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INDEPENDENT COMMUNICATIONS AUTHORITY OF SOUTH AFRICA

NO. 4471 **26 March 2024**

FINDINGS DOCUMENT AND POSITION PAPER ON THE INQUIRY INTO THE IMPLEMENTATION OF DYNAMIC SPECTRUM ACCESS AND OPPORTUNISTIC SPECTRUM MANAGEMENT

1. The Independent Communications Authority of South Africa ("the Authority") gave notice of its intention to conduct an inquiry into Phase 2 of the implementation of Dynamic Spectrum Access and Opportunistic Spectrum Management according to section 4B of the Independent Communications Authority of South Africa Act, 2000 (Act No. 13 of 2000) ("ICASA Act"), in the Discussion Document published in Government Gazette No. 48352 on 31 March 2023.

2. The purpose of the inquiry was to:

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

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

   (c) consider the establishment of the technical conditions under which the DSA 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. The Authority received seventeen (17) responses to the Discussion Document by 26 June 2023.

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4. In summary, the Authority has found the following, regarding the implementation of Phase 2 of the Dynamic Spectrum Access and Opportunistic Spectrum Management:

4.1 The majority of the stakeholders supported the Authority's consideration to implement Phase 2 of the Dynamic Spectrum Access and Opportunistic Spectrum Management with measures and mitigating techniques in place. However,there were conflicting views regarding which spectrum band the Authority should consider using to implement Phase 2 of the Dynamic Spectrum Access and Opportunistic Spectrum Management.

4.2 Notwithstanding the support by the majority of stakeholders for the Authority to implement Phase 2 of the Dynamic Spectrum Access and Opportunistic Spectrum Management in spectrum bands that are not currently allocated to or earmarked for future IMT services, a minority of stakeholders proposed that the Authority implement Phase 2 of the Dynamic Spectrum Access and Opportunistic Spectrum Management in any feasible spectrum bands.

5. A copy of the Authority's Findings Document and Position Paper regarding the consideration to implement Phase 2 of the Dynamic Spectrum Access and Opportunistic Spectrum Management, along with the Authority's Position on this matter is available on the Authority's website www.icasa.org.za and can be accessed at the Authority's head office library located at (Block C, 350 Witch-Hazel Avenue, Eco Point Office Park Eco Park, Centurion) during office hours between 08:00 and 16:00, Monday to Friday.

Yolisa Kedama
Acting Chairperson
Date: 22/03/2024

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FINDINGS DOCUMENT AND POSITION PAPER ON INQUIRY INTO THE IMPLEMENTATION OF DYNAMIC SPECTRUM ACCESS AND OPPORTUNISTIC SPECTRUM MANAGEMENT

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ACKNOWLEDGEMENTS

The Authority would like to thank the following organizations who have participated in this Inquiry thus far:

1. Cell C
2. Nokia
3. Orbicom
4. Dynamic Spectrum Alliance (DSA)
5. Wireless Access Providers Association of South Africa (WAPA)
6. Mobile Telephone Networks Proprietary Limited ("MTN")
7. South African Broadcasting Corporation (SABC)
8. Huawei
9. Sentech
10. South African Communications Forum("SACF")
11. Telkom
12. Vodacom
13. Federated Wireless
14. University of Western Cape (UWC)
15. Zenzeleni Community
16. Association of Progressive Communication (APC)
17. Mozilla Foundation

The Authority wishes to acknowledge the contributions and support provided by the Council for Scientific and Industrial Research (CSIR) through the Research Collaboration Programme Memorandum of Understanding (MoU).

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GLOSSARY OF ABBREVIATIONS, TERMS AND DEFINITIONS

AFC - Automatic Frequency Coordination

CBRS - Citizens Broadband Radio Service

CNOs – Community Network Operators

CSIR - Council for Scientific and Industrial Research

DSA[1] - Dynamic Spectrum Access

DSS - Dynamic Spectrum Sharing

ECA - Electronic Communications Act

ECNS –Electronic Communications Network Services

ECS – Electronic Communications Services

FCC -Federal Communications Commission

FWA -Fixed Wireless Access

GAA – General Authorized Access

GDP - Gross domestic product

GHz -Gigahertz

ICASA - Independent Communications Authority of South Africa

ICT – information and Communications Technology

ISM -Industrial, Scientific, and Medical

ITU -International Telecommunications Union

IMT - International Mobile Telecommunications

ISM – Industrial Scientific and Medical band

LAL – Local Area License

LSA- Licensed Shared Access

[1] In this document, the terms "Dynamic Spectrum Access" and "Dynamic Spectrum Sharing" should be used interchangeably.

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MNOs -Mobile Network Operators

MHz -Megahertz

Ofcom -Office of Communications

OpenRAN - Open Radio Access Network

OEMs -Original Equipment Manufacturers

PAL - Priority Access License

SAL – Shared Access License

SAS -Spectrum Access System

SMMEs – Small Micro, and Medium Enterprises

SSM - Secondary Spectrum Markets

TVWS -Television White Spaces

USSFF - Unified Spectrum Sharing Framework

VSATs - Very Small Aperture Terminals

WAPA -Wireless Access Providers Association of South Africa

WRC23 – World Radio Congress 2023

SABC - South African Broadcasting Corporation

S Band – Frequency range 2 to 4GHz

C Band – Frequency range 4 to 8GHz

Wi-Fi6 – Refers to an umbrella term used to describe the license-exempt spectrum sub-bands 5.925-6.425 GHz authorised to provide low-power, fixed wireless broadband services.

