that locations of FS are known, it is possible for the Authority to implement DSS in the S band while affording protection from harmful interference to the incumbent services by applying a protection zone approach recommended in the ECC report 254.

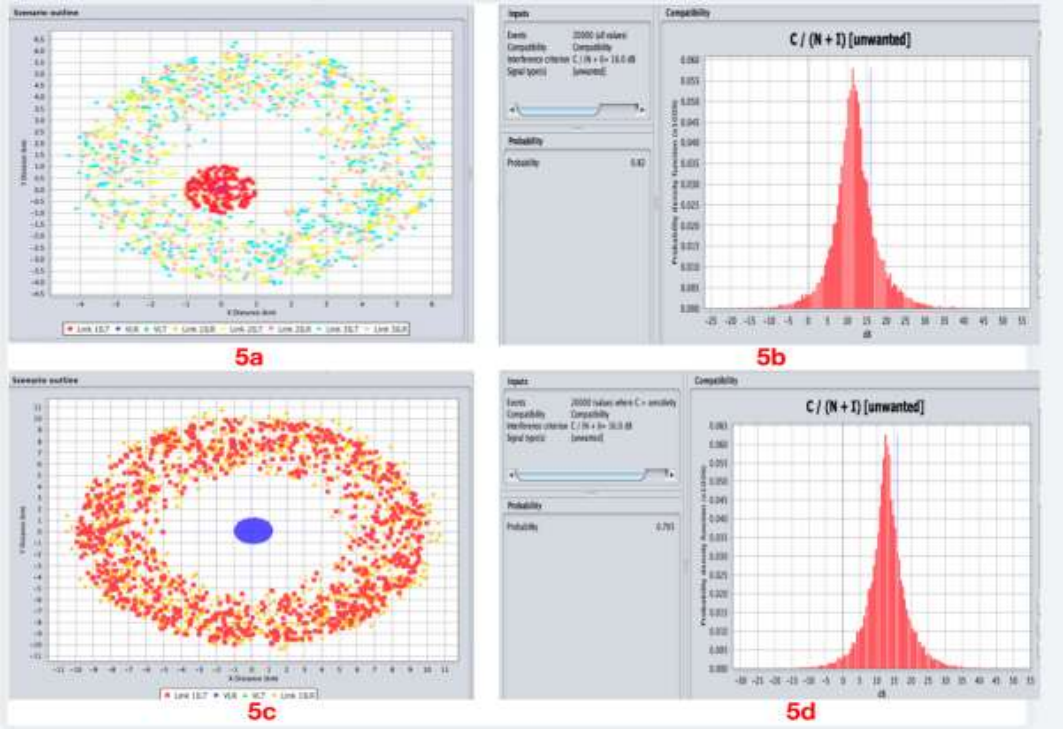


Figure 5: Decreased Probability of Interference (PI) between IMT (interfering system) service and fixed satellite downlink (victim system) with increased separation distances (SDs). Figure 5a depicts PI of 0.82% and mean C/(N+I) of at a SD of 6 km, while Figures 5c & 5d depicts PI of 0.76% and mean C/(N+I) of at SD of 10 km.

ANNEXURE B: FREQUENCY SPECTRUM BANDS UNDER CONSIDERATION FOR THE IMPLEMNETATION OF DSS FRAMEWORK

Table 3: An extract of frequency spectrum bands under consideration for the implementation of DSS framework (Source: National Radio Frequency plan 202[20]1)

ITU Region 1 allocations and footnotes	South African allocations and footnotes	Typical Applications	Notes and Comments
3 100-3 300 MHz RADIOLOCATION Earth exploration-satellite (active) Space research (active) 5.149 5.428	**3 100-3 300 MHz** RADIOLOCATION Earth exploration-satellite (active) Space research (active) 5.149		
3 300-3 400 MHz RADIOLOCATION	**3 300-3 400 MHz** RADIOLOCATION	**Radio astronomy (CH Molecules)**	

