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**Vodacom's written submission in response to the Authority's Discussion Paper on the Draft Framework for Dynamic and Opportunistic Spectrum Management 2015**

**[Government Gazette Number: 39302 of 19 October 2015]**

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## 1 Introduction

Vodacom PTY Ltd (“**Vodacom**”) wishes to thank the Authority for the opportunity to respond to the “Discussion Paper on the Draft Framework for Dynamic and Opportunistic Spectrum Management 2015”, hereinafter referred to as the “Discussion Paper”.

Vodacom’s response is comprised as follows:

Section 2: Executive Summary

Section 3: General Comments

Section 4: Specific Questions: Vodacom’s responses to the questions posed in the Discussion Paper

Where applicable, text in “*Italics*” denotes quotations as per the Discussion Paper. For questions not included in the response, Vodacom does not have any comments to these questions at this stage due to the immaturity of Dynamic Spectrum Assignment (“DSA”) and Television White Spaces (“TVWS”).

Furthermore, subsequent to this submission, due to the immaturity of DSA and TVWS, Vodacom may decide to initiate a further study to comprehensively assess the technical, economic and practical viability of DSA and TVWS. However, irrespective of whether Vodacom initiates a further study or not, its rights to provide further or revised comments subject to the outcome of this assessment and / or further maturity of policy and/or standards around DSA and TVWS remain reserved.

## 2 Executive Summary

Vodacom believes that subject to maturity, TVWS based on DSA could offer a potential further alternative solution to address the objective of efficient spectrum assignment and consequently further the objectives of SA Connect<sup>1</sup>.

While Vodacom remains supportive of the Authority's eagerness to embrace innovative technologies and regulatory practices like TVWS and DSA, Vodacom 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<sup>2</sup>, 800MHz<sup>3</sup> and 2600MHz<sup>4</sup> bands to date;
- Failure to conclude the migration of Broadcasting Services from the 700MHz<sup>2</sup> and 800MHz<sup>3</sup> bands;
- The inconclusive status of the Authority's recently published Information Memorandum;

Notwithstanding, Vodacom can support the Authority's consideration of the potential implementation of TVWS based on DSA in the future when the ecosystem is sufficiently mature to the extent that it promotes more efficient use of certain spectrum ultimately benefiting end-users, subject to the following:

- It is restricted to the lower part of the 470 – 694MHz band, namely 470 – 605MHz on a secondary basis while Broadcasting Services will remain on a primary basis for the full 470 – 694MHz band;
- The remaining part of the 470 – 694MHz band, namely 614 – 694MHz should be reserved for consideration of a potential future allocation to Mobile Services on a primary basis subject to harmonisation;
- It is not implemented in the spectrum bands allocated to Mobile Services on a primary basis because mobile spectrum is efficiently utilised leaving no feasible white space opportunity for TVWS deployment. In cases where there may be very limited white spaces like mobile spectrum used for 2G<sup>5</sup> (GSM), Vodacom submits that the Authority utilise spectrum leasing or trading of such spectrum.
- The 470 – 605MHz part of the band should be allocated to the Mobile Service on a secondary basis and TVWS can be one such application of Mobile Services in this part of the band;
- Due consideration is applied to the impact of spectrum harmonisation and technology standardisation;
- Any implementation of TVWS based on DSA does not cause harmful interference to primary services;
- The provision of a tangible migration process, should it ever become necessary to migrate TVWS from the 470 – 605MHz part of the band.

Furthermore, Vodacom submits that the Authority must adopt a spectrum sharing variant of a fully licensed model for the licensing of this band to TVWS operators, namely Licensed Shared Access ("LSA") that would also be subject to the Administrative Incentive Pricing<sup>6</sup> ("AIP") regime. This is to ensure:

<sup>1</sup> South Africa National Broadband Policy, Government Gazette Number: 37119

<sup>2</sup> IMT700 Radio Frequency Spectrum Assignment Plan - Notice 271, Government Gazette Number: 38640 and Notice 388, Government Gazette Number: 38755

<sup>3</sup> IMT800 Radio Frequency Spectrum Assignment Plan – Notice 273, Government Gazette Number: 38640 and Notice 390, Government Gazette Number: 38755

<sup>4</sup> IMT2600 Radio Frequency Spectrum Assignment Plan – Notice 277, Government Gazette Number: 38640 and Notice 393, Government Gazette Number: 38755

<sup>5</sup> Vodacom's 2G network currently operates in both the 900MHz and 1800MHz bands

<sup>6</sup> Radio Frequency Spectrum License Fee Regulations, Government Gazette Numbers: 33495 & 38642

- The 470 – 694MHz band is appropriately valued and;
- The avoidance of the significant risk of harmful interference that will emanate from a license-exempt deployment in this band;
- The reduction of potential for arbitrage that could distort the market.

Vodacom also cautions the Authority to apply due consideration of the current status of the TVWS based on DSA ecosystem. The Authority must:

- Recognise that DSA and TVWS technology ecosystem is still very immature;
- Take cognisance of the critical role the availability of a globally embraced supporting technology ecosystem plays in meeting the objective of a widespread communication system that is universally accessible as envisaged in SA Connect’;
- Apply due consideration that the International Mobile Telecommunication (“IMT”) ecosystem may be a more appropriate solution to addressing the objectives of SA Connect’ given the already extensively developed supporting technology ecosystem and consequent economies of scale achievable;
- Allow flexibility to enable deployment of any IMT technologies in the 470 – 605MHz part of the band in the future depending on harmonisation;
- Ensure that it does not adopt regulatory practices like a secondary allocation to TVWS in spectrum bands allocated to Mobile Service which would compromise the deployment or further investment in IMT technologies and related services due to market uncertainty or harmful interference in spectrum bands already allocated to Mobile Services on a primary basis, ultimately to the detriment of end-users.