Regulatory Sandbox – Refers to a framework set up by a specific-sector regulator to allow live testing of innovations and products by participants in a controlled environment with no relaxed or no regulatory obligations under the regulator's supervision[2]

[2] According to the Intergovernmental Fin tech Working Group (IFWG) of South Africa,

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The DSA Innovation Spectrum - Refers to the sub-bands 3.8-4.2 GHz and 5.295-6.425 GHz, which the Authority is considering for implementing the Dynamic Spectrum Access Framework. Its purpose is to foster innovation, encourage stakeholder collaboration, and ensure the efficient utilization of spectrum resources.

The Regulatory Sandbox (RSB) provides market innovators with an opportunity to test new products and services that push the boundaries of existing legislation and regulation responsibly, all under the responsible supervision of relevant regulators.

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This document consists of two major sections:

- Section A lays out the introductory remarks and the background.
- Section B outlines the high-level summary of the submissions received in response to the discussion paper and the Authority 's findings and position. This includes the general responses from the stakeholders, the specific questions and responses from the stakeholders, the authority's position, and the conclusion.

SECTION A:

1. INTRODUCTION

1.1 FINDINGS DOCUMENT AND POSITION PAPER

This Findings Document and Position Paper reflects the findings of the Authority from the inquiry, held in terms of section 4(B) of the Independent Communications Authority of South Africa Act, 2000 (Act No.13 of 2000) ("ICASA Act "), and communicates its position regarding the consideration to implement Phase two (2) of the Dynamic Spectrum Access and Opportunistic Spectrum Management.

The Positions herein are guided by the findings of the inquiry.

1.2 THE PUBLIC PROCESS

The Authority published the Discussion Document entitled "Phase 2 of the Implementation of Dynamic Spectrum Access and Opportunistic Spectrum Management" on 31 March 2023 for public comment. Leading to the drafting of the Discussion Document on Phase 2 of Dynamic Spectrum Access and Opportunistic Spectrum Management, the Authority conducted desktop research with the support of the research collaboration program partner, the CSIR.[3]

The Authority also undertook a benchmark study tour to learn from international best practices on how Dynamic Spectrum Access and Opportunistic Spectrum Management are regulated by other Authorities.

[3] The collaborative and benchmarking approach resulted in a Discussion Document structure that took the form of questions supported by explanatory and contextual discussion.

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On 22 May 2023, the Authority published an extension on Government Gazette Number 48640 (Notice 3441 of 2023) extending the submission deadline from 12 May 2023 to 26 June 2023.

The Authority received written submissions from the stakeholders listed on the acknowledgement section.

None of the acknowledged stakeholders indicated their intention or desire to make oral representations, as a result the Authority did not hold public hearings.

2. BACKGROUND

2.1 THE GROWING SPECTRUM DEMAND TO SUPPORT THE NATIONAL WIRELESS BROADBAND INFRASTRUCTURE

The demand for wireless broadband capacity is growing faster than the availability of additional spectrum for supporting wireless infrastructure deployment. The National Development Plan and SA Connect Policy both advocate for broadband to reach "a critical mass of South Africans[4]". To meet this demand, future generations of wireless technology and services will not only be required to increase their efficiency in terms of bits per second per Hertz, but they will also require new wireless network architectures and new approaches to spectrum management.

The SA Connect Policy proposes making significant amounts of otherwise underutilized spectrum available for broadband use as a holding promise for increasing South Africa's broadband capacity. The proposed regulatory framework for dynamic spectrum assignment would enable the widespread utilization of this underutilized spectrum and promote efficient use of available spectrum.

Spectrum is a finite and scarce resource, as such we cannot continue with the existing unsustainable practice of assigning a particular block of spectrum to a particular licensee once off. Once spectrum is assigned t exclusively to a licensee on a national basis, it is implicit that the same block of spectrum cannot be assigned to others. Due to the limited number of available spectrum blocks, so it

[4] South Africa Connect: Creating Opportunities, Ensuring Inclusion, South Africa's Broadband Policy 20 November 2013

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follows that the spectrum is "scarce". Even though the licensee can't use the spectrum in every square km of the country on any viable economic basis. There are some geographic locations wherein the frequency spectrum is not utilised by the licensee, this is a potentially inefficient use of the scarce national frequency spectrum resources.

2.2 DYNAMIC SPECTRUM ACCESS AND OPPORTUNISTIC SPECTRUM MANAGEMENT

Dynamic spectrum assignment is a viable mechanism to assign the unused spectrum to other parties, on a secondary basis, such that they don't cause any interference with the primary licensee. Re-using the same spectrum hundreds or even thousands of times over, in many small areas, means that the spectrum is readily available and used efficiently.

The second phase of the Authority's implementation of the Dynamic and Opportunistic Spectrum Management regime in the S-band and C-band which follows the first Phase of the Authority's implementation of the Dynamic and Opportunistic Spectrum Management regulatory framework which was formulated and published as Regulations on the use of TV White Spaces of 2018 in Government Gazette Number 41512 (Notice 147 of 2018). Regulations on the use of TV White Spaces came into force on the 1st of April 2021. The TVWS spectrum is actively utilised by various network operators to provide affordable broadband services in underserved and unserved rural and peri-urban communities.

SECTION B:

3. SUBMISSIONS

The Authority posed fourteen (14) questions regarding its consideration to implement Phase 2 of Dynamic Spectrum Access and Opportunistic Spectrum Management. The questions were categorized under the following themes:

- Overview of the state of the ICT sector and Digital Infrastructure.
- Spectrum Management Regimes and Considerations for Implementation of Dynamic Spectrum Access in the High Demand Spectrum Bands; and

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- Radio Frequency Spectrum Trading.