[20] ICASA, National Radio Frequency Plan, 2021

5.149 5.429 5.429A 5.429B 5.430	MOBILE except aeronautical mobile 5.149 5.429A 5.429B	**IMT Res. 223 (Rev.WRC-15)**	**See section 5 for coordination with radio astronomy** Recommendation ITU-R M.1036-6 **(International Mobile Telecommunications (IMT))** **Develop a RFSAP for the band**
3 400-3 600 MHz FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile 5.430A Radiolocation	**3 400-3 600 MHz** FIXED MOBILE except aeronautical mobile 5.430A NF9 Radiolocation	**BFWA** **IMT3500 TDD (3400 – 3600 MHz)**	**The band 3400 -3600 MHz is also used for BFWA in some SADC countries** **International Mobile Telecommunication (GG No.42829 Notice 600 of 2019).** Radio Frequency Spectrum Assignment Plan (GG N. 38640) as amended 30 March 2015.

5.431			Recommendation ITU-R M.1036-6 **(International Mobile Telecommunications (IMT))**
3 600-4 200 MHz FIXED FIXED-SATELLITE (space-to-Earth) Mobile	**3 600-4 200 MHz** FIXED FIXED-SATELLITE (space-to-Earth) **NF14**	**Fixed links (4 GHz) (3600 – 4200 MHz)** **C-band downlink (VSAT/SNG/PTP links)(3600 – 4200 MHz)** **BFWA (3600 – 3800 MHz)**	**The sub-band 3 600-3 800 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 latest version Annex 1.** **The sub-band 3 600-4 200 MHz is used for medium and high capacity PTP links and FSS.**

			In the band 3 600-3 800 MHz, FS PTP and FSS applications will have to operate on coordinated basis. **Operators are encouraged to apply for spectrum licenses including registering all C-Band Earth stations on the ICASA online database**
4 200-4 400 MHz **A**ERONAUTICAL MOBILE (R) 5.436 AERONAUTICAL RADIONAVIGATION 5.438	**4 200-4 204 MHz** **AERONAUTICAL MOBILE (R) 5.436** AERONAUTICAL RADIONAVIGATION 5.438 STANDARD FREQUENCY AND TIME SIGNAL-SATELLITE (4 202 MHz) (space-to-Earth)	**Wireless avionics intra-communication systems** **Radio altimeters on board aircraft and associated ground transponders)** **Radars**	

	Earth exploration-satellite (passive) Space research (passive) 5.437 5.440		
5.437 5.439 5.440	**4 204-4 400 MHz** **AERONAUTICAL MOBILE (R) 5.436** AERONAUTICAL RADIONAVIGATION 5.438 Earth exploration-satellite (passive) Space research (passive) 5.437 5.440	**Wireless avionics intra-communication systems** **Radio altimeters on board aircraft and associated ground transponders)**	
4 400-4 500 MHz FIXED MOBILE 5.440A	**4 400-4 500 MHz** FIXED NF14 NF15 MOBILE	**Fixed links (4.8 GHz) (4400 – 5000 MHz)** **Government services** **Outside Broadcast links**	

		Electronic News Gathering	
4 500-4 800 MHz FIXED FIXED-SATELLITE (space-to-Earth) 5.441 MOBILE 5.440A	**4 500-4 800 MHz** FIXED NF14 FIXED-SATELLITE (space-to-Earth) 5.441 MOBILE NF15	**Fixed links (4.8 GHz) (4400 – 5000 MHz)** **Government services** **Outside Broadcast links** **Electronic News Gathering** **SRD(reservoir level probing radar)**	**The band 4 500-4 800 MHz is part of the APP30B Plan (FSS space-to-Earth). Refer to Annex B. Ultra-wide-band applications (UWB) see ITU-R Recommendation SN.1896-1. Rec SM.1755 and Rep SM.2153-7 (latest versions)**
4 800-4 990 MHz FIXED MOBILE 5.440A 5.441A 5.441B 5.442	**4 800-4 825 MHz** FIXED NF14 MOBILE 5.441B	**Fixed links (4.8 GHz) (4400 – 5000 MHz)** **Government services**	Recommendation ITU-R M.1036-6

