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INDEPENDENT COMMUNICATIONS AUTHORITY OF SOUTH AFRICA

NOTICE 350 OF 2016

INDEPENDENT COMMUNICATIONS AUTHORITY OF SOUTH AFRICA

FINDINGS DOCUMENT ON THE FRAMEWORK FOR DYNAMIC AND OPPORTUNISTIC SPECTRUM MANAGEMENT

1. The Independent Communications Authority of South Africa ("the Authority") hereby publishes a notice the findings document on the framework for dynamic and opportunistic spectrum management in terms of section 4C (6) of the Independent Communications Authority of South Africa Act 13 of 2000 ("the ICASA Act").

2. A copy of the Findings Document will be made available on the Authority's website at http://www.icasa.org.za and in the Authority's Library on the ground floor of Block D, Pinmill Farm, 164 Katherine Street, Sandton between 09:00 and 16:00 from Monday to Friday.

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FINDINGS DOCUMENT ON

THE FRAMEWORK FOR DYNAMIC AND OPPORTUNISTIC SPECTRUM MANAGEMENT

2016

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1   ACKNOWLEDGEMENTS

1.1   The Independent Communications Authority of South Africa ("the Authority") received nineteen (19) written representations in response to the discussion paper on dynamic and opportunistic spectrum management from a variety of stakeholders. These comprised of local telecommunications operators; national terrestrial broadcasters; signal distributors; local ISP and wireless operators, and industry associations; multi-national equipment vendors as well as multi-national companies.

1.2   The Authority would like to acknowledge the following stakeholders who participated in the consultation process:

- Broadband Infraco;

- Cell-C;

- Indigo;

- Dynamic Spectrum Alliance;

- Google;

- GSMA;

- Intel;

- Internet Solutions;

- ISPA;

- Microsoft;

- Morai;

- MTN;

- NAB;

- Orbicom and Mnet;

- SABC;

- SENTECH;

- TELKOM;

- Vodacom; and

- WAPA.

1.3   The Authority would also like to acknowledge the contributions and support provided by its research partners through their collaboration in the development of the discussion paper and the analysis of written representations from stakeholders. The research partners in this regard are the Council for Scientific and Industrial Research (CSIR), through its Meraka Institute; the University of Pretoria, through its Faculty of Engineering, Build Environment and Information Technology (EBIT); and the

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University of the Witwatersrand, through its Centre for Telecommunications Access and Services (CeTAS), and the LINK Centre (SLLM).

2   INTRODUCTION AND BACKGROUND

2.1   On the 19th October 2015, the Authority published a Discussion Document[1] on the Draft Framework for Dynamic and Opportunistic Spectrum Management for consultation in terms of sections 2 (c) (d), (e), (i), read with sections 4, 30, 31(4), and 33 of the Electronic Communications Act No. 36 of 2005 ("the ECA"), Regulation 16 of the Radio Frequency Spectrum Regulations 2015, and the Frequency Migration Plan 2013.

2.2   The discussion paper proposes the adoption of the concept of Dynamic Spectrum Assignment (DSA) on a geo-location basis as one of the techniques to achieve the priorities of SA Connect that seek to promote technologies and techniques that promote more effective and efficient use of radio frequency spectrum. While class licensees have been in existence in South Africa over many years, there is currently no process for assigning spectrum on a geo-location basis, the proposed adoption of DSA therefore can address this gap.

2.3   The paper focused on adoption of DSA in the Broadcasting TV band (470Mhz to 694Mhz) and proposes a regulatory framework that would enable broadband services on a secondary user assignment basis in the aforementioned band. This band is currently utilised exclusively for terrestrial broadcasting service.

2.4   The secondary assignment basis ensures that the primary service (terrestrial broadcasting service) in this band is protected from interference while enabling access to up to 168Mhz of otherwise unused spectrum.

2.5   The research conducted by the research partners of the Authority and majority of other studies done elsewhere on the TV white spaces subject assumed fixed wireless assignment of spectrum in this band and therefore the proposed regulatory framework for TV white spaces is primarily for fixed networks.

2.6   The paper further seeks input on studies that could be commissioned for extending DSA beyond terrestrial broadcasting band.

