Optimal Spectrum Utilisation in South Africa to improve Broadband Services

White Paper by the Wireless Access Providers' Association

(www.wapa.org.za)

Version 1.0

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Substantial inputs were received from WAPA's Exco and Membership

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1. Motivation for Change

WAPA is the Wireless Access Provider's Association of South Africa (www.wapa.org.za) – a body representing over 200 members who are either wireless Internet Access Providers or related Service Providers.

This document sets out both general principles and specific recommendations on spectral reform, which is in the interests of the wireless industry, the customer and South Africa itself.

South Africa clearly needs fundamentally better broadband - cheaper, faster, higher quality, deeper penetration (into under-served areas) and more responsive customer service. Government, industry bodies, the media and consumers have been calling for this since the mid-90s. Broadband is known to drive economic growth[1] and competitiveness and is seen by many as a basic human right.

However, for the last 20 years or so, South Africa has slipped in its rankings (globally, within the developing world and within Africa). Given the socio-economic imperative, the situation is dire and requires urgent attention.

Wireless broadband provision is foundational to any solution, and it in turn depends on better government management of the radio frequencies used for wireless broadband – to facilitate '***optimal spectrum utilisation'***.

WAPA represents an industry growing rapidly and ticking all of the right boxes in terms of promoting better and more affordable broadband - providing highly competitive last-mile access in both urban and rural areas. WAPA members have good average BEE ratings, support employment growth (as SMEs) and technical skills transfer. The growth of this wireless industry is good for the consumer, critical for the economy and essential for rural access, job creation and skills transfer.

WAPA operators built an entire industry on narrow bands of shared (license-exempt) spectrum (typically Wi-Fi based). Wi-Fi-based technologies (and the industry that uses them) were fairly 'below the radar' for years but the industry is now mature enough to be considered mainstream and continuing to grow significantly. Wi-Fi-based data traffic on smartphones now exceeds that carried by larger mobile operators – leading to a *paradigm shift* in the understanding of which operators are really driving growth and how

[1] e.g. World Bank (2009). "Information and Communication for Development: Extending Reach and Increasing Impact". Ch 3 (http://siteresources.worldbank.org/EXTIC4D/Resources/IC4D_Broadband_35_50.pdf)

this is being achieved. This is in line with global trends. Specific studies have verified the direct economic benefits of making license-exempt spectrum available[2]. Recently the FCC increased the size of a key license-exempt band, citing as a reason, to "increase the potential for more unlicensed spectrum innovation[3]"

WAPA therefore envisages a ***dual-view*** model as the basis for spectral reform. Under this model, the larger operators (who have dedicated assignments of spectrum for area coverage of GSM, CDMA, WiMAX, LTE and others) are seen as ***complementary*** to the multiple emerging operators, who range in size from small to large and don't yet have large national spectrum assignments[4] for the provision of access services.

For this and other reasons, the recommendations outlined in this document will boost the industry of which WAPA is a part, and thereby underpin attainment of South Africa's socio-economic objectives.

The recommendations include both general principles for allocation, assignment and management of radio frequency spectrum as well as frequency-band-specific proposals.

This white paper seeks visionary and informed transformation of the regulatory regime to address urgent, current issues, whilst at the same time laying the foundation for the future.

2. Fundamental Concepts

The following fundamentals will lead South African on the 'high road' of broadband-led development:

2.1. **Urgency**

There is absolute, industry-wide consensus on the urgency of spectral redress. The backlog in addressing key issues is a national crisis. The key issues requiring priority attention relate to spectrum allocation, assignment and management and the general

[2] See for example, Thanki, R. "The Economic of License Exempt Spectrum". Dakar, June 2013. Downloadable PDF, link from https://sites.google.com/site/tvwsafrica2013/presentations

[3] FCC, "FCC Increases 5GHz Spectrum for Wi-Fi, Other Unlicensed Uses". 2014-03-31.

[4] In this document the term "allocation" is used to describe the entry in the National Radio Frequency Plan which describes the uses which a specific radio frequency spectrum band may be put. The term "assignment" refers to the process of granting radio frequency spectrum licences to operators for use in the provision of electronic communications network services.

strengthening of the communications regulator (ICASA) in terms of its capacity to develop and enforce regulations.

2.2. **Paradigm Shift**

The old order of spectral allocation, assignment and management is obsolete and inadequate. The fundamentals listed below are part of a new order, and need to be seen from a 21st Century perspective.

2.2.1. Wider Focus

The target of spectral reform should be more than a few mobile operators and a fixed-line incumbent (although their central role is acknowledged) – it is equally about the hundreds of licensed providers who collectively constitute the industry. **A dual-view, complementary strategy** is required.

2.2.2. Licence-Exempt and Managed Spectrum

The spectrum assigned to any single provider on an exclusive long tenure basis should be limited. Spectrum is a national resource. Far more spectrum should be allocated on a **licence-exempt** basis. Studies have shown the wider economic benefits of such an approach[5]. More spectrum should also be allocated on a ***managed*** basis, to be assigned either dynamically according to regulator-specified rules, or via privately-operated spectrum databases. Furthermore, assigning one operator a spectrum licence for an entire region or across the country leads to sub-optimal usage of spectrum. Management should include ***geolocation-based*** management, where spectrum is provisioned at specific locations and for specific time periods. In future, when technologies improve, management should allow for ***sensing*** technologies which can detect dynamically whether spectrum is available for use.