Radio astronomy	Radio astronomy NF15	**Outside Broadcast Links Electronic News Gathering** **Radio astronomy (Observations of formaldehyde (H2CO) interstellar clouds)**	**(International Mobile Telecommunications (IMT))** **RFSAP to be developed** **See section 5 for coordination with radio astronomy**
	4 825-4 835 MHz FIXED NF14 NF15 MOBILE except aeronautical mobile **5.441B** Radio astronomy **5.149**	**Outside Broadcast Links Electronic News Gathering** **Government services** **Radio astronomy (Observations of formaldehyde (H2CO) interstellar clouds)**	Recommendation ITU-R M.1036-6 **(International Mobile Telecommunications (IMT))** **RFSAP to be developed** **See section 5 for coordination with radio astronomy**

5.149 5.339 5.443	**4 835-4 950 MHz** FIXED NF14 NF15 MOBILE 5.441B Radio astronomy	**Fixed links (4.8 GHz) (4400 – 5000 MHz)** **Government services** **Outside Broadcast Links Electronic News Gathering** **Radio astronomy (Observations of formaldehyde (H2CO) interstellar clouds)**	Recommendation ITU-R M.1036-6 **(International Mobile Telecommunications (IMT))** **RFSAP to be developed** **See section 5 for coordination with radio astronomy**
	4 950-4 990 MHz FIXED NF14 NF15 MOBILE except aeronautical mobile**5.441B** Earth exploration-satellite (passive)	**Fixed links (4.8 GHz) (4400 – 5000 MHz)** **Government services** **Outside Broadcast Links Electronic News Gathering**	Recommendation ITU-R M.1036-6 **(International Mobile Telecommunications (IMT))** **RFSAP to be developed**

	Radio astronomy Space research (passive) **5.149 5.339**	**Radio astronomy (Observations of formaldehyde (H2CO) interstellar clouds)**	**See section 5 for coordination with radio astronomy**
4 990-5 000 MHz FIXED MOBILE except aeronautical mobile RADIO ASTRONOMY Space research (passive) 5.149	**4 990-5 000 MHz** FIXED NF14 MOBILE except aeronautical mobile RADIO ASTRONOMY Space research (passive) 5.149 NF15	**Fixed links (4.8 GHz) (4400 – 5000 MHz)** **Outside Broadcast links** **Electronic News Gathering** **Government services** **Radio astronomy (Observations of formaldehyde (H2CO) interstellar clouds)**	**See section 5 for coordination with radio astronomy**
5 000-5 010 MHz AERONAUTICAL MOBILE-SATELLITE (R) 5.443AA	**5 000-5 010 MHz** AERONAUTICAL MOBILE-SATELLITE (R) 5.443AA		

AERONAUTICAL RADIONAVIGATION RADIONAVIGATION-SATELLITE (Earth-to-space)	AERONAUTICAL RADIONAVIGATION RADIONAVIGATION-SATELLITE (Earth-to-space)		
5 010-5 030 MHz AERONAUTICAL MOBILE-SATELLITE (R) 5.443AA AERONAUTICAL RADIONAVIGATION RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.328B 5.443B	**5 010-5 030 MHz** AERONAUTICAL MOBILE-SATELLITE (R) 5.443AA AERONAUTICAL RADIONAVIGATION RADIONAVIGATION-SATELLITE (space-to-Earth) (space-to-space) 5.443B 5.328B		
5 030-5 091 MHz AERONAUTICAL MOBILE (R) 5.443C AERONAUTICAL MOBILE-SATELLITE (R) 5.443D	**5 030-5 091 MHz** AERONAUTICAL MOBILE (R) 5.443C AERONAUTICAL MOBILE-SATELLITE (R) 5.443D	**Microwave Landing System**	