3.1 SUMMARY OF GENERAL RESPONSES FROM THE RESPECTIVE STAKEHOLDERS

MTN is of the view that the Authority should implement Dynamic Spectrum Access and Opportunistic Spectrum Management regime since small operators are occupying band n78 which is not fully utilized. A transparent near-real-time spectrum licensing database must first be put in place/implemented.

SABC is of the view that Dynamic Spectrum Access and Opportunistic Spectrum Management regimes be introduced in the S-band and C-band only after a database system has undergone thorough public scrutiny. It has expressed the interference challenges it faces in the C-band, (Reuters feed).

Telkom is of the view that the Authority should create a "regulatory sandbox" in the 3.8 – 4.2GHz to implement the Dynamic Spectrum Access and Opportunistic Spectrum Management regime. Telkom further reminds the Authority of provisions of the ECA and the RFSR regarding issues such as spectrum transfer, ceding, sharing etc.

SENTECH is of the view that the concepts of Dynamic Spectrum Access (DSA) and Secondary Spectrum Markets (SSM) should not be implemented in the same frequency bands. It further requests the Authority to clarify the following impending processes:

-The "Spectrum Outlook" inquiry

-The policy directive on Next generation RF spectrum for economic development

WAPA is in support of the Authority's consideration of implementing the Dynamic Spectrum Access and Opportunity Spectrum Management regime and advises the Authority to consider conducting a regulatory impact assessment on the spectrum secondary market aspect.

Vodacom is in support of the Authority's consideration to implement the Dynamic Spectrum Access and Opportunistic Spectrum Management regime and proposes a certificate-based time-limited dynamic spectrum leasing of a minimum of 1 month and a flexible maximum period.

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Cell C is of the view that the Authority should only consider implementing Dynamic Spectrum Access and Opportunistic Spectrum Management among licensed operators.

DSA is of the view that the Authority should consider implementing Dynamic Spectrum Access and Opportunistic Spectrum Management in mixed approaches to enable DSA across the S and C bands.

Orbicom is of the view that the Authority should exercise caution in its consideration of implementing Dynamic Spectrum Access and Opportunistic Spectrum Management regimes. It has advised the Authority to be cautious, and transparent, and prioritise the creation of geolocation spectrum databases. It has raised the past issues of interference in their assigned spectrum.

Federated Wireless Inc. is in full support of the Authority's consideration of implementing a Dynamic Spectrum Access and Opportunistic Spectrum Management regime.

Nokia is of the view that the Authority should consider implementing Dynamic Spectrum access and Opportunistic Spectrum Management regime in the exclusive, licensed, and dedicated spectrum.

Huawei is of the view that the Authority should consider the implementation of a static sharing approach in the 3.8 - 4.2GHz instead of Dynamic Spectrum Access and Opportunistic Spectrum Management.

A joint submission by UWC, APC, Zenzeleni and Mozilla Foundation are of the view that the Authority should initially consider using Ofcom's Shared Access Licensing ("SAL") approach without a geo-location spectrum database, and later implement the Dynamic Spectrum Access and Opportunity Spectrum Management regime using the geo-location spectrum database.

3.2 SPECIFIC QUESTIONS AND RESPONSES FROM RESPECTIVE STAKEHOLDERS AND THE AUTHORITY'S FINDINGS AND POSITION

3.2.1 Overview of the State of the ICT Sector and Digital Infrastructure

The Discussion Document posed the following questions to the public to comment to understand about stakeholder's industries and their market segments.

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Q1: *If you are an active ECNS and ECS license holder, what is your market size and how many customers are currently using your services?*

Q2: *Which industries use your services extensively?*

3.2.2 The Authority's Findings

The findings of the Authority were that the submissions were representative of different industry stakeholders with varying addressable market shares ranging from Mobile Network Operators (MNOs), broadcasters, Wireless Internet Service Providers (WISPs), Community Network Operators (CNOs), Original Equipment Manufacturers (OEMs), Academia, and industry lobby groups. The stakeholders indicated a varied customer base, with the majority being MNOs who have a combined significant market share percentage.

4. Spectrum Management Regimes and Considerations for Implementation of Dynamic Spectrum Sharing in the High Demand Spectrum Bands

Q3: *Which frequency bands are you particularly interested in, and you would like the Authority to consider for the implementation of the DSS approach? (Options: 3 - 4 GHz, 4 - 5 GHz, 5 -6 GHz, 6 - 7 GHz).*

Q4: *Do you currently use or intend to use unlicenced spectrum such as TVWS and the ISM band in your services?*

Q5: *What has the impact of the existing static radio frequency spectrum assignment regime been on your business?*

Q6: *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.*

Q7: *Which category of wireless network operators would you prefer a dynamic spectrum sharing regime apply to? (Options: Small operators with no dominant market share, Established operators with dominant market share, rural and township operators, All operators)*

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Q8: *When would you like to see a dynamic spectrum-sharing regime introduced in South Africa? (Options: Immediately, in 1 year, in 2 to 3 years, in 5 years, there is no need for it)*

4.1 Stakeholders Responses:

In their joint submission UWC, APC, Zenzeleni NPC, Mozilla Foundation (Joint Submission): It was emphasised that, the focus of Zenzeleni NPC is in rural areas as such they will be interested in the lowest part of the spectrum for the better propagation characteristics of the lower band. Zenzeleni Networks NPC currently uses unlicensed spectrum in the ISM bands for providing its services. Using license exempt ISM spectrum has led to interference with other operators especially in Zenzeleni Networks backhaul endpoint in Mthatha, where the band is congested, as well as in other points of the network where other operators are using wide channels to achieve higher throughputs.