2.3. **Policing and Self-Regulation**

WAPA believes that spectral policy can only succeed if underpinned by sound High Site management, radio apparatus procurement and installation practice. This requires a combination of effective ICASA policing and a level of self-regulation in the industry. WAPA has contributed to this with its Code of Conduct as well as High Site Guidelines (these documents being complementary to this white paper). Topics

[5] See for example, Thanki, R. "The Economic of License Exempt Spectrum". Dakar, June 2013. Downloadable PDF, link from https://sites.google.com/site/tvwsafrica2013/presentations.

covered include safety, compliance, labelling of equipment, sound installation principles, and management of interference-related issues.

2.4. **An Open, Fair and Neutral Wholesale Market.**

Larger players who have dedicated national spectrum must be required to open this spectrum and associated infrastructure to ***open, fair*** and ***neutral wholesale access***. This measure will help to overcome barriers to competition. In this respect, WAPA enthusiastically supports "South Africa Connect", the Government's recently-published broadband policy document[6] which calls for "the enforcement of wholesale access regulation to dominant players' networks and mandatory open access to infrastructure rolled out through public investment" (Page 4). WAPA's concern is that ICASA is not currently equipped or resourced to be the strong, capable regulator needed to ensure true competition. In particular there is a critical shortage of engineering expertise available for spectrum management and type approval.

In the short term, it is important for ICASA to apply the principle of this Section 2.4 when allocating spectrum for LTE.

2.5. **General Optimisation of Spectrum Usage.**

It is a travesty that spectrum is such a scarce and valuable resource and yet there is so much unused spectrum because of inefficient assignment and utilisation. Aside from a few high-traffic bands (e.g. for GSM, 3G, CDMA and ISM), the remaining spectrum is significantly under-utilized. Measures needed to correct this include general reforms (such as those already listed) and spectrum-band-specific reforms (as per the next section).

2.6. **Equal rights**

All ECNS licenses are 'equal' and therefore there should be a consistent principle that all users must have equivalent rights to access to spectrum, whether licensed or license-exempt. Where spectrum is allocated on a licence-exempt basis it is critical that there are mechanisms to ensure equitable access by licensees.

[6] South Africa Connect: Creating Opportunities, Ensuring Inclusion. South Africa's Broadband Policy. Government Gazette Government Notice Number 953. 6 December 2013. Issued by the Department of Communications in Terms of the Electronic Communications Act, 2005.

3. Spectrum-band Change

The following changes are proposed:

3.1. **470 to 862 MHz.** This spectrum is used for analogue UHF TV channels. ICASA-endorsed trials have shown that wireless broadband can be broadcast on channels not being used for TV broadcasting[7]. WAPA has (in November 2013) submitted proposals to, and held a meeting with ICASA, on the use of unused channels. The proposals were in the form of a document co-written with Google, TENET and the CSIR Meraka Institute[8].

WAPA requests that all unused frequencies (being the channels that are allocated to TV broadcast, but are not being used for TV broadcast in a particular geographic location) be made available for wireless broadband access provision. The details of this request are specified in Section **Error! Reference source not found.** (**Error! Reference source not found.**).

3.2. **695 to 790 MHz.** This spectrum (the so-called Digital Dividend 2 spectrum) is due for assignment to mobile operators for LTE, after the digital switch over (DSO) is complete. Government must expedite the DSO implementation and must ensure that LTE-network sharing principles are strongly entrenched before licensing this spectrum.

3.3. **790 to 862 MHz.** This spectrum is due for allocation to mobile operators (together with 2600 MHz) for LTE, after the spectrum has been cleared at the end of DSO phase 1. WAPA makes exactly the same call as for the previous spectrum.

3.4. **2.4 GHz and 5.8 GHz.**

3.4.1. WAPA wants tangible commitment from ICASA to policing compliance by operators using this spectrum: ensuring they are licensed; use only type approved equipment; and operate within the specified technical parameters (such as EIRP limits)

3.4.2. WAPA's view is that there is scope for increasing transmission power limits currently applicable to licence-exempt bands in South Africa. This will facilitate greater use of this spectrum and better quality of service management as well as promoting competition in the ICT SMME sector. The potential for such an increase is greater in rural areas, where it would be a boon to Government's plans to provide universal service and access by 2020

3.4.3. ICASA and the government policy-makers need to better understand these technologies and the impact of bigger operators moving into this space as data throughput demands exceed what these operators can provide in their licensed spectrum.

[7] The Cape Town TV White Spaces Trial. Post trial preliminary results (http://www.tenet.ac.za/tvws/) (as at 2014-05-01)

[8] Cape Town TVWS Partners. "Allowing Access to Television White Spaces in South Africa: Recommendations and Learnings from the Cape Town Television White Spaces Trial. 2013

3.5. **3.4 – 3.6 GHz.** This is prime spectrum which has been highly underutilized. It should be available for 'managed spectrum parks', with rules established to enforce fair, equitable usage. WAPA is available to manage such parks (on a non-profit basis). As some spectrum has been assigned in this band on a regional basis, it would be appropriate to continue to do so, with geo-location also being implemented. It is noted that ICASA has indicated in its Frequency Migration plan that this will be assigned for IMT use.