2.7   The Authority subsequently received 19 written representations from stakeholders in response to the discussion paper.

2.8   This Findings Document presents analysis of the views expressed by the stakeholders in their written representations on the Draft Framework for Dynamic and Opportunistic Spectrum Management.

3   ABBREVIATIONS AND DEFINITIONS

3.1   **Allocate.** In spectrum terms, allocate means to determine that a specific portion of the spectrum is to be used for specific purposes. These purposes are coordinated via the ITU on a regional or global basis.

3.2   **Assign.** In spectrum terms, spectrum that is allocated for a specific purpose may be assigned to a specific user of that spectrum and the user provided with a spectrum licence by the Authority.

3.3   **Authorised Service.** Any usage of spectrum that is authorised by the Authority, either directly or indirectly. This includes the long-term assignment of spectrum for broadcasting purposes (primary

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[1] Discussion Document, Notice 1001 of 2015, Government Gazette 39302

use), licensed TVWS devices and light licensed TVWS devices. It may include or exclude licence-exempt TVWS device and certain ancillary services, such as radio microphones and STLs.

3.4   **Available Frequency.** A frequency range that is not being used by an authorized service of a higher priority at or near the same geographic location as the WSD and is acceptable for use by a White Space Device under the provisions of this framework. Such frequencies are also known as White Space Frequencies (WSFs).

3.5   **Broadcast Television Frequency Band.** A frequency range that is primarily allocated to television broadcasting service, e.g. the 470 – 694 MHz UHF DTT band

3.6   **Channel.** A single DTT broadcast channel is 8 MHz wide. When discussing Available Frequencies, these will always be in blocks of 8 MHz, within the DTT band. Used synonymously with "Available Frequency". Other channel widths may apply in other bands.

3.7   **Coordination.** In the context of spectrum management, coordination is the process of analysing spectrum usage in order to ensure that interference between uses does not occur. This is usually carried out with the help of a radio frequency propagation modelling tool.

3.8   **Dynamic spectrum assignment.** Dynamic Spectrum Sharing is an umbrella term used to describe a set of technologies and techniques that enable opportunistic assignment of available radio spectrum to radio communications devices. These technologies and techniques ensure that consumers and their devices have wireless bandwidth when and where they need it.

3.9   **Geo-location capability.** The capability of a WSD to determine its geographic coordinates in WGS84 format, usually using GPS. This capability is used with an approved Geo-Location Database to determine the availability of frequencies at a WSD's location.

3.10   **Geo-location database.** A database system that maintains records of all authorized services in the frequency bands approved for WSD use, is capable of determining available frequencies at a specific geographic location, and provides lists of available frequencies to Master WSDs. Geo-location databases that provide lists of available frequencies must be authorized by the Authority.

3.11   **High Demand Spectrum.** A number of bands, coordinated as IMT through the ITU, are deemed "high demand" because they are coordinated in sufficiently large markets to mean that device manufacturers find it worthwhile to design and manufacture equipment in sufficient quantities to mean that consumer equipment is easily and cheaply available. These bands include the 700, 750, 800 and 850 MHz bands, as well as the 1.8, 1.9, 2.1, 2.3, 2.6 and 3.5 GHz bands. Section 31(3) of the ECA obliges the Authority to define procedures and criteria for assigning this spectrum. Despite several attempts, this has not yet happened in South Africa.

3.12   **IMT**. International Mobile Telecommunications is a definition by the ITU of certain bands for mobile or fixed use, primarily today for broadband access to the Internet.

3.13   **ITU.** International Telecommunications Union. A global body (falling under the United Nations) to which member states subscribe and negotiate various things, including spectrum allocations.

3.14   **Primary.** A primary spectrum licensee has protection, via the Authority, from all other users of the spectrum, whether licensed, licence-exempt or unlicensed.

3.15   **Protection.** The term "protection" means that a licensee who is experiencing interference has the right to require the Authority to investigate and ameliorate the cause of the interference.

3.16 **Secondary User.** A user that is only authorised to use spectrum when the spectrum will not cause interference to a primary user. Also usually provided with protection by the Authority against interference caused by others.