### 3 General Comments

Vodacom believes that subject to maturity, TVWS based on DSA could offer a potential further alternative solution to address the objective of efficient spectrum assignment and consequently further the objectives of SA Connect<sup>1</sup>. Vodacom therefore commends the Authority on its efforts to investigate the potential viability of DSA technology and its related implementation for TVWS, notwithstanding Vodacom's concern about the Authority's prioritization of its operational activities. Furthermore, Vodacom applauds the efforts of the CSIR in its related research to date.

Considering the immaturity of DSA and TVWS, Vodacom encourages continued research and development on DSA and TVWS. Furthermore, Vodacom welcomes an opportunity to be more closely involved in such further research and development to ensure that it is sufficiently comprehensive to enable the Authority to arrive at an appropriately informed decision on the viability and appropriate implementation of TVWS based on DSA.

Vodacom's response addresses the following important aspects that will directly impact the Authority's decision in respect of the potential deployment of TVWS based on DSA:

- The Authority's Operational Activities
- Spectrum Management for TVWS
- Licensing Model for TVWS
- Technology Ecosystem for DSA and TVWS

#### 3.1 Operational Activities

Vodacom is concerned about the Authority's prioritization of its operational activities to meet the strategic objectives under its legislative mandate. The Authority remains aware of the high priority of it assigning spectrum, using existing licensing mechanisms, in the critical 700MHz<sup>2</sup>, 800MHz<sup>3</sup> and 2600MHz<sup>4</sup> bands for the provision of mobile broadband services supporting IMT technologies. Notwithstanding, the Authority has to date failed to address the timely assignment of this spectrum already allocated to Mobile Services on a primary basis. It is worth noting that the vast majority of the 2600MHz spectrum band has been unused by any service for several years to date which is inconsistent with the objectives of the Authority under section 2(e) of the Electronic Communications Act<sup>7</sup> ("ECA").

More recently in September 2015, the Authority engaged on a consultative process in respect of the proposed licensing of the aforementioned spectrum bands through the publication of an Information Memorandum<sup>8</sup> in the absence of Ministerial Policy Directives, which has not materialised into any subsequent process of assignment of such spectrum to date.

Furthermore, the Authority is yet to conclude the migration of existing analogue Broadcasting Services from the critical 700MHz<sup>2</sup> and 800MHz<sup>3</sup> spectrum bands which are particularly important for rural coverage and indoor penetration. In section 3.3.3 of the Discussion Paper, the Authority also correctly recognises the economic importance of spectrum below 1GHz required by mobile operators to provide services in sparsely populated low income rural areas.

The Authority's Discussion Paper now, instead seeks to consider alternative immature licensing mechanisms / technologies and applications (Please refer to section 2.5 in respect of the technology ecosystem), namely DSA and TVWS, that aim to utilise similarly critical spectrum in the 470 – 694MHz band and furthermore, intent to consider the potential extension of DSA and TVWS on a secondary basis to other spectrum bands including those above 694MHz currently allocated to Mobile Services on a primary basis.

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<sup>7</sup> Electronic Communications Act, 2005 and Amendment Act, 2014 - Government Gazette Numbers: 28743 & 37536

<sup>8</sup> Information Memorandum for radio frequency spectrum prospective licence to provide mobile broadband wireless access services for urban and rural areas using the complimentary bands, 700 MHz, 800 MHz and 2.6 GHz, Government Gazette Number: 39203

Vodacom submits that the Authority must prioritize its operational activities based on the following:

- Ensure the efficient assignment of spectrum;
- Implement spectrum management mechanisms that are mature enough to ensure material realisation of objectives in the short term;
- Avoid the creation of artificial scarcity of spectrum due to a failure to assign spectrum timeously;
- Allow harnessing the capabilities of current technologies rather than depending on the promise of future immature technologies;
- Prioritize the allocation and subsequent assignment of the primary service of a spectrum band before the secondary service;
- Carefully select the best mechanisms and solutions that will realise the objectives of SA Connect<sup>1</sup> rather than investigate all ambits of the vision of SA Connect<sup>1</sup>.

### 3.2 Spectrum Management

Vodacom submits that the Authority must adopt spectrum management practices that strive to address the following objectives:

- Promote the efficient assignment and use of spectrum;
- Flexibility to adapt to technological and demand changes;
- Support and encourage harmonisation ensuring technical compatibility;
- Avoid or minimise harmful interference;
- Promote innovation;
- Encourage provision of services to underserved or rural areas.

#### Efficient Assignment and Use of Spectrum

Vodacom's view is that the Authority must implement spectrum management practices that will promote the efficient assignment of spectrum and in line with section 2(e) of the ECA<sup>7</sup>, subsequently ensure the efficient use of such spectrum. This is particularly important in the case of sub-1GHz spectrum bands which support more economical business models due the benefits of substantially better propagation characteristics and are consequently in high demand.

In cases where it is both technically and economically justifiable, the Authority should consider the potential implementation of innovative mechanisms like DSA and TVWS to ensure both the efficient assignment of spectrum and the efficient use of spectrum by all licensees, provided that the primary licensee is sufficiently protected from harmful interference.

