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Dear Mr Makgotlho

**RE: TELKOM'S WRITTEN SUBMISSION ON THE DISCUSSION PAPER ON THE DRAFT
FRAMEWORK FOR DYNAMIC AND OPPORTUNISTIC SPECTRUM MANAGEMENT**

Telkom SA SOC LTD ("**Telkom**") welcomes the opportunity to provide written comments on the Discussion Paper on the Draft Framework for Dynamic and Opportunistic Spectrum Management ("**Discussion Paper**"), as published in Government Gazette No. 39302 (Notice 1001 of 2015) on 19 October 2015.

Please find herewith Telkom's written comments, and in the event that the Authority convenes public hearings in relation to the subject matter hereof, Telkom would appreciate an opportunity to make oral submissions thereto.

Yours Sincerely



Siyabonga Mahlangu
Group Executive: Regulatory Affairs and Government Relations

Submission to the Independent Communications Authority of South Africa

Discussion Paper

Government Gazette No. 39302 (Notice 1001 of 2015) of 19 October 2015

Telkom SA SOC Ltd

Submission date: 22 January 2016

1 Executive Summary

As the global demand for spectrum intensifies, new spectrum management approaches such as Dynamic Spectrum Assignment (DSA) in Television White Spaces (TVWS) are attracting considerable interest globally. As with any other technology capable of providing broadband access, DSA in TVWS has the potential to contribute to economic growth, increase social inclusion, enhance productivity and create jobs. In order to fully exploit the benefits offered by DSA and minimise the risks associated with the introduction of this new technology, it is imperative that the following factors be taken into account:

1. **Scope of Regulation** – The future regulatory framework for TVWS should cover, *inter alia*:
 - i. **Licencing Method** – The adoption of the mixed licensing regime is supported.
 - ii. **Type Approval** – Type approval of all TVWS equipment and databases in accordance with defined technical standards.
 - iii. **Spectrum Fees** – Application of the AIP regime in order to levy a fee proportionate to the use of spectrum and covering at least the cost in managing the spectrum.
 - iv. **Interference Management** – The Authority should be responsible for the definition or development of clearly defined technical standards that will permit the interference free operation of TVWS devices. These should be developed in collaboration with industry. Moreover, the Authority should be responsible for the resolution of cases of harmful interference, as is currently the case.
2. **Adoption of Harmonised Technical Standards** – The Authority should endeavour to adopt harmonised technical TVWS standards in order to benefit from economies of scale, facilitate roaming and to mitigate cross-border interference.
3. **Rural Focussed Deployment of TVWS** – Rural areas have higher availability of TV whitespaces than urban settings thus facilitating the unconstrained and interference free deployment of TVWS technology. In addition, rural settings have low levels of broadband coverage and therefore stand to benefit greatly from technologies, such as TVWS, which are geared toward providing broadband access, albeit at unpredictable levels of quality of service.

4. **Hybrid Database/Sensing Approach** - A hybrid geolocation database/sensing model should be adopted, where spectrum sensing will be used in conjunction with the geolocation base. It is envisaged that the hybrid system will enhance channel identification and interference resolution capabilities
5. **Mandatory Registration of all TVWS Devices** – Any TVWS device which has the potential (sufficient transmit power) to cause harmful interference should be subject to registration.
6. **Delayed Introduction of Mobile TVWS Devices** - The introduction of mobile device types be implemented only after fixed TVWS devices demonstrate sustained interference free operation in commercial deployments. If mobile devices are implemented, the FCC/Canadian approach seems viable.
7. **GPS Location Capability** - Inclusion of GPS location capability in all TVWS devices as this will expedite the resolution of cases of harmful interference.
8. **Restricting DSA to TVWS frequencies** - It is premature to consider extending DSA to other frequency bands when the technical and commercial feasibility of TVWS technologies have yet to be proven.

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2 Response to Key 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 Spaces and to build a suitable framework? If the answer is no, please elaborate.

Yes.

Q2. Are there any existing licensing models overlooked here?