3.6. **5 GHz (see previous paragraph with combined discussion on 2.4 GHz and 5.8 GHz).** In addition, the actual range of frequencies incorporated in the 5 GHz range should be expanded, to include the indoor Hiperlan range from 5.15-5.35 GHz as well as the outdoor Hiperlan range (5.47 – 5.725 GHz) and 5.8GHz (ISM) (5.725-5.85 GHz).

3.7. **17 GHz.** This spectrum is licence-exempt but should be managed with a compulsory registration of each link in a central database to prevent interference. This will enable fast deployment of high quality links for all operators. Current regulation for power limitations should be removed for Point to Point links, where automatic power control features are enabled to minimize signal "overshoot".

3.8. **24 GHz.** This spectrum is currently allocated for automotive radar and short range devices but is under-utilised and should be available for microwave usage on the same basis as the 17 GHz usage

3.9. **>30 GHz**. WAPA recognizes that demand for higher frequency spectrum is increasing as technology improves, general bandwidth demand escalates, and short-distance links and small-cell coverage gain focus. In general, spectrum in the ranges 30 GHz and higher should be allocated and assigned on a license-exempt, managed basis, taking into account obvious exceptions (for example, the 38 GHz range, already licensed for point-to-point services

A higher frequency microwave beam is narrower and attenuates more rapidly over distance than a lower frequency beam. Therefore signal interference management in the 30 GHz and greater spectrum range is easier to implement than for lower frequencies. The recommendation needs to be implemented soon, whilst there are relatively few installations in the higher frequencies. Since signal interference management is easier, WAPA also proposes increasing transmission power limitations in these bands. The higher the frequency band, the greater the increase in power limitation that can be effected

3.10. **60 GHz.** At around 60 GHz, microwaves are attenuated more rapidly (relative to adjacent frequencies) by moisture and air and therefore support short range communications, whilst interfering less with nearby installations using the same frequency. These radio attributes are suitable for the provision of high capacity Wi-Fi in dense indoor and public outdoor areas, where multiple wireless operators may wish to deploy systems. Major regulators such as Ofcom (in the United Kingdom) and the FCC (in the United States) have already specified this spectrum as license-exempt. The next generation of Wi-Fi devices capable of using this spectrum (i.e.

based on the 802.11ad standard) are already in the market, typically integrated with traditional Wi-Fi equipment. This makes it urgent for ICASA to act now and manage the inevitable advance of this technology within a proactive framework

3.11. **80 GHz.** This band is of interest for communication over longer distances, because signals at these frequencies are less attenuated by absorption due to moisture and other gases in the air than adjacent frequencies. Numerous test licenses have been granted and equipment has been tested successfully. Failing to regulate this spectrum will only tempt some to use the spectrum knowing well that ICASA has no means currently to measure or monitor their activities. Given the large amount of spectrum in question and the advantages for fast deployment, WAPA strongly recommends a license-exempt model for this spectrum.

4. Detailed Discussion on Key Points

The key requirements in the white paper have been detailed. The remaining pages cover the concepts in more detail.

5. Urgency

What is fundamentally at stake is the cost of private and business communication, and the economic growth of the country. In this respect, WAPA endorses the sentiments of the National Development Plan[9]:

"*Compared with the best international standards, South Africa's ICT infrastructure is abysmal. Efficient information infrastructure that promotes economic growth and greater inclusion requires a stronger broadband and telecommunications network, and lower prices. The economic and employment benefits outweigh the costs*"

WAPA further endorses the sentiments of "South Africa Connect", the Government's recently published Policy Document[10]. Under the "Challenges of Broadband" section the following quotation is found:

"In South Africa, the lack of always-available, high-speed and high-quality bandwidth required by business, public institutions and citizens has impacted negatively on the country's development and global competitiveness … The high cost of communication has constrained investment in South Africa ... [and] … broadband pricing remains a barrier to exponential growth in broadband use"

WAPA also notes the landmark World Bank Study[11] which indicates that a 10% increase in broadband penetration drives up to 1.38% increase in the rate of GDP growth for medium income developing countries. The actual number may vary by context, but the strong correlation is clear. This and other studies are echoed in the government's policy document (cited above), which states:

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[9] Manuel, T (Chairperson). "National Development Plan 2030: Our Future, Make it Work". National Planning Commission. 2012. p. 46)

[10] South Africa Connect: Creating Opportunities, Ensuring Inclusion. South Africa's Broadband Policy. Government Gazette Government Notice Number 953. 6 December 2013. Issued by the Department of Communications in Terms of the Electronic Communications Act, 2005.

[11] World Bank (2009). "Information and Communication for Development: Extending Reach and Increasing Impact". Ch 3 (http://siteresources.worldbank.org/EXTIC4D/Resources/IC4D_Broadband_35_50.pdf)

"… there is enough evidence to support claims that increases in broadband penetration correlate with increases in GDP, new jobs, broadening of educational opportunities, enhanced public service delivery and rural development".