AERONAUTICAL RADIONAVIGATION 5.444	AERONAUTICAL RADIONAVIGATION 5.444	**AERONAUTICAL RADIONAVIGATION (MLS) (precision approach and landing)]**	
5 091-5 150 MHz **FIXED-SATELLITE (Earth-to-space) 5.444A** AERONAUTICAL MOBILE 5.444B AERONAUTICAL MOBILE-SATELLITE (R) 5.443AA AERONAUTICAL RADIONAVIGATION 5.444	**5 091-5 150 MHz** **FIXED-SATELLITE (Earth-to-space) 5.444A** AERONAUTICAL MOBILE 5.444B AERONAUTICAL MOBILE (telemetry) AERONAUTICAL MOBILE-SATELLITE (R) 5.443AA AERONAUTICAL RADIONAVIGATION	**Feeder links of non-GSO-satellite systems in the MSS** **NGSO MSS feeder links (5091 – 5150 MHz)** Surface applications at airports **Air to ground** AERONAUTICAL RADIONAVIGATION (MLS) (precision approach and landing)	**Resolution 114 (Rev.WRC-15)**

5 150-5 250 MHz AERONAUTICAL RADIONAVIGATION FIXED-SATELLITE (Earth-to-space) 5.447A MOBILE except aeronautical mobile 5.446A 5.446B	~~**5 150-5 216 MHz**~~ AERONAUTICAL RADIONAVIGATION FIXED-SATELLITE (Earth-to-space) 5.447A FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile 5.446A 5.446B AERONAUTICAL MOBILE (telemetry) Radiodetermination-satellite (space-to-Earth) 5.446 5.446C 5.447B 5.447C	**Feeder links of non-GSO-satellite systems in the MSS** **NGSO MSS feeder links (5091 – 5150 MHz)** **WAS / RLAN (5150 – 5350 MHz)** **Air-to-ground**	**Radio Frequency Spectrum Regulations as amended (Annex B) (GG. No. 38641, 30 March 2015).** **ITU Resolution 229 revised WRC-19**
	5 216-5 250 MHz AERONAUTICAL MOBILE (telemetry) (air to ground)	**WAS / RLAN (5150 – 5350 MHz) (indoor use only – ITU Res229 WRC-19)**	**Radio Frequency Spectrum Regulations as amended (Annex B) (GG.**

5.446 5.446C 5.446D 5.447 5.447B 5.447C	AERONAUTICAL RADIONAVIGATION FIXED-SATELLITE (Earth-to-space) 5.447A MOBILE except aeronautical mobile 5.446A 5.446B 5.446 5.446C 5.447B 5.447C	**Air-to-ground** **Feeder links of non-GSO-satellite systems in the MSS**	**No. 38641, 30 March 2015). ITU Resolution 229 revised WRC-19**
5 250-5 255 MHz EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION SPACE RESEARCH 5.447D MOBILE except aeronautical mobile 5.446A 5.447F 5.447E 5.448 5.448A	**5 250-5 255 MHz** EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION SPACE RESEARCH 5.447D MOBILE except aeronautical mobile 5.446A 5.447F Space research 5.448A	**WAS / RLAN (5150 – 5350 MHz) (indoor use only)** **Active spaceborne sensors** **Other than active spaceborne sensors**	**Radio Frequency Spectrum Regulations as amended (Annex B) (GG. No. 38641, 30 March 2015). ITU Resolution 229 revised WRC-19**

5 255-5 350 MHz EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION SPACE RESEARCH (active) MOBILE except aeronautical mobile 5.446A 5.447F 5.447E 5.448 5.448A	~~**5 255-5 350 MHz**~~ EARTH EXPLORATION-SATELLITE (active) RADIOLOCATION SPACE RESEARCH (active) MOBILE except aeronautical mobile 5.446A 5.447F 5.448A	**WAS / RLAN (5150 – 5350 MHz) (Power limitation ITU Resolution 229 WRC-19))**	**Radio Frequency Spectrum Regulations as amended (Annex B) (GG. No. 38641, 30 March 2015).** **ITU Resolution 229 revised WRC-19**
5 350-5 460 MHz EARTH EXPLORATION-SATELLITE (active) 5.448B SPACE RESEARCH (active) 5.448C AERONAUTICAL RADIONAVIGATION 5.449 RADIOLOCATION 5.448D	**5 350-5 460 MHz** EARTH EXPLORATION-SATELLITE (active) 5.448B SPACE RESEARCH (active) 5.448C AERONAUTICAL RADIONAVIGATION 5.449 RADIOLOCATION 5.448D	**Ground based airborne weather radars and**	