The examples provided in section 3.3.1 are not licensing models per se, but rather specific instances of licensing. In general, the Radio Frequency Spectrum Regulations 2015 prescribes four spectrum licensing mechanisms, namely licence exempt, standard application, extended application and Invitation to Apply.

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

Telkom wishes to highlight that spectrum reform is not limited to the four areas mentioned in the Discussion Paper. In actual fact, many other reform initiatives are underway, mainly through the ITU WRC process, which endeavours to improve spectrum utilisation and efficiency through the allocation of spectrum for new services.

Telkom's specific comments on the Authority's proposals follow:

- The statement "above 30 MHz" is not clear although it is assumed to mean "above 50 GHz".
- Applicability of the Spectrum Fee Regulations for frequencies above 50 GHz – It is incorrectly stated that annual spectrum fees for links above 50 GHz are prohibitively expensive. A recent amendment to the Spectrum Fee Regulations, as contained in GG 38642, Notice 280 of 2015, mandates that for links above 50 GHz the minimum fee of R120 applies. Moreover, it must be noted that this "reform above 50 GHz" currently addresses only the use of specific bands above 50 GHz for fixed terrestrial services (i.e. E-Band and V-Band). There are also other spectrum reform initiatives for other services and frequency bands (e.g. new spectrum bands for 5G, fixed services in bands above 250 GHz, etc.).
- Power Line Communications – The adoption of globally harmonised standards and to an extent regulatory frameworks are critical success factors for the implementation of

new technologies such Power Line Communications. Telkom notes that draft technical standards Power Line Communications were published in the past however these were never concluded. It is also debatable whether PLC should be seen as a spectrum reform matter although the issue of harmful interference resulting for these systems is a definitive issue to be addressed.

- Licence Exempt Spectrum – There are several frequency bands that could be identified for licence-exempt use in South Africa for a range of applications and services. Whereas certain bands have been identified in the Radio Frequency Spectrum Regulations 2015, it is noted that these require a comprehensive review to bring same in line with international developments. The potential use of the 5 GHz for licence exempt applications was on the WRC-12 agenda although no decision on such use was taken. This matter will be further studied by the ITU with a final decision taken probably at WRC-19.

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

Telkom will actively participate in the WRC-19 preparatory process on this matter. Moreover, Telkom is of the view that a decision regarding the use of potential bands on a licence exempt basis must always take into account the current primary use and protection of such primary services.

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

Telkom has not earmarked specific bands for licence exempt use, however it is suggested that the Authority carefully monitor ITU Region 1 developments with a view of ensuring harmonised service allocations and frequency usage, to the greatest extent possible.

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

The effective and efficient use of spectrum is important in order to address increasing spectrum requirements. Exploring of Dynamic Spectrum Assignment is therefore worthwhile and supported. New technologies based on the Dynamic Spectrum Assignment approach are however in the early stages of development and therefore Telkom is unable to provide an informed view regarding its viability. Nevertheless, Telkom suggests that the Authority conduct studies and closely monitor international developments, with a specific focus on the following, *inter alia*, in order to determine the viability of this technology.

- Extent of technology uptake globally
- Degree of adoption of harmonised technology standards
- Costs of Deployment
- Scalability – The ability to ensure future bandwidth bottlenecks are avoided
- Resiliency – Access to infrastructure that can endure potentially disrupting and critical situations
- Quality of Service – The level of quality service provided
- Interoperability – the ability of user equipment from different vendors to operate with other vendors' network equipment.

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

Yes, all technical information regarding the National TV network should be available as this is also used for national planning purposes. Furthermore, it is assumed that this information was utilised when conducting the recent TVWS trials in South Africa.

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

Yes¹, however the benefits of efficient spectrum usage will not be realised if the use of TVWS results in harmful interference towards primary users such as existing TV broadcasters, as well as services in adjacent bands.

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

The attainment of these objectives is underpinned by the establishment of a stable regulatory environment and high levels of service uptake.

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

The availing of TVWS spectrum for non-broadcasting type services such as fixed and mobile could result in a higher degree of use of traditional broadcasting spectrum and may facilitate the extension of the broadband coverage footprint, particularly in rural areas.