Cell C emphasised that it does not support the implementation of DSA in the current IMT bands and future bands earmarked for IMT use. Cell C does not utilise an unlicensed spectrum. In addition, Cell C articulated that there are instances where devices and end-user equipment operate in the ISM band. According to Cell C, under the existing static radio frequency spectrum regime, its business was not negatively affected and operated as 'business as usual'. Cell C recommended that to identify the relevant market, the nature of the market failure, and the necessary actions, the Authority should follow the processes under Competition Matters as outlined in section 67 of the ECA. Cell C further states that it is unclear how the IMT spectrum will be dynamically shared with other licensees considering the nature of IMT services, complexity and costs associated with IMT technology in the cases of spectrum interference and mitigation techniques. Lastly, it is also unclear how IMT licensees would meet and maintain the stringent prescribed quality of service parameters under such a DSS framework.

SENTECH supports the implementation of the DSA framework using the Licensed Shared Access (LSA) approaches in the spectrum bands already licensed to MNOs. Sentech proposes that only small players excluding large MNOs should participate in the implementation of the DSS framework. Sentech is of the view that the

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inclusion of the entire band will cause challenges in regulatory, technical, spectrum availability, interference management, pricing, and coexistence with legacy systems. Sentech advocates for the Authority to exclude radio frequency bands that are critical for applications such as air traffic control, maritime communications, public safety, satellite-based navigation, and weather radar.

Furthermore, Sentech stated that the band is congested as it is one of the SA connect models. Sentech mentioned that the challenge with the current static radio frequency spectrum assignment for high-demand spectrum is biased towards big MNOs and does not cater for a wider variety of operators and SMEs.

SENTECH is in favour of supporting the licensed shared access (LSA) model instead of the spectrum access systems (SAS) model.

SENTECH supports LSA for the following reasons:

a. Regulatory Control: LSA is a regulatory framework, which means that the Authority maintains control over how the spectrum is used and who can use it, in compliance with existing regulations such as the National Radio Frequency Plan 2021 and Radio Frequency Spectrum Regulations. This can help to ensure that spectrum is used responsibly and efficiently, and that interference is minimized.
b. Predictable Access: LSA provides secondary users with predictable access to licensed spectrum. Under LSA, the primary user has a responsibility to provide secondary users with access to the spectrum according to agreed-upon rules and conditions, which can provide greater certainty for secondary users.

SENTECH stated that the DSS framework will assist in alleviating the congestion in the ISM bands, and enable operators with no dominant market share, rural and township operators, etc., the opportunity to become entrepreneurial. The company does not support the inclusion of the six (6) MNOs that took part in the auction process. The intention of the DSS framework must be to assist entities with limited or no spectrum, including those with challenges in accessing funding for purchasing spectrum, to offer services at reasonable and affordable rates. The

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inclusion of the six (6) MNOs will be counterintuitive to a plurality of services, and the development and promotion of SMMEs and cooperatives.

MTN indicated an interest in the spectrum bands 3.7 – 3.8 GHz (n78) and 4.3 – 4.9 GHz (n79) to be considered for the implementation of the DSS framework. It currently provides BFWA with Air Fibre products in the 5.8 GHz Type Approved in 2021. The DSS regime opens a new window of opportunities/ secondary markets and promotes efficient spectrum usage, allows spectrum trading, minimizes/eradicates spectrum capacity constraints, and limits spectrum hoarding. In terms of spectrum trading, MTN prefers LSA in the 3.7 – 3.8 GHz to allow other MNOs without licenses to operate exclusively on a national basis. They can be able to deploy networks in other parts of the country to benefit citizens. All operators should participate in the DSS framework especially established operators who have already invested in infrastructure, and they can invest more and deploy the spectrum effectively to grow the economy. The DSS framework should be implemented immediately, other MNOs can deploy spectrum currently occupied by smaller MNOs in band n78 to effectively service other markets such as private networks.

Orbicom doesn't agree with the Authority's consideration of the 3800 – 4200 MHz band for the implementation of the DSS approach, however, it may support such implementation in other bands. Orbicom raised a concern about interference as there are multiple registered and unregistered FSS earth stations in the band.

Vodacom would support the Authority to consider implementation of the DSS framework in the following specific bands which seems to be underutilised: 3600-3800MHz, and 470-585MHz. Furthermore, Vodacom would not support implementation of the DSA framework in the IMT spectrum bands and future bands earmarked for IMT. Vodacom has provided the following reason on their position stated above, should the primary user of the IMT spectrum decide to expand their services in the band potentially overlapping with the secondary user of the spectrum (an operator that has deployed their services using the DSS framework); the secondary user may refuse to vacate the band causing a challenge known as "spectrum squatting" i.e. refusal to vacate a band or part thereof once lawfully instructed to do so. It is critical that the Authority develop effective means to prevent such challenges to occur. Vodacom has proposed a 5-

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tiered approach for the implementation of Dynamic Spectrum Access and Opportunistic Spectrum Management Approach. All operators should voluntarily participate in the DSS framework.

Telkom highlighted that certain portion of sub-band 3.6 – 3.8 GHz are already allocated for Fixed Wireless Access (FWA) shared use in South Africa. Additionally, Telkom noted that this sub-band is subject to decisions made at WRC23. Furthermore, Telkom suggested to the Authority that the sub-band 3.8 - 4.2GHz be considered for the LSA and SAL approaches in implementing the DSA framework. Telkom has provided the following reasons on their position stated above: The band 3.8 – 4.2GHz is not earmarked for future IMT use by the WRC, furthermore this band is not assigned for IMT in South Africa, while there is a limited use of satellite Earth stations and fixed link in South Africa, international best practices have shown that in the UK, Ofcom has identified this band for spectrum sharing under the SAL framework. Most importantly, there is already an existing matured ecosystem of IMT equipment that support the band in question.