South Africa has slipped from being a leader in Internet adoption in the 1990's to the point where (to quote the same government Policy Document) "*South Africa's broadband penetration remains poor compared to that of other lower-middle-income countries*". The government's National Development Plan 2030 also calls for action to reduce the cost to communicate and the negative impact of the 'digital divide'[12]. The urgency to fix this could not be more clear.

Wireless technologies allow rapid and cost-effective provision of backhaul and last-mile broadband connectivity and complement copper and fibre-based solutions. There is significant spectrum which is not used at all (since it has not yet been assigned), is poorly utilised or is assigned and managed in such a way as to stifle competition. Optimising usage of this spectrum is key to promoting broadband in South Africa.

WAPA is encouraged by ICASA's open-ness to holding discussion and working jointly on projects (such as the TV White Spaces trial, follow up policy presentations and public meeting). WAPA also welcomes ICASA's recent commitment to following up on spectral reform for broadband, expressed in Strategic Outcome 3 of its 2015-2019 Strategic Plan[13]- "Establish innovative approaches to technology and dynamic spectrum usage" - detailed in Strategic Outcome Oriented Goal 3.1.1[14], with the Strategic Objective being "Radio Frequency spectrum and favourable regulatory frameworks for a variety of services including broadband", and the 2014/2015 target outcome as "Position Paper on opportunistic spectrum management approved and results gazetted".

6. Paradigm Shift

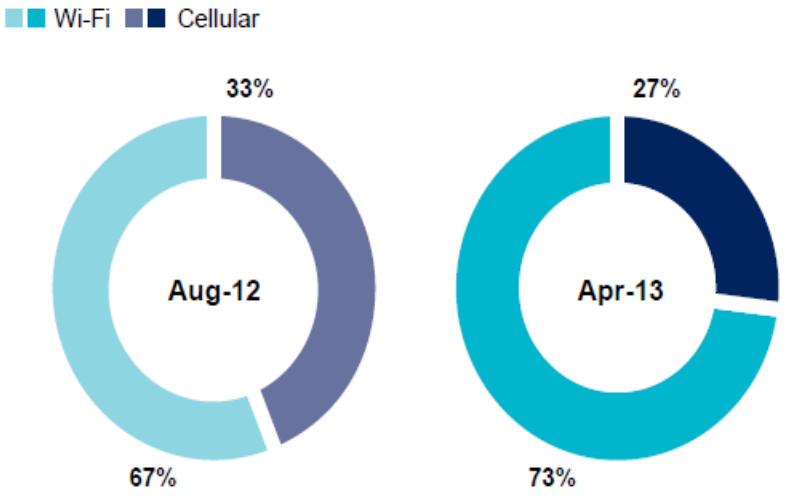
6.1. **Wider Focus**

The historical focus on spectrum regulation is on the requirements of a few, larger players – especially mobile operators and fixed-line incumbents. Their role is obviously fundamental to broadband rollout, but that is only half the story.

[12]. Manuel, T (Chairperson). "National Development Plan 2030: Our Future, Make it Work". National Planning Commission. 2012 (Overview Section, p. 33)
[13] ICASA. "Independent Communications Authority of South Africa, Strategic Plan for the Fiscal Years 2015 – 2019". August 2014. p25.
[14] Ibid. p44.

Most of the world's wireless data is actually carried on unlicensed bands (which included operations by multiple, smaller players) and the trend is strengthening, as evidenced by graphs such as the one below[15].

Fig. 3: Percentage of data use via cellular and Wi-Fi for Android smartphone users, major markets, Aug-12 and Apr-13