#### Spectrum Bands for TVWS

Vodacom can support the Authority's consideration of appropriate mechanisms such as DSA in the future when the ecosystem is sufficiently mature, to ensure the efficient use of spectrum currently licensed to Broadcasting Services on a primary basis but only in the lower part of the 470 – 694MHz band, namely 470 – 605MHz. Subject to maturity, TVWS could be one such application of DSA in this part of the spectrum band on a secondary basis. However, Vodacom does not support the consideration of the adoption of similar mechanisms for spectrum currently allocated to Mobile Services on a primary basis as allocated in the National Radio Frequency Plan<sup>9</sup> ("NRFPP") and specified in the applicable IMT Radio Frequency Assignment Plans<sup>10</sup> ("RFSAP").

#### *Why Broadcasting Bands may be suitable*

Spectrum currently assigned to Broadcasting Services in the 470 – 694MHz is considered inefficiently utilised due to following reasons:

<sup>9</sup> National Radio Frequency Plan 2013, Government Gazette Number: 36336

<sup>10</sup> IMT Radio Frequency Spectrum Assignment Plans, 2015 – Government Gazette Numbers: 38640 & 38755

- Considering the Digital Terrestrial Migration (“DTT”) frequency plan depicted in Figure 1<sup>11</sup>, 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 5<sup>th</sup> 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 AIP<sup>6</sup> licencing fee regime and there is therefore no incentive for broadcasters to use spectrum efficiently.

### ***Why Mobile Spectrum Bands are Unsuitable***

Firstly, exclusive access to a single licensee remains the main spectrum management practice for mobile broadband spectrum globally, as it guarantees quality of service, safeguards against harmful interference and provides a higher degree of desired market certainty to protect current investments and incentivise further investment.

Secondly, mobile technologies like 3G<sup>12</sup> and LTE<sup>13</sup> (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<sup>12</sup> population coverage of 96% which is likely to reach 2G<sup>5</sup> population coverage of 99.8% over the short to medium term;

In the case of 2G<sup>5</sup> (GSM), while there may be some opportunity of white spaces in the frequency domain due to the implementation of a higher frequency reuse factor greater than 1, this is negligible due to the expected evolution of 2G<sup>5</sup> to newer technologies, namely 3G<sup>12</sup> and beyond. Furthermore, the current extensive densification of 2G<sup>5</sup> radio base stations nationally coupled with the implementation of random frequency hopping techniques across all 2G<sup>5</sup> base station transceivers that support population coverage of 99.8% leaves a very limited number of small white spaces in the frequency domain.

Such small geographic or frequency white spaces are particularly challenging to model and develop an appropriate propagation model for the implementation of DSA rendering the implementation of TVWS based on DSA technically challenging and therefore unfeasible in the mobile spectrum bands.

Thirdly, unlike Broadcasting Spectrum, Mobile Spectrum is subject to the AIP<sup>6</sup> license regime with one of its primary objectives being to incentivise efficient use, ultimately also promoting the most economic benefit for end users.

Fourthly, transparent market based spectrum auctions have proven to be the most effective method of assigning high demand mobile spectrum as it ensures that spectrum is assigned and used efficiently. Given the Authority’s support for this method as expressed in the Information Memorandum<sup>8</sup>, such market based approach complimented by spectrum trading and leasing mechanisms will further incentivise efficient use of mobile spectrum.

To the extent that limited populated geographic white spaces may exist in mobile bands, Vodacom submits that a more appropriate solution for promoting the efficient use of spectrum in these very limited geographic areas will be through spectrum trading and leasing mechanisms. This will ensure the most

<sup>11</sup> Discussion Paper - Section 1, page 10. Vodacom has assumed that the Authority’s reference to channel 39 is a typographical error and should instead have read as channel 29.

<sup>12</sup> Vodacom’s 3G network currently operates in both the 900MHz and 2100MHz bands

<sup>13</sup> Vodacom’s LTE network currently operates in the 1800MHz band

efficient mechanism to effectively manage harmful interference, avoid the risk of discouraging investment due to uncertainty and consequently reduce the administrative burden on the Authority.

### ***Why 470 – 605MHz***

Vodacom is of the view that Broadcasting Services in South Africa will not require more than 4 multiplexes. Therefore, based on the DTT plan of 4 Multiplexes, as per Figure 1<sup>11</sup>, the spectrum that will be utilised by Broadcasting Services will be below 606MHz post DTT.

Considering the demand for mobile spectrum supported by the economic value of such spectrum, noting the allocation of 606 – 614MHz to Radio Astronomy<sup>9</sup> as per the NRFP on a primary basis, it is important to retain sufficient flexibility to allow for the potential allocation of the 614 – 694MHz part of the band to Mobile Services in the future, subject to harmonisation (please refer to section 3.4). It may therefore be appropriate to restrict the potential implementation of TVWS to only part of the band, namely 470 – 605MHz.

### **Differentiate Application and Technology**

The Authority must clearly differentiate between DSA and TVWS, in terms of a type of technology and a type of application respectively.

Vodacom's view is that TVWS should be defined as an application of the Mobile Service ("MS") and therefore believes that it would be far more appropriate for the Authority to consider to potentially allocate the 470 – 605MHz part of the band to the Mobile Service on a secondary basis while the primary allocation will remain to the Broadcasting Service.