3.17 **Spectrum sensing.** A process whereby a WSD monitors a frequency range to detect whether frequencies are occupied by a radio signal and to what extent.

3.18 **Studio – Transmitter Link (STL).** It has been the practice in the past for broadcasters to make use of the PtMP spectrum, which they are licensed to use for PtP links. In the past, these links were not registered with the Authority, and therefore were not entitled to any protection. The Authority has set in motion a process of migrating these to alternative bands.

3.19 **White space.** The frequency bands not used by their primary licensed users at a specific location or at a specific time.

3.20 **White space device ("WSD").** A device designed to detect the available frequencies, usually making use of a geo-location database, and utilise these unused channels to transmit signals for Internet connectivity.

4   ANALYSIS OF SUBMISSIONS: SPECIFIC COMMENTS – SUMMARY OF INDUSTRY VIEWS

4.1   Legislative Mandate

4.1.1 Majority of respondents agreed that the Authority has the legislative mandate to address the issues of dynamic and opportunistic spectrum management and TV White Spaces and to build a suitable framework. There were only three submissions that clearly disagreed that the Authority had the legislative mandate to build a TV white spaces regulatory framework, these were from NAB, Orbicom and Mnet.

4.1.2 SENTECH[2] also agrees that the Authority had the legislative mandates, while also arguing that section 2(e) of the ECA is the only aspect relevant to the discussion. They argue that the authority should also consider sections 2(r), (s) and (t) of the ECA since SAP/SAB have secondary allocations in the targeted band for TV white spaces regulatory framework.

4.1.3 The strongest disagreement with the question of mandate came from the NAB[3] as well as Orbicom and Mnet[4] submissions. They argue that the Discussion Paper appears to overlook the distinctive roles played by the Minister and the Authority on spectrum and related issues.

4.1.4 They highlight that the role of the Minister in terms of section 3(1) (a) and (b) of the ECA, which states that the Minister is responsible for setting policies on matters of national policy applicable to the ICT sector in relation to the frequency band, the Republic's obligations, undertakings under bilateral, multilateral or international treaties, and conventions, including technical standards for frequency matters. They further state that the Minister is responsible for representing the country at the ITU and other international fora and therefore responsible for spectrum allocations.

4.1.5 They further argue that it is only after the use of a band has been determined at ITU level and adopted by the Republic (represented by the Ministers) that the Authority may proceed to control, plan, administer and manage the use and licensing of that spectrum. They further argue that this implies

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[2] See section 4.2 of Sentech submission
[3] See section 2.1 on page 3 of NAB submission
[4] See section 8 and 9 on page 1 of Orbicom and Mnet submission

in executing these functions, the Authority must always be in accordance with the bilateral agreements or international treaties entered into by the Republic, section 34 of ECA. This argument is joined by SENTECH[5] with reference specifically to GE-06 Agreement.

4.1.6　A point stressed by Orbicom and Mnet[6] is that the sub-band below 694MHz is currently utilised exclusively for terrestrial broadcasting services and that this sub-band has not been allocated to mobile telecommunications either on a co-primary basis with broadcasting services or at all. They then argue that the Authority can only deviate from the current allocation if the Ministers approve a deviation from the ITU Table of Allocations and such deviations would have to be coordinated with the neighbouring countries.

4.1.7　A further argument from SENTECH[7] is that in compliance with section 2 (t) of the ECA (as amended), the Regulator is obliged to ensure that both primary and secondary spectrum usage for broadcasting is protected from interference. Since SAP/SAB have a secondary allocation in the frequency band 470 – 694 MHz, the Authority has to consider protection of these services from interference under sections 2 (r), (s) and (t) of the ECA. They point that the Authority has erroneously limited the discussions to the existing terrestrial television transmitter network.

4.1.8　The three submissions argue therefore that, for all of the above-mentioned reasons, the Authority should put this process on hold and commence with it afresh after all of the legal pre-requisites have been met and with due regard to all of the practical implications involved.

4.2　Introduction of Dynamic Spectrum Assignment

4.2.1　There is an overwhelming support for the proposals in the discussion document. Out of 19 responses, 12 supported both Dynamic Spectrum Assignment (DSA) and the development of a regulatory framework for TV white spaces proposals.