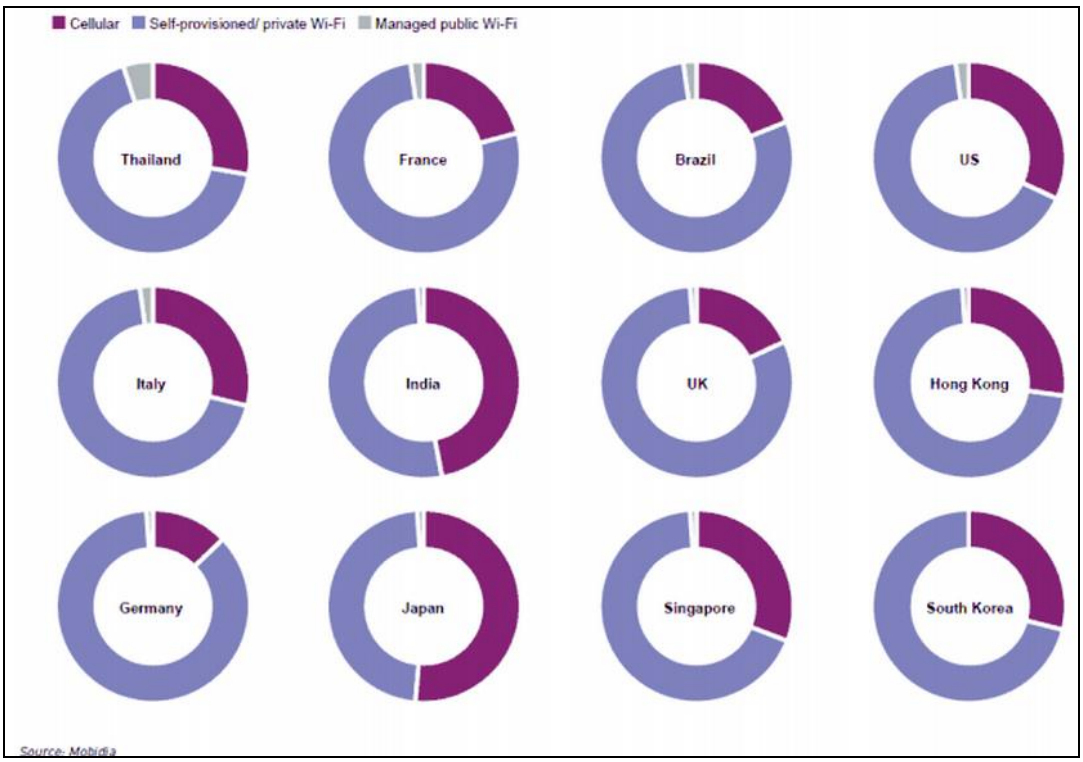


Note: Figures cover Canada, Germany, Japan, South Korea, UK and US.
Source: Mobidia

Similarly, a snapshot comparing Wi-Fi versus cellular usage on smartphones, in 12 countries, across 3 continents[16], shows Wi-Fi's dominant position.

[15] Informa Telecoms and Media. "Understanding Today's Smartphone User. An updated and expanded analysis of data-usage patterns in six of the world's most advanced 4G LTE markets". A white paper using Mobidia's information (www.mobidia.com)

[16] Song, S, "TV White Spaces Africa Forum 2013 Introduction" (powerpoint presentation). Slide 11, found at https://sites.google.com/site/tvwsafrica2013/presentations (find Song's name and click on the link). (as at Apr 24, 2014), based on white papers found on Mobidia's website (www.mobidia.com)



Spectral reform should consider the needs of larger, incumbent operators but also the multiple, smaller operators and retail service providers.

The focus on spectrum regulation in the past has been on providing spectrum to a small set of large, selected companies, given the exclusive right to provide specific services. Examples are the early provision of microwave frequencies to Telkom for national backhaul, CDMA to Neotel for fixed-wireless telephony, terrestrial television to Sentech for broadcasting and GSM/3G spectrum to MNOs for cellular telephony. This is an important element of regulation, but is only a part of the story. The importance and impact of these assignments is obvious, but the liberalisation of service licensing in 2009 and technological developments have created a new reality.

This new reality can also be seen within the global context, where the liberalisation of operator licensing within progressive regulatory regimes has resulted in a very significant industry of smaller operators who have 'opened the market' in dramatic ways in terms of broadband penetration, pricing and product innovation. This growth is even more dramatic in countries where these operators are allowed to self-provide their backhaul and access by means of fibre, cable, copper and wireless. Since such operators have had restricted access to licensed spectrum, a substantial portion of the explosive growth has taken place within the very restricted spectrum bands where shared usage is allowed.

A powerful illustration of this phenomenon is evident in the spectrum range implemented internationally, historically known as the “ISM bands”. Two examples of this are frequencies centred around 2.4 GHz and 5.8 GHz. Communication based on Wi-Fi has proliferated to the point mentioned at the beginning of this section, where more data is communicated within these two bands than on the spectrum specifically licensed and operated by MNOs. Schools, clinics, offices, homes and public spaces have all been connected via the same frequency bands, extending a few hundred megahertz, within a total spectrum range extending many gigahertz.

That is one of a number of reasons why research has confirmed that the availability of license-exempt spectrum is itself a driver of economic benefit, and why there is a drive to make more such spectrum available.

6.2. **Managed Spectrum**

The current model where a particular spectrum band is allocated to a single wireless operator may have served in the past, but is no longer appropriate. Spectrum is a national resource and needs to be used optimally. ICASA studies have shown that most of the allocated spectrum is unused[17].

Only limited spectrum from the total spectrum available should be allocated to a single provider on a long tenure basis. Most spectrum should be allocated on a managed basis, allocated dynamically according to regulator-specified rules, but via privately-operated databases.

The underlying principle is co-existence of two or more wireless networks in the same location (or nearby to each other) without causing interference to one another’s networks. This principle includes the concepts often called *dynamic spectrum assignment* or *lite-licensing of spectrum*.

[17] See, for example, links available from http://www.ellipsis.co.za/licensing/frequency-licensing/spectrum-audits/

7. Policing and Self-Regulation

7.1. WAPA believes that spectral policy can only succeed if underpinned by sound High Site management and radio apparatus installation practice.

7.2. This is in turn achieved by a combination of effective ICASA policing and a level of self-regulation in the industry.

7.3. WAPA welcomes the increased budget allocated to ICASA for monitoring equipment, and calls for greater institutional capacity building to ensure better actual monitoring and compliance.