As one of many potential applications of Mobile Services, TVWS can then be deployed on a secondary basis, based on supporting technologies like DSA if and when the TVWS and DSA ecosystems are sufficiently matured. In the event that a supporting technology ecosystem for TVWS does not materialise, the flexibility will exist to allow for the deployment of any other applications of Mobile Services like IMT in such spectrum bands. Such an approach would (please also refer to section 3.4):

- Align with global spectrum management best practice;
- Promote technology agnostic implementations;
- Enable the South African market to harness the benefits of larger economies of scale;
- Ensure spectrum management flexibility.

### **Harmonisation and Standardisation**

The Authority must adopt spectrum management practices that promote spectrum harmonisation based on ITU Region 1. Spectrum harmonisation promotes and enables much desired technology standardisation due to the intimate dependency of radio technology on spectrum.

The Authority therefore has the ability to significantly influence technology standardisation through spectrum management practices adopted. Technology standardisation will not only ensure technological interoperability but also avoid undesired diluted research and development efforts, dramatically improving economies of scale which will ultimately benefit all markets globally including South Africa. Supporting and encouraging harmonisation will therefore realise significant benefits both technologically and economically.

### **Deviation from Regional Harmonisation**

Vodacom cautions the Authority against deviations from harmonisation with ITU Region 1. It is important for the Authority to take relevant learnings from the historic adoption of a non-harmonised channelling arrangement in respect of the 800MHz<sup>3</sup> / 850MHz<sup>14</sup> band in South Africa. Please refer to section 3.6 of Vodacom's submission to the Information Memorandum<sup>8</sup>.

<sup>14</sup> IMT850 RFSAP – Notice 274, Government Gazette Number: 38640

Vodacom therefore submits that the Authority's objectives would be best served through harmonisation with ITU Region 1 and should exercise caution when considering deviations from ITU Regional harmonisation which could emanate from the premature adoption of radio frequency allocations.

### **Harmful Interference**

The Authority must adopt spectrum management practices that ensure the protection of primary services from harmful interference. Such protection is imperative to enable the delivery of Quality of Service ("QoS") as demanded by many end users and or applications as well as the objectives set out SA Connect<sup>1</sup>. As such, it is a pre-requisite to protect current investment and encourage much desired future investment in communication infrastructure.

Vodacom would like to highlight that the successful implementation of TVWS based on DSA is highly dependent on the consistent availability of an accurate database of frequency assignments and calibrated propagation models to ensure that instances of harmful interference is avoided.

In cases where the adoption of DSA and TVWS may be deemed appropriate in the future, the Authority cannot rely purely on the principles of DSA technologies to effectively and efficiently manage harmful interference and therefore as a precautionary measure prior to the consideration of DSA and TVWS deployment, the Authority must devise and implement clear Regulatory guidelines that address the following:

- Assurance of the accuracy of DSA databases;
- Clear and defined timeframes for the resolution of harmful interference;
- Penalties applicable to secondary licensees for non-compliance and how this will be effected;
- A tangible resolution process with clearly defined roles and responsibilities;
- The Authority's tangible action plan to address situations of illegal 'squatting' by secondary licensees if and when migration of secondary licensees may be required.

### **Technology Agnostic**

The Authority must ensure the adoption of a technology agnostic spectrum management approach in line with global best practice. This will enable the desired flexibility to support technology evolution in the applicable spectrum band(s) harmonised with ITU Region 1 and consequently ensure that the South African market is able to efficiently adopt new technologies and capitalise on applicable economies of scale as guided by global technology harmonisation. Please also refer to Vodacom's comments under section 3.4.

### **Spectrum Sharing**

Vodacom supports the concept of spectrum sharing, where technically feasible, practical as well as economically justifiable, and therefore encourages the Authority to promote same in selected spectrum bands where appropriate.

Spectrum sharing techniques offers a potential solution to provide opportunities for operators to gain access to additional spectrum, which is typically allocated to other radio services and inefficiently utilised like the 470-694MHz spectrum band and thus not available via traditional exclusive licensing models. Please also refer to Vodacom's comments under section 3.3.

## **3.3 Spectrum Licensing Model**

Vodacom submits that there is a need to support multiple licensing models based on both licensed and licence-exempt models of spectrum as each model has their respective merits. These can be broadly classified into licensed or licensed-exempt administration.

The objectives of these licensing frameworks include:

- Coordinating an orderly use of the spectrum resource through licensing and registry (national and international);
- Avoiding or minimising harmful interference through the establishment of license parameters;
- Ensuring that the finite spectrum resource is appropriately valued (and not hoarded), through appropriate licensing fees;
- Enabling equitable, rational, efficient and economical forms for assigning spectrum when demand exceeds supply;
- Avoiding monopolies and enabling competition ultimately benefiting consumers;
- Providing a stable regulatory environment for spectrum users in order to encourage investment and innovation.

### Licensed vs Licensed Exempt Models

Licensed spectrum provides the licensee with a degree of certainty of right of use, allowing optimal deployment to deliver very high efficiency and assured quality of service. Mobile operators with licensed spectrum can build dense networks of radio base stations and fine-tune power levels and antenna configurations to achieve very high levels of frequency reuse that would simply not be possible with multiple independent licensees. Furthermore, spectrum licensing fees promote efficient use of spectrum.