Additionally, Telkom proposed that only Tier-2 and non-licensees should participate in the implementation of the DSA framework. The Authority must ensure that dominant players do not distort the market. Telkom has provided the following reasons on its position stated above; spectrum trading deals, have already benefited dominant mobile operators with substantial amounts of additional spectrum which was not included in the auction rules or their spectrum caps, and therefore, provided them additional spectrum holding benefits.

Further Telkom stated that the technical and regulatory rules applicable to the use of this band for Wi-Fi on a license exempt basis, as provided in the Radio Frequency Spectrum Regulations, Annexure B, must be actively enforced by the Authority to ensure that harmful interference to Lower 6 GHz PTP links is not caused.

Federated Wireless Inc. is in support of the Authority's consideration to implement the DSS framework in the entire band using the Spectrum Access System (SAS) approach used to implement the Citizens Broadband Radio Service (CBRS) in the US. It further proposes the use of the Automated Frequency Coordination (AFC) approach for the Wi-Fi6 band, reasons for view not indicated.

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Huawei notes that the 3.8-4.2 GHz band is a band for which IMT network equipment and terminals already exist, but currently in South Africa only allowed for usage by satellite downlinks and fixed links. Though it may not be possible for the Authority to open that band completely for IMT use, we suggest that 3.8-4.2 GHz is a band where sharing among satellite and mobile use might be possible and considered. Further suggests that sharing does not need to be dynamic, as satellite use (satellite receive stations and VSATs) does not change frequently. In practice, the sharing scheme will need to calculate the separation distance to avoid interference from Mobile stations into satellite receivers.

Nokia strongly encourages ICASA to further align in its technical decisions with the international trends and with global standards such as 3GPP. This allows the licensees to benefit from the associated global economies-of-scale and more diverse product ecosystem, hence supporting overall 5G deployment, while the entire society can take advantage of standardised equipment.

DSA is in support of the Authority's consideration to implement the DSS framework in the following spectrum range, 3.3 – 3.4GHz and 5.925 – 7.125 GHz using a mixed-tiered-based approach to enable DSS across the S and C bands. All players should be allowed to participate. Nokia strongly encourages ICASA to further align its technical decisions with international trends and with global standards such as 3GPP. This allows the licensees to benefit from the associated global economies-of-scale and more diverse product ecosystem, hence supporting overall 5G deployment, while the entire society can take advantage of standardised equipment.

WAPA stated that all its members make extensive use of the licence exempt allocations for point-to-point and point-to-multipoint applications detailed in Annexure B to the Radio Frequency Spectrum Regulations, 2015 but have limited growth due limit in the number and capacity of suitable licence exempt allocations. The scarcity of spectrum has limited both the geographic reach and rate at which WAPA's members have been able to expand their networks and the transition to a more permissive and enabling spectrum sharing regime would be welcomed. Further typical delays, administrative burden and costs associated with coordination of the existing static radio frequency spectrum assignment regime,

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leaves most fixed wireless operators with little choice but to rely on licence exempt allocations for the pro-vision of their services.
WAPA favours the adoption of an SAS approach in the 3.55-3.7GHz band and the use of AFC in the 4.925-7.125GHz band.

SABC did not specify any specific band of interest for the implementation of the DSS framework but rather expressed the interference challenges it faces in the C-band, (Reuters feed) it is of the view that DSA in S-Band and C-band should only be introduced after a geo-location spectrum database system goes through public scrutiny. S- and C-band is used by Broadcasters for signal distribution from the Signal Distributor's uplink facility to the various terrestrial transmission sites. A loss of signal at a terrestrial transmission site or anywhere in the transmission path can mean millions of viewers and listeners being affected negatively.

4.2 The Authority's Findings

4.2.1. The Authority found clear support from a majority of respondents for its consideration to implement the DSA regulatory framework within the S and C spectrum bands as one way of alleviating spectrum scarcity and thus additional spectrum access for broadband to additional players.

4.2.2 The Authority found that there were wide-ranging opinions from respondents on which specific sub-bands (within the S and spectrum bands), the Authority should consider implementing the DSA regulatory framework. While some respondents believed that the Authority should not consider implementing the DSA and opportunistic spectrum management framework in the current IMT bands and future bands earmarked for IMT, some of the respondents were of the opinion that the DSA and opportunistic spectrum management framework should be implemented in the spectrum bands exclusively licensed for the use by MNOs. Other respondents thought that the DSA framework should be implemented across the S and, lower C spectrum bands.

4.2.3 Moreover, the Authority found that the majority of respondents expressed that implementation of the DSA regulatory framework should be exclusive to "Tier 2", small operators with no significant market share, and new entrants' categories.

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4.2.4 On the preferred type of the DSA management framework approach, the Authority found that the majority of respondents preferred geo-location spectrum database-driven approaches ranging from CBRS, eLSA, and LSA. Furthermore, the Authority has noted the submission by Telkom for the establishment of a "Regulatory Sandbox" to facilitate the implementation of the DSA framework.

4.2.5 Furthermore, the Authority found that the majority of the respondents believed that the Authority should consider commencing with the implementation of the DSA regulatory framework in South Africa once the geo-location spectrum database has been developed and reviewed transparently.