		associated airborne beacons	
5 460-5 470 MHz RADIONAVIGATION 5.449 EARTH EXPLORATION-SATELLITE (active) SPACE RESEARCH (active) RADIOLOCATION 5.448D 5.448B	**5 460-5 470 MHz** AERONAUTICAL RADIONAVIGATION 5.449 EARTH EXPLORATION-SATELLITE (active) SPACE RESEARCH (active) RADIOLOCATION 5.448D RADIONAVIGATION except aeronautical radionavigation 5.448B	**Ground based airborne weather radars and associated airborne beacons**	**ITU Resolution 229 revised WRC-19**
5 470-5 570 MHz MARITIME RADIONAVIGATION MOBILE except aeronautical mobile 5.446A 5.450A EARTH EXPLORATION-SATELLITE (active)	**5 470-5 570 MHz** MARITIME RADIONAVIGATION MOBILE except aeronautical mobile 5.446A 5.450A EARTH EXPLORATION-SATELLITE (active)	**WAS / RLAN (5470 – 5725 MHz)**	**Radio Frequency Spectrum Regulations as amended (Annex B) (GG. No. 38641, 30 March 2015).**

SPACE RESEARCH (active) RADIOLOCATION 5.450B 5.448B 5.450 5.451	SPACE RESEARCH (active) RADIOLOCATION 5.450B 5.448B		**ITU Resolution 229 revised WRC-19**
5 570-5 650 MHz MARITIME RADIONAVIGATION MOBILE except aeronautical mobile 5.446A 5.450A RADIOLOCATION 5.450B	**5 570-5 600MHz** MARITIME RADIONAVIGATION MOBILE except aeronautical mobile 5.446A 5.450A RADIOLOCATION 5.450B 5.452	**Location Radar WAS / RLAN (5470 – 5725 MHz)** **Weather Radars (5600 – 5650 MHz)**	**ITU Resolution 229 revised WRC-19** **Radio Frequency Spectrum Regulations as amended (Annex B) (GG. No. 38641, 30 March 2015).**
	5 600-5 650MHz MARITIME RADIONAVIGATION METEOROLOGICAL AIDS		**Radio Frequency Spectrum Regulations as**

5.450 5.451 5.452	MOBILE except aeronautical mobile 5.446A 5.450A RADIOLOCATION 5.450B 5.452	**Ground based meteorological radars (5600 – 5650 MHz)** **WAS / RLAN (5470 – 5725 MHz)** **Weather Radars (5600 – 5650 MHz)**	**amended (Annex B) (GG. No. 38641, 30 March 2015).** **ITU Resolution 229 revised WRC-19**
5 650-5 725 MHz RADIOLOCATION MOBILE except aeronautical mobile 5.446A 5.450A Amateur Space research (deep space)	**5 650-5 670 MHz** RADIOLOCATION MOBILE except aeronautical mobile 5.446A 5.450A Amateur Amateur-satellite (Earth-to-space) Space research (deep space) 5.282 5.453	**WAS / RLAN (5470 – 5725 MHz) (Power limitation ITU Resolution 229 WRC-19))**	**Radio Frequency Spectrum Regulations as amended (Annex B) (GG. No. 38641, 30 March 2015).** **ITU Resolution 229 revised WRC-19**
	5 670-5 725 MHz		

5.282 5.451 5.453 5.454 5.455	RADIOLOCATION MOBILE except aeronautical mobile 5.446A 5.450A Amateur Space research (deep space) 5.282 5.453	**WAS / RLAN (5470 – 5725 MHz) (indoor use only)**	**Radio Frequency Spectrum Regulations as amended (Annex B) (GG. No. 38641, 30 March 2015).**
5 725-5 830 MHz FIXED-SATELLITE (Earth-to-space) RADIOLOCATION Amateur	**5 725-5 830 MHz** FIXED-SATELLITE (Earth-to-space) RADIOLOCATION Amateur Fixed NF16	**Fixed links (5725 – 5850 MHz)** **RTT data (5795 – 5815 MHz)** **ISM applications (5725 – 5875 MHz)** **BFWA (5725-5850 MHz)** **ISM (5725-5875 MHz)** **RTTT (Road Transport and Traffic Telematics) (5795-5815 MHz)**	**Radio Frequency Spectrum Regulations as amended (Annex B) (GG. No. 38641, 30 March 2015).** **.** **BFWA in some SADC countries is limited to below 5850 MHz in order to protect FSS in the band 5850-6425 MHz**