4.2.2　Since it was made clear that in the context of this discussion, DSA applies only to TVWS, majority of the respondents did not make a distinction between the concept of DSA and its implementation for TV white spaces operation.

4.2.3　There were however some key comments from those that distinguished the DSA concept from the TV white spaces operation from Cell C[8], Intel[9] and Vodacom[10].

4.2.4　According to Cell C, DSA introduces technical challenges that are associated with cognitive radios and/or software defined radios. Cell C[11] states that the demand and the expected impact for DSA has not been made clear in the document, hence the demand should be considered first before a regulatory framework is developed. Cell C further recommends that priority be given to existing demand for leasing, trading and sharing, along with the allocation of high demand spectrum.

4.2.5　Vodacom[12] also makes a distinction between DSA and TV white spaces, and provides a strong motivation for DSA implementation in the terrestrial broadcasting bands only, as opposed to the bands

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[5] See section 7.5 of Sentech submission
[6] See section 16 of Orbicom and Mnet submission
[7] See section 3.3 of Sentech submission
[8] See section 3 of the Cell C submission
[9] See section 2.6 on page 5 of the Intel submission
[10] See section 3.2 on page 8 of the Vodacom SA submission
[11] See section 8 of the Cell C submission
[12] See section 3.2 on page 6 to 7 of the Vodacom SA submission

allocated to mobile services. Vodacom's proposal is based on key reasons that are provided in the following table:

Why Broadcasting Bands may be suitable	*Why Mobile Spectrum Bands are Unsuitable*
Spectrum currently assigned to Broadcasting Services in the 470 – 694MHz is considered inefficiently utilised due to following reasons: • Considering the Digital Terrestrial Migration ("DTT") frequency plan, the frequency reuse factor is equal to 4 for only part of the 470 – 694MHz band, namely below 606MHz, meaning that the same frequency is only utilised at every 5th broadcast transmitter. • The prevalence of white spaces in the frequency domain, namely unused frequencies between transmitting radio frequency channels. It is however noted that such frequency white spaces will be less of an opportunity post DTT migration; • More importantly, the prevalence of a number of large white spaces in the geographic domain, namely large geographic areas where radio frequencies are unused; • Broadcasting spectrum is currently not subject to the AIP6 licencing fee regime and there is therefore no incentive for broadcasters to use spectrum efficiently.	Mobile technologies like 3G and LTE (and beyond) implement a highly efficient use of spectrum for the following reasons: • There are no white spaces available in the frequency domain or the time domain; • The frequency re-use factor is equal to 1, meaning that the same frequency is utilised at each radio base station transceiver; • Geographic white spaces will therefore only be prevalent where no base station transceiver signal is prevalent, leaving a very limited number of small populated geographic white spaces nationally given the current 3G population coverage of 96% which is likely to reach 2G population coverage of 99.8% over the short to medium term;

4.2.6 Vodacom[13] agrees with Cell C on the immaturity of the ecosystem, however, does not recommend lowering the priority of the work on DSA but to continue to investigate the potential implementation of TV white spaces. Vodacom further raised the following points which were not covered in the discussion document:

 4.2.6.1 Allow for flexibility to allow for the potential implementation of IMT technologies in 470 – 605MHz part of the band on a secondary basis should the TVWS ecosystem not materialise; and

 4.2.6.2 Consider the potential re-allocation from Broadcasting Services to Mobile Services in the part of the 470 – 694MHz band above 614MHz, namely 614 – 694MHz subject to regional harmonisation.

4.2.7 The first point is supported by the recommendation to consider Licensed Shared Access (LSA), which is emerging as a further licensing model. Intel who makes an important additional point that DSA can be used to accommodate spectrum sharing between commercial and non-commercial interests supports this view.

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[13] See section 3.2 on page 6 of Vodacom SA submission

4.3   TV White Spaces Regulatory framework

4.3.1 Introducing TV white spaces regulatory framework

4.3.1.1   There is an overwhelming support for the proposal of the regulatory framework for TV white spaces. There was however no clear support of applying Dynamic Spectrum Assignment in other spectrum bands.