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

The principle disadvantage is the unpredictability associated with use of TVWS for the provision of non-broadcasting type services. Of particular concern is ongoing spectrum availability, susceptibility to harmful interference, irregular levels of quality of service and potential for harmful interference towards primary services. Furthermore, the resolution of harmful interference between TVWS devices and broadcasting services may prove to be problematic and may be challenged in court in instances where TVWS providers offer

¹ The term efficient spectrum use has not been defined, however in the context of this Discussion Paper Telkom interprets this term as the degree or intensity of spectrum usage.

commercial services and are requested to terminate same due to incompatibility with broadcasting services.

Q12. Do you foresee any risks?

Yes, the following risks are envisaged:

- The deployment of TVWS technologies may hinder the future co-primary allocation of the 470-694 MHz frequency range to other services such as mobile. (to be discussed at WRC-23).
- TVWS deployments may cause harmful interference to in-band and adjacent-band primary services.
- The introduction of TVWS technology may distort the market given that certain operators will provide wireless broadband offerings, without having to pay exorbitant spectrum fees or being subject to burdensome roll-out obligations.
- The limited availability and unpredictable availability of TVWS spectrum provides a significant barrier for servicing future data traffic requirements.
- The elimination of once available TVWS due to changes in the allocation of the 470-694 MHz frequency range or deployment of additional broadcasting channels may result in consumers being stranded without services. Moreover, the TVWS operator may incur significant losses to revenue and OPEX.

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

The introduction of TVWS technologies may advance the SA Connect goal of extending the wireless broadband coverage footprint. However, the uncertainty of spectrum availability, potential low levels of quality of service and susceptibility to harmful

interference do not support the attainment of SA Connect speed targets and may also serve as an impediment for service uptake.

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

Wireless networks that utilise licenced spectrum are the principal means for the delivery of broadband services. Dynamic spectrum assignment on the other hand utilises spectrum on a secondary basis and merely serves as complement to licenced wireless networks. Telkom is therefore of the view that it is not necessary to consider mechanisms that result in spectrum security of tenure for TVWS service providers. Efforts should rather be focussed on allocating and assigning additional spectrum on a fully licenced basis with the understanding that dynamic spectrum access players may be accommodated subject to technical feasibility.

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

Like other technologies used to deliver broadband services, TVWS has the potential to increase consumer value and improve social and economic inclusion. However, the attainment of the aforementioned benefits is underpinned by the degree of harmonised TVWS use, equipment economies of scale and the potential uptake of this service.

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

Telkom has not conducted a technical assessment of the use and availability of TVWS post digital switchover and is therefore unable to provide a response. However, it appears as if the relevant analyses have already been conducted in the Discussion Paper, which states the following:

“After the analogue to digital migration and subsequent restacking (digital to digital migration), 75% of spectrum will be unused in any one of the 11 regions. Except on the border areas, all of this 168 MHz will be available for TVWS use.”

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

No, Telkom is of the view that the implementation of authorisation and licensing measures are crucial in order to ensure the effective management and mitigation of harmful interference towards primary spectrum users. As a minimum, this will be required until such time as the concept of TVWS/DSA utilising automatic and real time access to a suitable geo-location database for self-coordination and management has proven to be successful.

Q18. Should there be rules for such usage?

Yes, it is imperative that rules are established in order to outline the actual DSA mechanism, to mitigate harmful interference towards primary users and to also mitigate harmful interference towards other secondary TVWS users. Furthermore, detailed interference resolution procedures will be required to ensure speedy resolution of such.

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

No. Although TVWS will bring additional spectrum to the market for wireless services and also increase the use of otherwise underutilised broadcasting spectrum, it will not necessarily remove spectrum scarcity for other technologies such as 4G and 5G, which requires licenced spectrum. Telkom is of the view that the Authority should rather focus on making additional licensed spectrum available as the primary means to address spectrum scarcity as opposed the adoption of volatile technologies to solve this problem.

Q20. [Question not provided]***Q21. Is there a space for license-exempt, unmanaged use of TVWS?***

No, the lack of regulatory oversight will result in severe degradation of both in-band broadcasting networks and adjacent band mobile networks. Moreover, no current TVWS model permits deployment on a licence-exempt unmanaged basis. Furthermore, the

secondary use of the broadcasting frequency band for SAP/SAB (services ancillary to program making/services ancillary to broadcasting) services will be negatively affected.