4.3 The Authority's Position

4.3.1 The position of the Authority is to implement the DSA framework in the sub-bands 3.8 – 4.2 GHz and the lower 6GHz (5925–6425 MHz) "Wi-Fi6" (collectively designated as "DSA innovation spectrum"). It is important to note that the Authority has already decided on the use of the lower 6GHz[5] spectrum on a license-exempt basis through Government Gazette Number 48643(notice number 1822 of 2023) to amend annexure B of radio frequency spectrum regulations.

4.3.2 The Authority will therefore, implement the DSA framework in the sub-band 3.8 - 4.2GHz for the provision of low and medium power mobile and fixed broadband services in a "tiered" access based, with geo-location based spectrum licensing approach. While the DSA approach for managing the lower 6GHz (5925–6425 MHz) "Wi-Fi6" will be geo-location-based, license-exempt, fixed wireless broadband access.

4.3.3 Consequently, the Authority is to formulate a draft "Regulatory sandbox" for public consultation to facilitate the implementation of DSA in the 3.8 GHz – 4.2 GHz sub-band (collectively designated as "DSA innovation spectrum") using a "tiered" access-based unified geo-location spectrum database approach as a primary mechanism to protect incumbent licensed services from harmful interference.

[5] https://www.gov.za/sites/default/files/gcis_document/202305/48643gon1822.pdf

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4.3.4 The Authority's legislative mandate regarding Management, regulating, assignment/incensing, controlling, and monitoring of spectrum is derived from Section 30 of the ECA in line with national spectrum policy, and applicable directions as guided by the national development plan. The Minister is the custodian of the national spectrum resources and is responsible for the allocation of spectrum in terms of Section 34 of the ECA.

4.3.2 The Authority has gained sufficient experience in managing geo-location spectrum databases during the implementation of the first phase of the DSA and opportunistic spectrum management framework for TVWS.

4.3.4 Additionally, the Authority has taken account of best international practices on the protection of primary licensees in countries where DSA frameworks are implemented in other spectrum bands beyond the TVWS. The Authority has conducted a benchmarking study in the United States of America (USA) where the Federal Communications Commission (FCC) is successfully implementing the DSA framework in the Citizens Broadband Radio Service (CBRS[6]) band, 3.55 -3.7GHz with over 300,000 CBRS low-and-medium power devices have been deployed through the Spectrum Access System (SAS). Furthermore, the Authority has conducted a benchmarking study in the United Kingdom (UK) where the Office of Communications (Ofcom), is successfully implementing the Shared Access License (SAL)[7] framework across various portions of unassigned spectrum including the sub-band 3.8 – 4.2GHz with over 1,000 low-and-medium power IMT devices deployed across the UK.

4.3.5 In fulfilling its legislative mandate and spectrum policy directive to support the goals set for the SA Connect, promotion of SMME network operators, community networks and innovation in emerging and future wireless network services such as Open Radio Access Networks (OpenRAN) and Private networks.

[6] https://www.fcc.gov/wireless/bureau-divisions/mobility-division/35-ghz-band/35-ghz-band-overview
[7] https://www.ofcom.org.uk/__data/assets/pdf_file/0035/157886/shared-access-licence-guidance.pdf

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5. Radio Frequency Spectrum Trading

Q9: How often do you need new spectrum assignments for your business?

Q10: 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.

Q11: Are you willing to dynamically share/or lease part of your spectrum assignment? Motivate your response with reasons and examples if relevant.

Q12: 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.

Q13: 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.

Q14: What would you prefer to be the minimum and maximum dynamic spectrum lease periods? Motivate your response with reasons and examples if relevant.

5.1 Stakeholders Responses:

UWC, APC, Zenzeleni NPC, and Mozilla Foundation, support the use of DSS based on the database-driven Unified Spectrum Sharing Framework (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. Access to this spectrum should be restricted to small operators with no dominant market share. This should be defined by operators with Class ECNS holders and license-exempt operators, excluding iECNS license holders. The DSS framework should be implemented as soon as possible. They believe that the priority of this phase of spectrum management should be the provision of affordable access to the unserved and underserved. They submit that the Authority should consider the use of the SAL framework similar to the Ofcom one in the interim and implement the fully Dynamic framework in the future. They propose a three-year initial license, with an automatic annual renewal as long as the license holder has maintained the terms of the license.

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Cell C is of the view that as demand for IMT mobile electronic communications services increases, a spectrum will be needed. Additionally, Cell C stated that the already assigned spectrum runs out when Cell C subscribers' service quality declines to a point where it is not compliant with the most recent ICASA End User and Subscriber Service Charter Amendment requirements. Cell C would prefer a spectrum leasing and trading regime for licensed spectrum among operators with interference protection measures because leasing and trading of licensed spectrum allows operators to manage the spectrum for a duration of time, and thus provides certainty in the use of the spectrum to the operators and the true value of the spectrum is realised.

Cell C further indicated that a spectrum leasing and trading regime for licensed spectrum also ensures that the spectrum is assigned and used efficiently, valued at market prices as operators can access the spectrum efficiently and flexibly. In addition, Cell C outlined that the spectrum leasing and trading regime for licensed spectrum allows operators to access spectrum on a more cost-efficient basis, and make use of newer spectrum technologies and features which can result in innovative and accessible services to consumers. Cell C opposed dynamic spectrum sharing or leases of IMT spectrum. In the case of pricing, Cell C recommended that the Authority follow the section 67 procedures under Competition Matters as outlined in the ECA to identify the relevant market, the existence of a market failure, and the necessary measures.

MTN is of the view that spectrum needs depend on various factors including network traffic growth and business opportunities to target other markets (e.g. NB-IoT, private networks). It proposed that Licensed Shared Access is preferred in the 3.7 – 3.8 GHz to allow other MNOs without licenses to operate exclusively on a national basis. They can be able to deploy networks in other parts of the country to benefit the country and economy. MTN is pursuing opportunities in the private network domain (i.e., mining companies) and the framework will allow faster deployment with less operational complexities, and ensure spectrum resources are efficiently used to the benefit of the country and economy.