4.3.1.2   Among those that supports the introduction of TV white spaces; Vodacom, MTN and TELKOM provide a number of requirements that must be met, which includes:

4.3.1.2.1   Clearly defined regulations in order to ensure that primary licensees rights are protected from harmful interference. They further note, together with others such as Intel and DSA that the Authority can learn from regulators that have TV white spaces regulatory framework in place.

4.3.1.2.2   Licensing regime should be flexible to accommodate future wireless applications such IOT and M-2-M. Vodacom explicitly indicates that IMT technologies should be allowed to operate in the targeted bands.

4.3.1.2.3   Consistent availability of an accurate database of frequency assignments and calibrated propagation models to ensure that instances of harmful interference are avoided. MTN went further to indicate they do not believe this data is widely available.

4.3.1.2.4   Manage the geo-spatial spectrum database (also referred to as geo-location spectrum database) providers and ensure that they adhere to regulations.

4.3.1.2.5   Standardization, Certification and testing of white spaces devices to ensure that they adhere to regulations. Vodacom further notes that the ecosystem is currently immature and further development is encouraged. They further note that the regulations should technology agnostic.

4.3.1.2.6   Authority should be able to rapidly respond to, and resolve complaints of interference by TV white spaces devices.

4.3.1.3   Respondents that support the development of the regulatory framework for TV white spaces also agree TVWS can be a key enabling technology to support SA Connect goals. They agree that various TV white spaces trial projects, have demonstrated potential to provide low-cost broadband connections for personal/portable devices as well as extend broadband coverage to unserved and underserved areas over a wireless connection where broadband is not currently available or severely limited, and where deploying other wireless technologies is not cost-effective.

4.3.1.4   The objections from GSMA, Cell-C and Intel mainly point to the readiness of the TV white spaces ecosystem. Cell-C is specifically referring to other models of dealing with spectrum scarcity such as trading, leasing and sharing as well as high-demand spectrum that should receive higher priority than TV white spaces

4.3.1.5   Other objections came from respondents that did not explicitly respond to the questions and are therefore analysed in more details in section 5 of this findings document.

4.3.2 TVWS licensing models

4.3.2.1   Generally, the respondents have appreciated the discussions on the licensing regimes for TVWS and DSA described in the discussion document. It is also mentioned that such regulatory licensing

frameworks can be adopted from best practices of other countries such as the FCC-US, Ofcom-UK, Canada and Singapore.

4.3.2.2 Automated licensing is clearly a preferred licensing regime. This is equally supported for those that support license-exempt as well as those that support full licensing regime. Intel provided further distinction between automated licensing (such as LSA), and automated, conditional assignment (they see TVWS in this category). In the TVWS case, an entity never holds a license; they only hold a conditional authorization to use unused spectrum licensed to another party. They argue that there may be overlap in the framework used to implement automated licensing and automated assignment, but they are not identical. However, they agree that both are technically feasible and their preferred route is automatic licensing, specifically licensed shared access.

4.3.2.3 There is very little support for license-exempt unmanaged regime. It is only Microsoft and Broadband Infraco who believe that there is room for license-exempt unmanaged regime.

4.3.2.4 There is a balanced support for license-exempt managed regime and full or light licensing regime. Key arguments for supporting license-exempt are that it is expected to improve network and service innovation and lower the barrier for entry for local network operators. Key arguments for full licensing include that license-exempt will introduce distortion to market competition and that it will improve compliance.

4.3.2.5 There is no clear support for mixed licensing regime. Most respondents argue that introducing mixed licensing regime in one band introduced unnecessary complications. Morai supports this regime to enable full licensing for point-to-point links and license-exempt for TV white spaces.

4.3.2.6 There is also a general caution that the regulatory environment should be flexible and adaptive to not limit the deployment of other services related to future wireless such as M2M, Internet of things and smart cities.