Licence-exempt spectrum provides flexibility for multiple users to share spectrum capacity on an ad-hoc basis, accepting in return the risk of inefficient use, congestion and uncertain quality of service. Technical protocols are used to manage contention, with no regard to economic benefit resulting from use. Given the ad-hoc sharing nature, licence-exempt implementations tend to be localised low-power applications such as Wi-Fi<sup>15</sup>, operating in higher frequency bands like 2.4GHz or 5GHz. Higher-power use would restrict sharing and severely reduce the degree of reuse and efficiency that could be achieved. Furthermore, due to the lower path loss of sub-1GHz spectrum bands enabling large coverage footprints, licence-exempt implementations will be impractical due to the resulting harmful interference to other adjacent operating systems.

Vodacom submits that the Authority, like all other regulators globally, must therefore find the right balance between licensed and licence-exempt. Worldwide, the vast majority of spectrum is licensed, and in the case of mobile licensed spectrum, ongoing excess demand causes regulators to continue to seek additional bands for licensing for mobile. Considering licence-exempt demand, Wi-Fi<sup>15</sup> use continues to grow, but is being accommodated through increased density of cells and expansion into the 5GHz band as well as the original 2.4GHz band. On balance, when given the choice on how to licence cleared spectrum, most authorities worldwide prioritise licensed over licence-exempt.

Licence Shared Access (LSA) based on the principles of spectrum sharing is emerging as a further alternative licensing model but only for a number of very specific situations, where the primary licensee is not able to make the most efficient use of the spectrum, for example:

- Where terrestrial broadcasters use Multi-Frequency Networks (“MFN”), leaving the majority of allocated frequencies unused in each broadcast frequency region. While MFN is considered better for carrying diverse regional programming, it is a highly inefficient solution and under more rational economic pricing of spectrum, broadcasters would almost certainly convert to Single Frequency Networks, resulting in an efficiency improvement of typically 400%. In the absence of economic market based pricing of spectrum which promotes efficient use, inefficient MFN may continue and LSA therefore becomes a secondary possibility. It will however create a difficult contradiction for any regulatory authority committed to the introduction of a fair and consistent spectrum charging regime;
- Where aeronautical or defence radars are installed at particular locations, and their frequencies are left unused in the vast majority of the country. In this case, sharing can be enabled by the application as simple exclusion zones, requiring no additional dynamic access or databases to be managed;

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<sup>15</sup> IEEE 802.11 family of standards

Apart from these cases, greater utilisation of high demand spectrum is best achieved through exclusive licensing to a single licensee through a transparent market based approach such as spectrum auctions, complimented by spectrum licensing fees that further incentivise efficient use.

### **Licensing Model for Mobile Spectrum**

Vodacom submits that spectrum allocated to Mobile Services for the implementation of IMT remains a critically scarce resource, especially so in the lower frequency bands, and should therefore continue to be licensed on an exclusive basis to a single licensee, complimented by spectrum trading and leasing mechanisms.

It is imperative for the Authority to adopt licensing models for spectrum that reflect the appropriate market value, encourage efficient use, discourage inefficient use and penalise spectrum hoarding which will ultimately support the best interests of South Africans. Vodacom therefore supports a transparent market based approach such as spectrum auctions to assign high demand spectrum and an Administrative Incentive Pricing<sup>6</sup> (“AIP”) license fee regime which further promotes efficient use of spectrum. Vodacom’s view is that the 470-694MHz band is one such band that should also be subject to a market based approach for assignment and an AIP<sup>6</sup> license fee regime.

### **Licensing Model for TVWS Spectrum**

Vodacom supports the adoption of LSA also known as Authorised Shared Access as a form of spectrum sharing under well-defined conditions for the licensing of TVWS. LSA provides a solution for spectrum bands that cannot easily be vacated by their incumbent users, but where actual spectrum usage is underutilized and or infrequent. It is important to note that the purpose of LSA is not to replace the traditional exclusive licensed model but rather to complement it.

In this license model a primary licensee grants spectrum access rights to one or more other sub-licensees, which may then use the band under specific service conditions. In the specific case of the 470 – 605MHz part of the band, this could also be executed by the Authority. Conditions defining how the spectrum may be used would be subject to individual sharing agreements, and to permission from the Authority under Regulation 18 of the Radio Frequency Spectrum Regulations. The Authority would be expected to issue licenses to one, or a very limited number of operators that would allow them to use specific spectrum bands as LSA licensees. Such usage will be on a co-ordinated basis between the operators and the primary licensee by time, frequency or location ensuring that a certain level of QoS performance can be realized.

Vodacom therefore submits that LSA would be an appropriate licensing model to be adopted for the 470-605MHz part of the 470 – 694MHz spectrum band (please refer to Vodacom’s comments under section 3.2) as it will advance the objectives of the efficient use of spectrum, promote the appropriate value of such spectrum through the AIP licensing model ensuring that the Authority is able to recover appropriate economic value and enable the support of desired quality of service. The adoption of LSA for TVWS will also reduce the potential for arbitrage that could distort the market.

## **3.4 Technology Ecosystem**

### **TVWS Ecosystem**

Vodacom submits that while TVWS based on DSA appears to be a promising solution, welcomed by research and investigation by multiple administrations globally; it still remains an emerging technology and is therefore immature. The availability of a supporting technology ecosystem is of critical importance in the enablement of mass deployment of related services.

Vodacom agrees with the Authority’s analysis that TVWS has been authorised in the United States by the Federal Communications Commission (“FCC”) and is under study in the United Kingdom (Office of Communications, “Ofcom”) and Canada. Vodacom would expect that the United States would be the first country where TVWS may be commercially deployed. It is therefore important to note that, so far, no mass market products have become available that would provide the benefits to the citizens of South Africa

envisaged in this consultation. All of the equipment that has been approved in the United States by the FCC<sup>16</sup> is either not mass market consumer grade (only carrier grade) or pre-production quality (for trials).