7.4. As a contribution to self-regulation, WAPA maintains a member Code of Conduct[18] as well as High Site Guidelines[19]. These documents are therefore complementary to this white paper. Topics covered include safety, labelling of equipment, sound installation and management of interference-related issues.

7.5. Wireless Operators, High Site owners and Vendors to Operators must adhere to and align their internal policies to these documents for the industry to thrive, operating within the relevant law and regulations.

7.6. WAPA welcomes discussion with government bodies, industry bodies and other interested parties in the interests of promoting best practice and achieving wide buy-in from stakeholders, regarding self-regulation.

8. An Open, Fair and Neutral Wholesale Market

A significant barrier to competition could be eliminated if those with national spectrum were required to open this spectrum and associated infrastructure to ***open, fair*** and ***neutral wholesale access***. In other words, any qualifying service provider should be able to access the facilities on equivalent, non-discriminatory terms.

In this respect, WAPA enthusiastically supports "South Africa Connect", the Government's recently-published broadband policy document[20] which calls for "*the enforcement of wholesale access regulation to dominant players' networks and mandatory open access to infrastructure rolled out through public investment*" (Page 4). WAPA is willing to engage ICASA to assist in defining the terms of such regulation.

[18] Go to http://www.wapa.org.za/code-of-conduct/ to download the latest version
[19] This is an internal document available to WAPA members and selected high site owners. For more information, contact WAPA at info@wapa.org.za
[20] See footnote 8, above

WAPA's concern is that ICASA is not currently equipped or resourced to be the strong, capable regulator needed to ensure true competition. ICASA needs the capacity to draft appropriate regulation, to adjudicate complaints in good time, to enforce resulting decisions and to amend regulations promptly if loopholes are found to exist or abusive practices persist.

In the short term, it is important for ICASA to apply open access principles when assigning spectrum for LTE for two reasons. The first is that LTE spectrum has not yet been assigned and there is an opportunity to build open-access requirements into the licensing conditions. The second is that LTE is a game-changing technology that needs to benefit the market as widely as possible. WAPA does not endorse the creation of a publicly owned or publicly built network, but submits that the optimal way to maximize participation with the limited spectrum available is to enforce a sharing model.

9. License Exempt Management Models

License exempt spectrum is of particular interest to WAPA.

For an overview of license exempt bands in South Africa, see the useful, free guide offered by Ellipsis[21].

The first consideration is that more spectrum bands should be accorded license exempt status.

The second consideration is that a level of self-management is required so that license-exempt spectrum can be utilised for reliable broadband communications and services which require a basic quality of service assurance. Many of the elements of such management are already covered: As discussed in Section 7.5 above, ICASA should police basic compliance and organisations such as WAPA can add a layer of self-regulation and the promotion of clear standards, applicable to all members of the wireless operational ecosystem.

9.1. **Spectrum Parks**

An overlapping approach which WAPA encourages is known as a 'spectrum park'. This concept is formulated well by the New Zealand Regulatory Authority:

[21] http://www.ellipsis.co.za/wp-content/uploads/2013/10/Guide-to-commonly-used-licence-exempt-frequency-bands-May-2013.pdf

"*Managed spectrum parks are intended to allow access to a number of users in a common band of spectrum on a shared, and as far as possible, self-managed basis. The objective of managed spectrum parks is to encourage the efficient user of spectrum, innovation and flexibility, and provide for low cost compliance and administration*[22]".

New Zealand has created such a park in the 2.5 GHz band and the associated website[23] outlines intended benefits, which include (in WAPA's view):

- multiple operators can access the spectrum (promoting competition);
- local or regional usage;
- 'use it or lose it' principles ensure lower spectrum dormancy;
- reduced overall licensing costs to operators; and
- flexibility to adapt to a changing context.

ICASA introduced the concept of a Spectrum Park in 2011[24], defining it as a "*model where a number of entities apply to participate in sharing a block of common spectrum on* [sic] *self-managed basis and according to some regulations and/or agreed procedures*". ICASA goes on to highlight the benefits – it "*encourages efficient use of spectrum, innovation and flexibility and provide [sic] for low cost compliance and administration over time*".

WAPA calls for discussion on the scope and implementation of the concept in South Africa and allocation of spectrum bands to such parks.

WAPA is well-positioned to manage the allocation of spectrum in the bands which are allocated to wireless operators, based on years of collective experience within its membership.

[22] New Zealand Government. "Proposals for operation of the Managed Spectrum Park at 2.5 GHz band. July 2008. To view, either go to http://www.rsm.govt.nz/cms/policy-and-planning/projects/recently-completed-work/managed-spectrum-parks/background/proposals-for-operation-of-the-managed-spectrum-park-at-2-5-ghz-band or cited in Kruys, J et al. "Sharing RF Spectrum with Commodity Wireless Technologies: Theory and Practice. 2011. Springer. Page 14..