4.3.3 Interference Management

4.3.3.1 It is generally agreed by those who support the development of the regulatory framework for TV white spaces that a geo-location spectrum database is the best method for interference management. This is the summary of the responses:

4.3.3.2 How to avoid interference by secondary networks on Legacy (TV broadcasting) stations. The technology that is generally accepted for achieving interference mitigation is the Geo-location spectrum database (GLSD) supported by spectrum sensing. Single or multiple GLSDs frameworks can be used with standard access protocols for white space radios (WSR), network admin and professional installers.

4.3.3.3 How to avoid self-interference between co-secondary networks. A secure registration scheme and an intelligent channel allocation mechanism incorporated by a regulatory GLSD spectrum database will make sure that interference between co-secondary networks are minimized.

4.3.3.4 Authentication of WSRs by implementing a secure registration scheme with a registration ID inside the GLSD certified by ICASA, can avoid rogue devices from entering and generating unwanted interference into white space communication networks.

4.3.3.5 Despite the fact that spectrum sensing is not yet at a mature and reliable stage, it is also being proposed as a stand-alone and supporting (for GLSDs) solution in avoiding radio frequency interference.

4.3.3.6   Generally, the consensus is that there is enough technological knowhow and technologies to limit the effect of RFI due to TVWS networks.

4.3.4   *Data on TV Broadcasters transmitters*

4.3.4.1   Almost all respondents agree on the need for accurate data to accurately model the TV broadcast coverage and determine TV white spaces; there is however no clear agreement as to whether we have enough data currently. There is equal number of respondents who said yes to those who said no. Vodacom indicates that it could be challenging to obtain accurate data and submits that further research is needed to address this issue while SENTECH argues that it cannot be stated confidently that there will ever be sufficient data to accurately simulate real coverage levels. Indigo, Morai and Internet Solutions further argue sensing/scanning maybe needed to complement a geo-location spectrum database.

4.3.4.2   There is also no clear common proposal on the mechanism that should be put in place to ensure that the database providers obtain required data. Most respondents indicate that this should be part of compliance by the broadcasters. MTN further indicates that the data should be publicly available via an interface determined by the Authority. Telkom proposes that an MOU between database providers and the Authority be signed to establish a process for information exchange. Intel agrees with Telkom for a process to be established after regulations have been published, Intel further proposes that this process include all spectrum users and incumbent operators.

4.3.5 Operational Management of Spectrum Databases

4.3.5.1   There is consensus that multiple commercial database operators that are certified by the Authority be adopted. Majority also point to a globally harmonized approach to access to spectrum databases.

4.3.6 White spaces devices

4.3.6.1   The general response is that operational parameters for WSDs (Power level, channel allocations) will be determined and assigned by a geo-location spectrum database.

4.3.6.2   It is also proposed that the Authority should set-up a device type approval laboratory. This will guarantee a baseline requirement for WSDs to avoid unnecessary RFI generated due to erroneous manufacturing of hardware/firmware parameters.

4.4   Roadmap for dynamic spectrum assignment in SA and other uses of UHF spectrum

4.4.1   On the question of the roadmap for future application of DSA to other bands, there is an overwhelming support for studies towards application of DSA to other bands and support that the four study question mentioned are the most relevant. There is no agreement however on which bands to consider, this maybe one of the initial research questions into the future studies. The additional study questions that have been proposed include, in no particular order of preference:

4.4.1.1   Can existing primary services co-exist with secondary DSA deployments? Note, the cumulative interference effect should also be taken into account here?

4.4.1.2   Is the long-term availability of whitespace guaranteed?

4.4.1.3   What frequency bands are being considered in other jurisdictions?

4.4.1.4 What is the potential level of scalability, resiliency and reliability that DSA service providers can offer? Will these levels be sustainable in front of increases in demand and increased sharing of white spaces?

4.4.1.5 Is DSA deployment in a particular band a short-term solution or a long-term connectivity strategy?

4.4.1.6 How does utilising a particular band for the deployment of DSA technology fit into a long-term national ICT strategy?

4.4.1.7 Ofcom's approach includes the white spaces database providing TVWS devices with the time interval when the available channels and power levels for each are valid ("time validity"). The Authority should consider adding a question regarding the potential advantages and disadvantages of such an approach.