### Importance of an Ecosystem

In section 5.1 of the Discussion Paper, the Authority references SA Connect<sup>1</sup> which envisages a widespread communication system that will be universally accessible. Such a universally accessible communication system is critically dependent on the mass availability of cost effective consumer devices which can only be realised through the availability of a globally embraced technology ecosystem operating in the applicable spectrum band(s). Such a technology ecosystem cannot be realised in the absence of harmonisation and standardisation (please refer to Vodacom's comments under section 3.2).

The Authority should 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 was WiMAX<sup>17</sup> technologies which demonstrated significant promise both technologically and economically but ultimately failed to materialise.

### Mobile Ecosystem

In contrast, in applicable spectrum bands already allocated to Mobile Services, the IMT technology ecosystem is already globally embraced with overwhelming economies of scale and vibrant innovation in all portions of the IMT technology ecosystem from network equipment to user devices. This has been the critical enabler of mass market cost effective deployment globally of ever improving mobile communications technology benefiting all South Africans. While the 470 – 694MHz band is not currently supported by an IMT technology ecosystem (it is currently allocated to Broadcasting Services in ITU Region 1), it is important to note that it is not inconceivable that a supporting IMT technology ecosystem will develop in the near future considering the followings resolutions at WRC-15<sup>18</sup>:

- Decision to repurpose part of this band, namely 614 – 694MHz to Mobile Services in other countries like New Zealand (ITU Region 3);
- Resolution to review the allocation of the 470 – 694MHz band for ITU Region 1 at WRC-23<sup>19</sup>.

### Approach to TVWS

Vodacom therefore recommends that the Authority continue to investigate the potential implementation of TVWS as follows (please also refer to Vodacom's comments under section 3.2 and 3.3):

- On a secondary basis, in the part of the 470-694MHz band below 606MHz, namely 470 – 605MHz (noting that 606 – 614MHz is currently allocated to Radio Astronomy<sup>9</sup> on a primary basis);
- 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;
- Consider the potential re-allocation of Broadcasting Services to Mobile Services in the part of the 470 – 694MHz band above 614MHz, namely 614 – 694MHz subject to regional harmonisation;
- Ensure that the Authority does not adopt regulatory practices that would compromise the deployment or further investment in IMT technologies and related services due to market uncertainty or harmful interference in spectrum bands already allocated to Mobile Services on a primary basis.

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<sup>16</sup> Please refer to <https://apps.fcc.gov/oetcf/eas/reports/GenericSearch.cfm> - select "WGF" equipment class to view a list of all approved products. Equipment photographs also provide good insight into the applicable type of construction and form factors.

<sup>17</sup> Worldwide Interoperability for Microwave Access – IEEE 802.16 family of standards

<sup>18</sup> ITU World Radiocommunication Conference 2015

<sup>19</sup> ITU World Radiocommunication Conference 2023

## 4 Specific Questions

Q1. Do you agree that ICASA has the appropriate legislative mandate to address the issues of dynamic and opportunistic spectrum management and TV White Space and to build a suitable framework? If the answer is no, please elaborate

**Vodacom Response:**

Vodacom agrees that the Authority has the necessary legislative mandate “to consult, propose, request, decide on and publish regulations on DSA and or TVWS” under the relevant sections that apply to spectrum management and advancement of the electronic communication sector. Notwithstanding, it is important for the Authority to take cognisance that in applying its mandate it must ensure that it achieves the objectives as set out in the applicable sections of the Electronic Communications Act<sup>1</sup> (“ECA”).

Furthermore, any related regulations that the Authority may publish and ultimately promulgate in future must still remain within the confines of the Constitution of South Africa.

Q2. Are there any existing licensing models overlooked here?

**Vodacom Response:**

Vodacom’s view is yes, the Authority has overlooked a model based on Licensed Shared Access (LSA). Please refer to Vodacom’s comments under General Comments, section 3.3.

Q3. Do you have any comments about these four areas of spectrum reform?

**Vodacom Response:**

Vodacom understands that the Radio Frequency Spectrum License Fee Amendment Regulations of 2015<sup>6</sup> make provision for licensing fees for links operating above 50GHz to be calculated at the minimum fee of R120 per annum per link which is effective from the 01 April 2015. The Discussion Paper section 3.3.2(i) therefore incorrectly points out that spectrum licensing fees for links above 50GHz will be prohibitively expensive calculated at AIP<sup>6</sup>. Furthermore, this section contradicts with section 3.3.1(vii) of the Discussion Paper.

Q4. Do you favour making more licence exempt spectrum available in the 5 GHz band?

**Vodacom Response:**

Vodacom’s view is yes but subject to harmonisation with ITU Region 1.

Q5. And in any other bands? Be specific, please, and support your recommendations.

**Vodacom Response:**

Vodacom’s view is no other bands should be considered at this time as the current bands are sufficient.

Q6. Do you believe that the Dynamic Spectrum Assignment approach is viable and worthwhile?

**Vodacom Response:**

Please refer to Vodacom’s comments under General Comments - sections 3.2, 3.3, 3.4.