Furthermore, MTN supports spectrum leasing and trading of licensed spectrum as it enables operators to target new opportunities like private networks efficiently

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and allows small MNOs to enter the market and promote competition. The regime supports the efficient use of spectrum, facilitates network investment, ensures faster recycling of spectrum, faster resolution of spectrum capacity, disincentivizes spectrum hoarding and is in line with international best practices. It prefers the price to be commercially negotiated on a case-by-case basis recognizing different demands for different spectrum bands and locations of use. MTN prefers the relaxation of the lease duration and terms to be agreed upon by the parties involved in the transaction. The period may be dictated by the incumbent state of network traffic against regulated QoS obligations.

NOKIA raised that Dynamic Spectrum Sharing (3GPP standardised Dynamic Spectrum Sharing (DSS)) is a good example that enables mobile operators to dynamically share spectrum resources across different technologies. The practical benefits of using DSS vary between operators due to their differing radio spectrum assets and their strategies for 5G services. For example, used in conjunction with higher frequency bands (3.5 GHz), 5G FDD with DSS can boost the end-user experience with an additional low-band carrier. Similarly, outside of the 3.5 GHz band, DSS provides a flexible way to extend 5G services using an operator's legacy frequency bands.

Nokia supports the development of standard-based solutions and acknowledges the development of standards such as 5G NR-U. This will guarantee proper mechanisms for sharing licensed and unlicensed technologies on the same band.

Vodacom proposes that given the nature of the unpredictability of links a certificate-based time-limited dynamic spectrum leasing of a minimum of 1 month and a flexible maximum period. The validity of the certificate will expire, and the system will prevent the equipment from transmitting on the band, unless the certificate is renewed by the primary licensee. It further proposes that the non-IMT spectrum should be considered in the dynamic secondary markets and the prices be determined by the market forces such an approach would ensure that spectrum is optimally valued through market forces.

Dynamic Spectrum Alliance supports dynamic secondary spectrum markets and proposes that spectrum in the 5GHz band should be reserved only for unlinked

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operations. It proposes that the process should be determined by the market forces.

SENTECH does not support the principle of dynamically sharing/or leasing part of your spectrum assignment in the 3800 – 4200 MHz band. SENTECH's spectrum assignment in the C-Band is for satellite services (transponder and remote receiver stations for terrestrial broadcasting). They also highlight the current challenges of interference on satellite services in the C-Band and include possible solutions for the Authority to consider. The Authority is yet to indicate any way forward on the co-channel and adjacent channel interference issues in the C-Band.

Sentech postulates that the justification and purpose of spectrum leasing and trading of unlicensed spectrum by the Authority require careful and extensive consideration. Sentech also raises that, unlicensed bands can provide SMEs with a low-cost, flexible, and rapid deployment option for broadband access, which can be particularly important in areas with limited broadband infrastructure or where licensed spectrum is unavailable or too expensive.

They also mention the decision of whether to let the market determine the dynamic spectrum lease and trading price or to have it set by the Authority may be a policy choice that can depend on various factors.

The length of an LSA contract can depend on a variety of factors, such as the duration of the primary license, the needs of the secondary user, and the availability of alternative spectrum options. In some cases, LSA contracts may be short-term arrangements designed to address specific spectrum needs, while in other cases they may be longer-term agreements that provide more stability and predictability for both parties.

WAPA is of the view that all spectrum bands can be considered for the secondary markets and prices be determined by market forces however, it advises the Authority to consider conducting a regulatory impact assessment on the spectrum secondary market aspect regulatory impact assessment on the spectrum secondary market aspect and determine which regime would have the greatest positive impact upon competition within the sector and the cost to communicate generally and inform the pricing principles. WAPA states that it is difficult in the circumstances to estimate the rate at which WAPA's members require new spectrum assignments, but there is considerable appetite for access to licensed

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spectrum (shared or otherwise) and would not hesitate to share spectrum resource with the adoption of a suitable DSA regime.

Telkom has motivated that the two aspects, the use of Dynamic Spectrum Sharing ("DSS"), and spectrum secondary markets. (i.e., spectrum secondary markets relate to spectrum leasing, sub-letting, selling, or pooling), be addressed through separate inquiries. The reason provided is that the concept of spectrum secondary markets is an existing phenomenon and spectrum trading in these markets has already been implemented in some form between current licensees using existing assigned International Mobile Telecommunication ("IMT") spectrum. This matter was a critical point raised by Telkom in the lead-up to the first spectrum auction. Issues pertaining to spectrum secondary markets have a direct bearing on the design of the second high demand spectrum licensing process which the Authority envisages to complete by March 2024. As part of the settlement between ICASA and Telkom, following the auction concluded in March 2022, the Authority committed to conduct an inquiry to investigate spectrum secondary markets.

In the absence of the findings of the inquiry, Telkom, however, is of the view that the DSS framework using geo-location spectrum databases is sufficient to enable short-term spectrum access to operators without the need for secondary markets.

Furthermore, Telkom is of the view that when DSS framework is implemented in bands already licensed to an operator, it should be the operator's imperative to set the lease price of the spectrum. However, if the DSS framework is implemented in spectrum bands not yet assigned to any licensee, it should be the Authority's imperative to set the leasing price of the spectrum. This approach is also practised by Ofcom in the UK in the SAL framework.