[23] Go to http://www.rsm.govt.nz/cms/licensees/types-of-licence/managed-spectrum-park (visited April 30, 2014)

[24] ICASA notice 911 of 2011, Section 5.8

9.2. **Geolocation Based Licensing**

According to the joint submission which WAPA has already made to ICASA (together with Google, the CSIR and others)[25]:

"*There is growing recognition across the globe that dynamic spectrum sharing enabled by geolocation databases has significant potential to increase the availability and ubiquity of broadband access ... Geolocation databases, such as those now being developed to access TV white spaces, indicate via a database query which TV channels are available for data communication based on the geographical location of the radio… Developments in database-driven dynamic spectrum sharing also highlight inefficiencies created by the traditional methods of allocating and assigning radio frequency spectrum.*"

The TVWS trial described in the above document demonstrated the successful operation of a geolocation database.

WAPA calls for ***all*** managed, licence-exempt spectrum to be underpinned by a geolocation database. As a loose example, the database would receive a query indicating a GPS location and operator name, and return info authorizing usage of a specific spectrum allocation, for a specified duration and at a specified power level.

WAPA believes that geolocation databases should be managed by the private sector, but accredited by ICASA. This approach promotes innovation and competition. The core functions should be subject to the same strict set of rules, so that queries to any of the databases yield the same result, and they should synchronise with each other as peers.

The database requires an underlying propagation model to calculate what spectrum is available at a given geographical location. WAPA is aware of the different models and their relative benefits, but proposes an ICASA-led discussion with relevant stakeholders before a final propagation model is agreed. ICASA must then regulate to ensure that all databases use the identical model and associated calculation parameters.

10. The Digital Switchover (DSO) and TV White Spaces (TVWS)

10.1. **Digital Switchover and the Digital Dividend**

The planned DSO (Digital Switch Over)[26] – the migration of television broadcasting from analogue to digital - unlocks spectrum opportunities which WAPA is proactively exploring.

[25] Cape Town TVWS Partners. "Allowing Access to Television White Spaces in South Africa: Recommendations and Learnings from the Cape Town Television White Spaces Trial. 2013. Page 5.

After the DSO, and the subsequent "restacking" or digital to digital migration, there will be the capability for broadcasters to increase the number of broadcast channels, and there will also be unused, quality spectrum available for non-broadcasting services, such as wireless broadband access. This spectrum is known as the Digital Dividend. It will become available in two phases. The first phase (Digital Dividend 1) will release spectrum in the 800 MHz range (790 – 854 MHz), and the second phase (Digital Dividend 2) in the 700 MHz range (695 – 790 MHz). WAPA strongly supports the consolidation of this spectrum together with other available access spectrum in a single assignment process.

South Africa, along with most countries in the world, has a migration timetable, but South Africa has slipped by at least five years in implementation (from 2010 to 2015) and is still not on track to proceed. WAPA therefore urges the government to prioritise this migration.

Digital Dividend 1 (800 MHz) is currently due for allocation to mobile operators, ostensibly for LTE rollout and as early as 2015. Government commissioned a study regarding allocation of the Digital Dividend 2 spectrum[27] which proposes this 700 MHz spectrum also be released for mobile broadband – most likely also LTE.

As discussed in Section 8 above) - An Open, Fair and Neutral Wholesale Market- WAPA believes that now is an opportune time to stipulate ways to open wholesale access to LTE networks, to all relevant service providers.

10.2. **Television White Spaces (TVWS)**

Much of the television broadcasting spectrum is unused because broadcasts do not take place on every channel, at every site. Trials were conducted in Cape Town which show that unused channels (the so called 'white spaces') can be exploited for the provision of wireless broadband, without interfering with TV broadcasts[28].

Following the trials, a public report back was held, and a set of proposals submitted in a face-to-face meeting with ICASA. These are the principles on how TVWS could be used

[26] See http://en.wikipedia.org/wiki/Digital_television_transition. This white paper covers related proposals, not the DSO itself.
[27] Deloitte. "Second Digital Dividend. Final Report and Implementation Plan". 2014. Available at http://www.ellipsis.co.za/wp-content/uploads/2014/04/Second-Digital-Dividend-Final-Report-and-Implementation-Plan-April-2014.pdf (on April 29, 2014)
[28] The Cape Town TV White Spaces Trial. Post trial preliminary results (http://www.tenet.ac.za/tvws/) (as at 2014-05-01)

as licensed, managed spectrum, underpinned by a geolocation database, and for wireless broadband access[29]. The principles appear to have been well received, and WAPA calls on ICASA to make it a top priority to finalise the policy and regulation process required to enable commercial exploitation of TVWS.

Motivation for TVWS:

a. Allows point-to-multipoint broadband access provision over wider areas than higher-frequency radio alternatives.

b. Improves utilization of otherwise unused spectral resources

c. Key aspects of the technology are already tested

d. Follows the example of other well regarded regulators: The United Kingdom, Canada, the USA and Singapore. South Africa can learn from the research, examples and submissions already available.

e. Reduce the lag that South Africa is experiencing in Africa. Delays will mean that Nigeria, Kenya, Malawi and others may soon show leadership in TVWS deployment.

In terms of the DSO, South Africa has considerable TVWS available right now. The Cape Town trial was undertaken in one of the most broadcast-intensive locations and there were six full channels available. During the transitional, dual-illumination period (when both digital and analogue broadcasts are taking place) the availability of spare channels may decrease, but is expected to be sufficient, given the uptake cycle of TVWS. Post DSO, Deloitte proposes that the spectrum range from 470 MHz to 694 MHz be reserved for TV Broadcasters as primary users[30]. WAPA believes that this allocation is more than sufficient for TV broadcasting requirements and it is therefore imperative that regulation allows secondary usage for commercial broadband provision.