Q7. Do we have enough data about the TV broadcast transmitters to be able to model their propagation accurately?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments - sections 3.2, 3.3, 3.4. Vodacom notes that the data required to model the propagation associated with television broadcast transmitters accurately, include transmitter power, antenna gain and radiation patterns, transmit frequency, accurate site position, antenna height as well as accurate and calibrated propagation models with up to date Digital Terrain Models (DTM), vector data and clutter data. Based on Vodacom's experience, it could be challenging to obtain all this data accurately and even more so to update and maintain it.

Vodacom submits that this requires further research and recommends that it be addressed through further trials and testing activities.

Q8. Does enabling the operation of TVWS contribute to the objective of ensuring efficient use of radio frequency spectrum?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments - sections 3.2.

Q9. Do you believe that it will also further objectives of encouraging investment and innovation in the electronic communications sector?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – sections 3.2, 3.3 and 3.4.

Q10. What are the benefits that could be expected from making TVWS available?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3.2.

Q11. What are the disadvantages that could be expected from making TVWS available?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3.

Q12. Do you foresee any risks?

**Vodacom Response:**

Vodacom's view is yes, there are potential risks. Please refer to Vodacom's comments under General Comments – section 3.

Q13. Does it support SA Connect goals regarding the deployment and adoption of broadband?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3. While TVWS appears to have the potential to contribute toward the goals of SA Connect<sup>1</sup>, due to the immaturity of the technology it is not yet possible to determine the extent to which it will contribute to these objectives applying due consideration of the current achievements of existing technologies like IMT.

Q14. What mechanisms should be put in place for dynamic spectrum assignment in meeting future demand for spectrum?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3.

Q15. Could TVWS provide increased consumer value and/or improved social and economic inclusion?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3.3.

Q16. What impact is the digital switchover expected to have on the use and availability of TVWS?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3.2, in specific subsection: "why mobile spectrum is unsuitable for TVWS"

In the 470 – 694MHz spectrum band, white spaces available for TVWS deployment in the frequency domain will decrease post DTT migration but there may still be an opportunity in the geographic white space domain.

Q17. Do you believe white spaces should be utilised without authorisation or licensing?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3.3. Vodacom's view is no, TVWS should be licensed based on Licensed Shared Access subject to the AIP<sup>6</sup> model.

Q18. Should there be rules for such usage?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – sections 3.2 and 3.3. Vodacom's view is yes in line with rules of the current exclusively licensed (fully licensed) model.

Q19. Does the advent of TVWS have the potential to remove the existing "spectrum scarcity", at least in some bands?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3. Vodacom's view is no, TVWS will not resolve spectrum scarcity.

Q20.

**Vodacom Response:**

Vodacom notes that Question 20 (Q20) was omitted by the Authority in the Discussion Paper.

Q21. Is there a space for license-exempt, unmanaged use of TVWS?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3.3. Vodacom's view is no, the Authority should not consider a license-exempt, unmanaged licensing model for TVWS.

Q22. Is there a space for license-exempt, managed use of TVWS?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3.3. Vodacom's view is no, the Authority should not consider a license-exempt, managed licensing model for TVWS.

Q23. Is there a space for licensed use of TVWS?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3.3 and Q17.

Q24. If so, should licensed users pay the minimum annual fee, or a fee proportionate to use?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3.3 and Q17.

Q26. Which of the licensing regimes do you favour? Why?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3.3 and Q17.

Q28. Do you see this as possible? Why / why not?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3.2. Vodacom's view is that the successful implementation of TVWS based on DSA is highly dependent on the consistent availability of an accurate database of frequency assignments and propagation models to ensure that instances of harmful interference is avoided.

Furthermore, it must be noted that the successful deployment of TVWS, as mentioned in section 3.4, is dependent also on the availability of a global ecosystem based on mature technology, in addition to accurate databases and propagation models.

Q29. Does this provide a significant improvement on the status quo?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3. While TVWS appears to have the potential to contribute toward the goals of SA Connect<sup>1</sup>, due to the immaturity of the technology it is not yet possible to determine extent to which it will realise in practice.

Q30. If some form of this approach is adopted, how should TVWS databases and TVWS database service providers be managed?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3. Vodacom's view is that due to the immaturity of TVWS at this stage, it is not yet possible to determine the best practice that should be employed for TVWS database management. Vodacom recommends that the Authority adopt practices in line with global harmonisation.

Q31. From a South African perspective what will be the socio-economic benefits of TVWS?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3.

Q32. Will TVWS be of the most benefit to rural or urban areas? Please provide reasons – technical and socio-economic

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3. Vodacom's view is that subject to the maturity of the technology supported by a global ecosystem, TVWS may potentially offer benefit more so to rural communities provided that it does not harm current and future investments in other developed ecosystems like IMT.

Q35. How should South Africa define TVWS?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3.2.

Q36. How will the rules for non-compliance apply?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3.3. Vodacom's view is in line with the current rules of the exclusively licensed (fully licensed) model.

Q37. On what basis should white space use in the 470-694 MHz band be authorised?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3.

Q38. Do the benefits of adopting a licence-exempt managed assignment approach apply?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3.3 and Q22.

Q40. Do you think that licensed use of TVWS requires the operator to have an ECNS licence?

**Vodacom Response:**

Taking into account section 7 of the ECA<sup>7</sup> and the definition of an Electronic Communications Network Service ("ECNS") as defined in the ECA<sup>7</sup>, Vodacom's view is yes, a TVWS operator must hold a valid ECNS license.