Additionally, Telkom supports the setting of minimum and maximum duration of the dynamic spectrum access licenses t and is of the view that the Authority should consider a timeframe of one to three years to be optimal for SAL/LSA frameworks. The minimum one-year duration should also trigger the use-it-or-lose principle, meaning that the SAL/LSA licence must be cancelled if not used within one year. After 3 years, the lease could be extended if needed.

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5.2 The Authority's Findings

5.2.1 The Authority found that the majority of respondents have expressed they often need additional spectrum to improve and expand their services. Furthermore, there is clear support among a majority of respondents that the introduction of a dynamic spectrum markets regime will promote faster deployment of networks with less operational complexities and ensure spectrum resources are efficiently utilised to the benefit of the country and economy.

5.2.2 One respondent suggested that a regulatory impact assessment be done to determine the spectrum price, secondary markets, and impact upon competition within the sector.

5.2.3 The Authority found that there is clear support among respondents that dynamic spectrum secondary market prices be determined by the market forces.

5.2.4 The Authority found that there is a split opinion among respondents on whether the dynamic secondary spectrum market regime should consider licensed spectrum or unlicensed spectrum and the minimum and maximum lease duration of it.

The Authority's Position

5.3.1 The Authority will include in the regulatory framework, short-term spectrum license prices for the geo-location-based "three tier" spectrum access in the 3.8 – 4.2 GHz S band as part of the draft DSA and opportunistic spectrum management regulatory sandbox. The band 3.8 – 4.2GHz is not earmarked for future IMT use by the WRC. Furthermore this band is not assigned for IMT in South Africa, while there is a limited use of satellite Earth stations and fixed link in South Africa, international best practices have shown that in the UK, Ofcom has identified this band for spectrum sharing under the SAL framework. Most importantly, there is already an existing matured ecosystem of IMT equipment that support the band in question.

5.3.2 While the Authority would continue to promote technology neutrality and discretion in spectrum use n by licensees of the awarded spectrum, it is the Authority's position to discourage practices of spectrum hoarding by instituting a "use it or lose it"[8] mechanism for a maximum period of thirty (30)-days to

[8] https://www.icasa.org.za/legislation-and-regulations/notice-ita-for-the-licensing-of-imt-radio-frequency-spectrum-bands-imt700-imt800-imt2600-and-imt3500.

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beneficiaries of geo-location based, short-term spectrum licenses under the DSA regulatory framework in the sub-band 3.8 – 4.2 GHz.

5.3.3 Furthermore, it is the Authority's position that the maximum period for the geo-location-based, short-term spectrum licenses under the DSA regulatory framework in the sub-band 3.8 – 4.2 GHz be 3 years subject to renewal based on the availability of spectrum. This is based on lessons learned from international benchmarking and best practices from leading regulators such as the FCC[9] and Ofcom[10]. Under the FCC's 3-tiered CBRS framework, the GAA operators obtain spectrum free of charge through an opportunistic dynamic, first-come, first serve basis, without being afforded any protection from harmful interference, while they must not cause interference to PAL operators and Primary users of the band. The maximum license period for PAL operators is 10 years and obtained through a spectrum bidding process, which is exclusive. Under the Ofcom's SAL and LAL frameworks, the maximum duration for the LAL operator's license is 3 years due to fact that the spectrum under this is already licenced to primary users, this gives a flexibility to enable primary licensee to claim back the use of the spectrum in case of expanding their network. The period of SAL licence is, however, indefinite because the licensees under this category obtain an exclusive right from Ofcom, unless the applicant has indicated that they want to access the spectrum on a short-term period (i.e. monthly or less than a year). Therefore, the Authority takes the position to implement a two-tiered geolocation databased system with two categories of spectrum users namely, Primary Users (PUs) and Priority Secondary Users (PSUs). PUs being the existing protected incumbents, PSUs will purchase short-term exclusive licenses and be protected.

5.3.4 The Authority will continue the discussion regarding implementation of dynamic secondary spectrum markets through a follow-up separate inquiry process. This Authority's position is in line with split opinion on the matter provided by respondents and particularly the motivations provided by Telkom on the aspect of treating the implementation of the DSA framework and secondary spectrum markets separately.

[9] https://www.fcc.gov/wireless/bureau-divisions/mobility-division/35-ghz-band/35-ghz-band-overview
[10] https://www.ofcom.org.uk/__data/assets/pdf_file/0035/157886/shared-access-licence-guidance.pdf

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6. CONCLUSION

6.1 The Authority would like to thank all stakeholders for their input into this process. The Authority considered all submissions together with the legislation, policy directives, international best practices and research conducted to produce the positions provided herein.

6.2 In the main, the Authority found that implementation of DSA and opportunistic spectrum management frameworks is important to achieve efficient utilization of spectrum resources to support universal broadband access and promotion of SMME operators, community networks, new entrants, and innovation in emerging and future wireless services for economic development.

6.3 Considering the discussions and positions on each subheading in this Findings Document and Position Paper, it is the position of the Authority that it will draft a Regulatory Sandbox for public consultation, aiming to facilitate the implementation of the Dynamic Spectrum Access (DSA) and Opportunistic Spectrum Management framework. This will be achieved through the adoption of a unified geo-location spectrum database approach within the DSA innovation spectrum:

- sub-band 3.8 - 4.2GHz, for short-term licenses for the provision of low-and-medium power mobile and fixed broadband services, and
- license-exempt, lower 6GHz sub-band (Wi-Fi6 (5925–6425 MHz)) for provision of low-power fixed broadband.

6.4 The Authority will develop draft Regulations for Dynamic Spectrum Access and Opportunistic Spectrum Management inviting written representations from all stakeholders.

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