4.4.1.8 Since the propagation characteristics of the white spaces are ideal for long range wireless backhaul, particularly in unserved and underserved areas, and that because fixed point-to-point backhaul equipment is available now, fixed licensed operations would spur immediate broadband deployment to unserved and underserved areas.

4.4.1.9 Since all mobile broadband networks need wireless backhaul and that there is a critical shortage of spectrum available for that purpose, will the Authority be considering fixed licensed Point-to-Point backhaul use of TVWS now or in the future? If so how does it propose to go about this exercise?

5 ANALYSIS OF SUBMISSIONS: GENERAL COMMENTS – ALL VIEWS WHICH WERE NOT RESPONDING TO THE QUESTIONS GROUPED UNDER SECTIONS

5.1 Timing considerations

5.1.1 ICASA should first finalize allocation of 700MHz, 800MHz and 2600MHz bands before considering new bands

5.1.1.1 Vodacom[14] is concerned about the Authority's prioritization of its operational activities to meet the strategic objectives under its legislative mandate, considering the Authority's investigation in this Discussion Paper of suitable spectrum for TVWS which is immature and envisaged for use on a secondary basis, whilst the Authority's activities in respect of spectrum that is already allocated to services on a primary basis are still pending, namely:

- Failure to timeously assign spectrum allocated to Mobile Services on a primary basis in the 700MHz, 800MHz and 2600MHz bands to date;

- Failure to conclude the migration of Broadcasting Services from the 700MHz and 800MHz bands;

5.1.1.2 Cell C[15] notes that the spectrum policy directions to be issued by the Minister in terms of SA Connect for the assignment of broadband spectrum have not occurred, they finally urge ICASA to focus its energies and resources on the allocation of high demand spectrum and digital migration.

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[14] See section 3.1 of Vodacom Sa submission
[15] See section 4 of Cell C submission

5.1.2 DTT should be finalized first - In all other countries US, Ofcom, Canada - final rules for TV white space were only published after full switchover.

5.1.2.1   NAB[16], and Orbicom and Mnet[17] submitted that they are worried about the impact on existing terrestrial television services and digital migration. They argue that the discussion paper's proposals would inhibit optimal spectrum use by broadcasters during the dual illumination period and are not practically feasible.

5.1.2.2   They further argue that until such time as a full technical plan has been done on how to move all of the existing terrestrial television broadcasting services below 694MHz, the introduction of any other services (such as broadband) into the sub-band will disrupt the digital migration process, impede orderly spectrum management and hamper the migration to DTT.

5.1.3 The 470-698MHz band is under review by ITU-R – hence TVWS is premature

5.1.3.1   Intel notes the decisions that have been taken at the World Radiocommunication Conference 2015 (WRC-2015), particularly: (2) a co-primary allocation to the mobile service and identification by some countries for parts of the 470-698 MHz band and (3) a proposal to review the UHF spectrum for broadcasting and mobile services in Region 1 at WRC-2023. They argue that enabling TV white spaces in this band could block the potential use of this band for mobile services in our region after 2023.

5.1.4 There is not sufficient critical mass behind TVWS

5.1.4.1   Intel does not believe TVWS will have a material, positive impact on encouraging investment and innovation in the electronic communications sector going forward. We note that the US FCC has a long history of policies designed to encourage investment and innovation. However, there has been little progress in the adoption of TVWS technology since U.S. regulatory efforts on TVWS began over a decade ago. Intel encourages the Authority to conduct its own independent analysis of the history of TVWS.

5.2   Technical

5.2.1 Protection of Broadcasting Services

5.2.1.1   SABC believes TVWS has the potential to introduce interference into the allocated broadcasting spectrum and more especially renders SABs potentially unusable.

5.2.1.2   SABC and Sentech are concerned about the process to deal with Services Ancillary to Broadcasting (SAB) and Services Ancillary to Programme making (SAP) for events that use frequencies in UHF - and are co-primary and ad-hoc. The broadcasters want to ensure that the Authority also consider protection of these services from interference. In the discussion document, the Authority limited the discussion to the existing terrestrial television transmitter network.