Q41. Should the white spaces database approach be adopted and or is there an alternative system?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3. Vodacom's view is that due to the immaturity of the technology at this stage, it is not yet possible to determine whether it should be adopted or not.

Q43. Should the Authority allow – or require - sensing as an option at this time?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3. Vodacom's view is that due to the immaturity of the technology at this stage, it is not yet possible to firmly determine whether it should be adopted or not.

Q46. What parameters should the Authority set forth for TVWS databases?

**Vodacom Response:**

Vodacom's view is that due to the immaturity of TVWS at this stage, it is not yet possible to comprehensively determine all the parameters that will be required for TVWS and submits that in order to determine this, further research is required. Please also refer to Vodacom's comments under General Comments – section 3.

Q50. Should mobile devices be obliged to have geolocation determination capability? How should the regulatory framework differentiate among devices types?

**Vodacom Response:**

Vodacom's view is that due to the immaturity of TVWS at this stage, it is not yet possible to determine the best practice that should be employed for geolocation or differentiation between device types. Vodacom recommends that the Authority adopt practices in line with global harmonisation. Please also refer to Vodacom's comments under General Comments – section 3.

Q51. What rules should be attached to each type of device?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3. Vodacom's view is that due to the immaturity of TVWS at this stage, it is not yet possible to determine the best practice that should be employed for geolocation or differentiation between device types. Vodacom recommends that the Authority adopt practices in line with global harmonisation.

Q52. Should operating parameters differ by device type or technology?

**Vodacom Response:**

Vodacom's view is that due to the immaturity of TVWS at this stage, it is not yet possible to determine the best practice that should be employed for operating parameters by device type. Vodacom recommends that the Authority adopt practices in line with regional harmonisation. Please also refer to Vodacom's comments under General Comments – section 3.

Q53. Should transmit power levels be different for different device types?

**Vodacom Response:**

Vodacom's view is that due to the immaturity of TVWS at this stage, it is not yet possible to determine the best practice that should be employed for transmit power levels of different device types. Vodacom recommends that the Authority adopt practices in line with regional harmonisation. Please also refer to Vodacom's comments under General Comments – section 3.

Q54. Should the Authority consider a variable power limit which could increase the utility of spectrum for devices?

**Vodacom Response:**

Please refer to Vodacom's comments to Q53.

Q55. Should there be a maximum power output and what maximum power level should the Authority consider?

**Vodacom Response:**

Please refer to Vodacom's comments to Q53. Vodacom submits that the Authority must prescribe a maximum power output level.

Q56. Should licensed devices be allowed a higher power limit than licence-exempt devices?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3.3 and Q17.

Q57. Recognising that allowing adjacent channel use would significantly improve spectrum utilisation and increase the amount of spectrum available for use by TVWS devices, should the Authority permit TVWS devices to operate in channels adjacent to incumbent operations? Please substantiate

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3.

Q58. Are there any substantiated concerns regarding harmful interference associated with adjacent channel operation?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3.

Q59. Should the Authority establish out of band emissions limits in order to improve spectral efficiency? If so, what are your recommendations to protect incumbent operators? What out-of-band emissions rules will best improve spectral efficiency and protect incumbent operations?

**Vodacom Response:**

Vodacom's view is that due to the immaturity of TVWS at this stage, it is not yet possible to determine the parameters that should be employed for out of band emission limits for TVWS and submits that in order to determine this, further research is required. Please also refer to Vodacom's comments under General Comments – section 3.

Q61. Which propagation model or models are most accurate for this application?

**Vodacom Response:**

Vodacom's view is that the Authority should consult with the television broadcasting operators to determine the most appropriate models for TVWS. Please also refer to Vodacom's comments under General Comments - section 3.

Q62. Which model or models maximise spectral efficiency?

**Vodacom Response:**

Please refer to Vodacom's comments to Q61.

Q63. Which models best protect incumbent operations?

**Vodacom Response:**

Please refer to Vodacom's comments to Q61.

Q64. Overall, what is the appropriate method of determining the required protection from authorised users in the TV bands?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3.2.

Q65. On balance, do the potential benefits of permitting licence-exempt managed assignment TVWS devices outweigh any potential risks?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3.3 and Q17.

Q66. Do the techniques discussed above adequately mitigate any interference potential?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3.

Q67. Should we oblige every device to have GPS location capability?

**Vodacom Response:**

Please refer to Vodacom's comments to Q50.

Q68. In the US model, only latitude and longitude was required of GPS location. Is there any reason why we shouldn't demand full 3D location?

**Vodacom Response:**

Vodacom's view is that if latitude and longitude information from a GPS system is available, it should be possible to provide height information and therefore supports that the Authority adopt a practice of requiring the provision of full 3D location information.

Q69. What about the situation where a fixed device is professionally installed with an external antenna and an internal unit. Should we accept the location details provided by the installer? Using what mechanism?

**Vodacom Response:**

Vodacom's view is that due to the likelihood of human error as well as unauthorized relocation of devices, the Authority should not adopt a practice of depending on location information determined on a manual basis. Please also refer to Vodacom's comments under General Comments – section 3.4.

Q70. Do you believe that Dynamic Spectrum Assignment should be applied to other bands, beyond the proposed TVWS operation? Plea/se provide reasons?

**Vodacom Response:**

Please refer to Vodacom's comments under General Comments – section 3.2, 3.3 and 3.4. Vodacom's view is that TVWS should not be applied in spectrum allocated to Mobile Services for the deployment of IMT.

END