5.150 5.451 5.453 5.455	5.150 5.453	**SRD applications (5 725-5 875 MHz)** **SRD - Transport and information control systems (5 805-5 815 MHz)**	**Common international SRD band;** see ITU-R **Rec. SM.1896 latest version** Transport information and control systems Recommendation ITU-R M.1453
5 830-5 850 MHz FIXED-SATELLITE (Earth-to-space) RADIOLOCATION Amateur Amateur-satellite (space-to-Earth) 5.150 5.451 5.453 5.455	**5 830-5 850 MHz** FIXED-SATELLITE (Earth-to-space) RADIOLOCATION Amateur Amateur-satellite (space-to-Earth) Fixed NF16 5.150 5.453	**Fixed links BFWA (5725 – 5850 MHz)** **ISM applications (5725 – 5875 MHz)** **SRD's – Reservoir Level Probing Radars**	**BFWA in some SADC countries is limited to below 5850 MHz in order to protect FSS in the band 5850-6425 MHz** **Radio Frequency Spectrum Regulations as amended (Annex B) (GG. No. 3417238641, 3130 March 2015).**

5 850-5 925 MHz FIXED FIXED-SATELLITE (Earth-to-space) MOBILE 5.150	**~~5 850-5 925 MHz~~** FIXED FIXED-SATELLITE (Earth-to-space) MOBILE 5.150	**PTP** **C-band uplink (VSAT/SNG links)** **ISM applications (5725 – 5875 MHz)** **Fixed-satellite uplinks (PTP/VSAT/SNG) (5850-6425 MHz)** **FIXED links (5850-5925 MHz)** **ISM (5725-5875 MHz)**	**FS could be used for temporary OB links.**
5 925-6 700 MHz FIXED 5.457 FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B MOBILE 5.457C	**5 925-6 425 MHz** FIXED 5.457 NF14 FIXED-SATELLITE (Earth-to-space) 5.457A 5.457B MOBILE	Fixed links - Lower 6 GHz (5925-6425 MHz) BFWA Fixed-satellite uplinks (PTP/VSAT/SNG) (5850-6425 MHz) ESVs (5925 – 6425 MHz)	**Channelling plan for L6 GHz band in accordance with ITU-R Rec. F.383 latest version.**

	5.149 5.440 5.458	**Radio astronomy (observation of Methanol)**	**Earth Station onboard vessels (ESV) also allowed under FSS.** **Resolution 902 (WRC-03)** Consideration may be made for future License exempt provided it is feasible for the protection of incumbent service.
	6 425-6 429 MHz FIXED 5.457 NF14 FIXED-SATELLITE (Earth-to-space) MOBILE STANDARD FREQUENCY AND TIME SIGNAL-SATELLITE (6 427 MHz) (space-to-Earth)	Upper 6 GHz (6425-7110 MHz), BFWA Fixed-satellite uplinks (PTP/VSAT/SNG) (5850-6425 MHz) **Radio astronomy (observation of Methanol)**	**Channelling plan for U6 GHz band in accordance with ITU-R Rec. F.384 latest version.** **Resolution 150 (WRC-12)**

	5.149 5.440 5.458		
5.149 5.440 5.458	**6 429-6700 MHz** FIXED 5.457 MOBILE **5.458**	Upper 6 GHz (6425-7110 MHz), BFWA **Radio astronomy (observation of Methanol)**	**Channelling plan for U6 GHz band in accordance with ITU-R Rec. F.384 latest version.** **Resolution 150 (WRC-12)**
6 700-7 075 MHz FIXED FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.441 MOBILE	**6 700-7 075 MHz** FIXED NF14 FIXED-SATELLITE (Earth-to-space) (space-to-Earth) 5.441 MOBILE	**Fixed Links (U6) (6425 – 7110 MHz)**	**Channelling plan for U6 GHz band in accordance with ITU-R Rec. F.384 latest version.** **The band 6 725-7 025 MHz is part of the APP30B Plan (FSS Earth-to-space); refer to Annex B.**