11. Comments on this White Paper

WAPA supports public debate on this White Paper and the issues it addresses. Please forward this to interested parties. Comments and queries are welcome and can be addressed to info@wapa.org.za.

[29] Cape Town TVWS Partners. "Allowing Access to Television White Spaces in South Africa: Recommendations and Learnings from the Cape Town Television White Spaces Trial. 2013. Page 5.
[30] Deloitte's Second Digital Dividend Final Report, April 2014

Appendix 1: Abbreviations, Terms and Definitions

Term or Abbreviation used	Definition or Meaning
ASO	Analogue Switch Off (see DSO)
DoC	The (Government) Department of Communications which was responsible for Telecommunications Policy until it was replaced by the DTPS, in June 2014
DM	Digital Migration (see DSO)
DSO	Digital Switch Over - also known as the Analogue Switch Off (ASO), the Digital Television Transition (DTT) or the Digital Migration (DM) - refers to the migration of television broadcasting from analogue to digital. This is a global occurrence, with each country having its own plan and timeframe. http://en.wikipedia.org/wiki/Digital_television_transition. Note that South Africa is not mentioned in the Wikipedia article (as at 30 April 2014).
DTPS	The (Government) Department of Telecommunications & Postal Services, responsible for telecommunications policy, created in June 2014.
Dynamic Spectrum Assignment	A tool for optimising efficiency by constantly evaluating what frequency is available and matching it with an application
FCC	Federal Communications Commission, the communications regulatory body of the United States.
ICASA	Independent Communications Authority of South Africa (the Government Regulator) (www.icasa.org.za)
IEEE 802.19	The Institute of Electrical and Electronic Engineers Working group which is finalising standards and principles whereby two or more unlicensed wireless networks can coexist, i.e. operate in the same location without causing significant interference to one another.
ISM Bands	The spectrum bands historically identified for Industry, Scientific and Medical use (http://en.wikipedia.org/wiki/ISM_band)
IMT	International Mobile Telecommunication – usually referring to the use of the spectrum for voice or broadband.
Lite-licensing	This is a generic or umbrella term for spectrum licensing with various sub-specifications (i.e. control via type approval, free-for-all, sensing, etc.) –

	anything short of command-and-control. This term is not applied within the White Paper because more specific terms are applied when required.
LTE	"Long Term Evolution" refers to the next evolution of cellular mobile data (http://en.wikipedia.org/wiki/LTE_(telecommunication)), beyond the current 3G standard (and enhancements associated with 3G, such as High Speed Packet Access). LTE enables faster data speeds, lower latencies and more flexible and efficient use of spectrum. The networks required to deliver this have a simpler architecture than 3G and ultimately deliver broadband in a more cost effective manner. LTE enjoys widespread global acceptance and itself has a clear evolution. LTE is mentioned in this white paper (which is largely technology-agnostic) because a number of wireless mobile data standards which used to compete, now have LTE as the agreed, common future evolution. LTE therefore plays a role in mobile broadband and fixed-wireless delivery. Of interest is that LTE can utilize a wide range of spectral bands (whereas 3G in South Africa was deployed on only the 900 MHz, 1800 MHz and 2100 MHz bands) and the fact that it is associated with the potential provision of ***wholesale* networks**. It should be noted that the use of LTE for commercial voice services, is still under development.
Spectrum Parks	This is a range of spectrum subject to managed, license-exempt spectrum principles (see Glossary definition) as described in the body of this document (see Section 6.2 above - Managed Spectrum)
Managed, license-exempt spectrum	This is spectrum for which an operator does not require a specific spectrum license in order to utilise it. However, it is managed (by a public or private body) via binding policies and processes regarding assignment and power levels.
MNO	Mobile Network Operator e.g. MTN, Vodacom. The term seems to have become more popular than the original term used: PLMN (Public Land Mobile Network).
TVWS	Television White Spaces. The unused spectrum within television broadcast channels due to no broadcasting taking place at that time and place, on those channels or because there is spectrum between television channels which is not used (the 'guard bands'). This is of interest in this White Paper because new technologies and developments mean that previously fallow spectrum can now be usefully used for broadband connectivity without

	impacting television broadcasts and because the spectrum allocations for broadcasting are particularly favourable for covering wide areas.
WAPA	The Wireless Access Providers Association, a body representing the interests of wireless access providers and ancillary bodies (www.wapa.org.za)
Wi-Fi	Wi-Fi (based on the acronym Wireless Fidelity) is a family of technology standards, managed by the IEEE (Institute of Electrical and Electronic Engineers) as 802.11 (http://en.wikipedia.org/wiki/Wifi), with so-called 'Carrier Wi-Fi' now being incorporated into the 3GPP set of standards (on which mobile operators base their roadmaps). The name "Wi-Fi" is registered to the trade association called The Wi-Fi Alliance (http://www.wi-fi.org/)