5.2.2 What if a TVWS protocol fails to deliver

5.2.2.1   Vodacom[18] advices the Authority to be mindful of the immaturity of TVWS and that the early promise of TVWS may not actually translate into a supporting technology ecosystem at a scale sufficient to support cost effective deployment of related services. One such example in the past

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[16] See section 4 of Nab submission
[17] See section 22 of Orbicom and Mnet submission
[18] See section 3.1 of Vodacom SA submission

was WiMax technologies, which demonstrated significant promise both technologically and economically but ultimately failed to materialise. Intel also recognised the immaturity of TV white spaces technologies.

5.2.2.2   Intel[19] further argues that TV white space does not have enough capacity as compared to other competing technologies in unlicensed bands such as 802.11ac or licensed bands such as LTE and is a poor choice of technology and therefore does not believe that TV white spaces will yield the intended benefits

5.2.3 What if we need to move from a 7 MUX SFN to a 7 MUX MFN DTT and there is no more TVWS?

5.2.3.1   SABC[20] argues that the discussion document is premised on successful implementation of a SFN for DTT and notes that there is no concrete evidence of successful implementation of seven (7) MUX SFN.

6   THE AUTHORITY'S FINDINGS

6.1   The Authority found the following:

6.1.1   There is clear support for introducing DSA concept as one way of alleviating spectrum scarcity and thus additional spectrum access for broadband to additional players. However, there are no clear proposals for applying this concept outside TV white spaces operation. There is a however a strong argument from one of the respondents to not apply this concept to the IMT bands, there is also an argument to apply it to IMT bands and finally an argument to apply DSA to support LSA.

6.1.2   There is majority support for introducing the TV white spaces regulatory framework.

6.1.2.1   Of these Vodacom and MTN provide a number of requirements that must be met, see 4.3.1.2. These requirements are similar to those indicated by GSMA and Intel, the difference being that the latter two are not supporting the introduction of TV white as they believe these conditions are unlikely to be met.

6.1.2.2   Indigo, Internet Solutions, Microsoft, Morai and WAPA all indicated that DSA approach is viable and that the trials have so far proven that it can be deployed without causing harmful interference to incumbent operators. Internet Solutions further indicated that it is not just viable but it is a necessary requirement for efficient and effective use of spectrum in the future.

6.1.2.3   Broadband Infraco, Dynamic Spectrum Alliance, Google and ISPA just indicated that they support the Authority's proposal.

6.1.3   The are a number of objections for introducing TV white space, for a variety of reasons:

6.1.3.1   Cell-C's view is that there are other priorities that must be addressed first before considering DSA and TV white spaces.

6.1.3.2   GSMA and Intel believe that the TV white spaces ecosystem is immature. They also object on the basis of understanding TV white spaces licensing regime to be license-exempt. Intel specifically advocates for Licensed Shared Access.

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[19] See section 3 on page 10 of Intel submission
[20] See section 3.3 on page 4 of SABC submission

6.1.3.3　Three submissions from SENTECH, NAB, and Orbicom and Mnet do not agree that the authority has legislative mandate to introduce TV white spaces. They view this introduction as allocation of services other than broadcasting in the band and argue that it is only the Minister who can make such allocation and only then should the Authority consider the introduction of TV white spaces.

6.1.3.4　SENTECH further objects on the basis that the Authority, in determining the available TV white spaces did not consider other devices operating in those bands such as STLs and therefore these will not be adequately protected.

6.1.4　There is support for introduction of automated licensing for TV white spaces operation; this support is for automated licensing with both full licensing and license-exempt. Geo-location spectrum databases are supported as the tools to enable this automated licensing.

6.1.5　There is support for further studies by the Authority of its collaboration partners on DSA related topics, either for refinement of TV white spaces regulatory framework or for introduction of DSA in other bands.

7　CONCLUSIONS AND THE WAY-FORWARD

7.1　The Authority noted all stakeholder inputs and were all considered in this findings document.

7.2　The Authority will consider all these findings in taking positions on the two key proposals that were the subject of the discussion document[21].

7.3　In parallel to developing the required positions, the Authority will support further studies on these topics identified in the discussion document as well as the additional topics proposed by the respondents.

End//

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[21] Discussion Document, Notice 1001 of 2015, Government Gazette 39302

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