5.458 5.458A 5.458B	5.458 5.458A 5.458B		
7 075-7 145 MHz FIXED MOBILE 5.458 5.459	**7 075-7 145 MHz** FIXED NF14 MOBILE 5.458	**Fixed Links (U6) (6425 – 7110 MHz)** **Fixed Links (L7) (7110 –** 7425 MHz)	**Channelling plan for U6 band in accordance with ITU-R Rec. F.384 latest version.** **Channelling plan for L7 band is in accordance with ITU-R Rec. F.385 latest version Annex 3.**
7 145-7 190 MHz FIXED MOBILE SPACE RESEARCH (deep space) (Earth-to-space) 5.458 5.459	**7 145-7 190 MHz** **FIXED** **MOBILE** **SPACE RESEARCH (deep space) (Earth-to-space)** **5.458**	**Fixed links - Lower 7 GHz (7110-7425 MHz)**	**Channelling plan for L7 band in accordance with ITU-R Rec. F.385 latest version Annex 3.**

7 190-7 235 MHz **EARTH EXPLORATION-SATELLITE (Earth-to-space) 5.460A 5.460B** FIXED MOBILE SPACE RESEARCH (Earth-to-space) 5.460 5.458 5.459	**7 190-7 235 MHz** **EARTH EXPLORATION-SATELLITE (Earth-to-space) 5.460A 5.460B** FIXED NF14 MOBILE SPACE RESEARCH (except deep space) (Earth-to-space) 5.460 5.458	**Tracking, telemetry and command for spacecraft operation** **Fixed Links (L7) (7110 –** 7425 MHz)	**SANAS to erect a facility near Matjiesfontein**
7 235-7 250 MHz **EARTH EXPLORATION-SATELLITE (Earth-to-space) 5.460A** FIXED MOBILE	**7 235-7 250 MHz** **EARTH EXPLORATION-SATELLITE (Earth-to-space) 5.460A** FIXED NF14 MOBILE	**Tracking, telemetry and command for spacecraft operation** **Fixed links - Lower 7 GHz (7110-7425 MHz)**	**Channelling plan for L7 band in accordance with ITU-R Rec. F.385 latest version Annex 3.**

5.458	5.458		
7 250-7 300 MHz FIXED FIXED-SATELLITE (space-to-Earth) MOBILE 5.461	**7 250-7 300 MHz** FIXED NF14 FIXED-SATELLITE (space-to-Earth) MOBILE MOBILE-SATELLITE (space-to-Earth) 5.461	**Fixed links - Lower 7 GHz (7110-7425 MHz)**	**Channelling plan for L7 band in accordance with ITU-R Rec. F.385 latest version Annex 3.** **RFSAP to be developed.**
7 300-7 375 MHz FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile	**7 300-7 375 MHz** FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile	**Fixed links - Lower 7 GHz (7110-7425 MHz) and Upper 7 GHz (7425-7750 MHz)**	**Channelling plan for L7 band in accordance with ITU-R Rec. F.385 latest version Annex 3.** **Channelling plan for U7 band in accordance with**

5.461	~~MOBILE-SATELLITE~~ (space-to-Earth) **5.461**		**ITU-R Rec. F.385 latest version Annex 3.** **RFSAP to be developed.**
7 375-7 450 MHz FIXED FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile MARITIME MOBILE SATELLITE (space-to-Earth) 5.461AA 5.461AB	**7 375-7 450 MHz** FIXED NF14 FIXED-SATELLITE (space-to-Earth) MOBILE except aeronautical mobile MARITIME MOBILE SATELLITE (space-to-Earth) (GSO) 5.461AA 5.461AB	**Fixed links - Lower 7 GHz (7110-7425 MHz) and Upper 7 GHz (7425-7750 MHz)**	**Channelling plan for L7 band in accordance with ITU-R Rec. F.385 Annex 3.** **Channelling plan for U7 band in accordance with ITU-R Rec. F.385 latest version Annex 3.**

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