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

Yes, where the lack of regulatory control over harmful interference can be offset by imposing limits on the permissible transmit power of TVWS devices. Knowledge of deployed TVWS devices and networks is essential to ensure that harmful interference can be resolved.

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

Yes, TVWS could be deployed on a licenced basis as this will promote the commercial viability of the technology. In particular, TVWS devices will be afforded protection from other similar devices thereby facilitating the provision of services at a defined quality. However, it should be noted that all TVWS deployments will remain susceptible to interference from primary broadcasting deployments.

Telkom recommends that future regulations explicitly state that the licenced use of TVWS does not provide protection from primary broadcasting services and cannot claim protection from these primary services. This will serve to mitigate the possibility of legal challenges in cases where commercial TVWS services must be terminated.

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

Telkom is of the view that a fee proportionate to the use of spectrum and in accordance with Administrative Incentive Pricing (AIP) should be charged. An internationally accepted practice is that the fee should, as a minimum, cover the spectrum management costs associated with the management of the spectrum. In this regard, the Authority could also consider appropriate fees for un-licensed use, to cover for example costs associated with resolution of interference, database establishment and management, etc.

Q25. Does the combination give us the best of both worlds?

Yes, the mixed regime offers benefits of both the licenced and licence-exempt managed regimes.

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

Telkom favours the adoption of the mixed licensing regime. This regime affords the necessary protection to primary users, allows TVWS operators the ability to offer improved quality of service and also promotes rapid deployment and innovation.

Q27. Rank the licensing regimes in order of preference with reasons for your preferred order.

- **Mixed Licencing** - This regime affords the necessary protection to primary users, allows TVWS operators the ability to offer improved quality of service and also promotes rapid deployment and innovation.
- **Fully Licenced** - This regime affords the necessary protection to primary users and allows TVWS operators the ability to offer improved quality of service.
- **Licence Exempt Managed** - The moderate regulatory oversight may result in instances of harmful interference towards primary services and disruption of services offered by other TVWS operators. Moreover, eliminating the cost of acquiring prime licenced spectrum for the provision of cellular type services could create an unfair advantage for TVWS operators
- **Lite Licenced** – The minimal regulatory oversight may result in instances of harmful interference towards primary services and disruption of services offered by other TVWS operators. Moreover, the marginal cost of acquiring prime licenced spectrum for the provision of cellular type services could create an unfair advantage for TVWS operators
- **Licence Exempt Unmanaged** - The absence of regulatory oversight will significantly increase the prolonged instances of harmful interference towards

primary services and the disruption of services offered by other TVWS operators. Moreover, eliminating the cost of acquiring prime licenced spectrum for the provision of cellular type services could create an unfair advantage for TVWS operators

An issue that is not addressed specifically in the discussion paper although very important, is the coordination between TVWS devices and networks and existing and planned services operating in neighbouring countries, in particular broadcasting services. All TVWS and DSA operations within South Africa must ensure the full protection of all services operating in neighbouring countries in accordance with the ITU Radio Regulations, in particular Article 5.

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

Yes, several trials worldwide have demonstrated that TVWS devices may be used in automated manner with geolocation databases. However, it should be noted that certain modifications to the back-end operations may have to be undertaken in order to implement certain aspects of the licencing regime, as outlined in Section 5.2.6 of the discussion paper.

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

Yes, the novel automated licensing approach proposed in Section 5.2.6 of the discussion paper provides significant improvements over the popular licence exempt unmanaged regime. In particular, the automated licensing approach introduces the benefits of enhanced interference mitigation capability, affords TVWS operators the opportunity to provide a defined level of service and also promotes rapid deployment and innovation. Further, an automated process should endeavour to lessen the possibility of circumventing the rules, as is currently the case in other bands where regulatory measures such as DFS (Dynamic Frequency Selection) are disabled or stipulated transmit power levels are exceeded in order to improve service quality of unlicensed radio apparatus.

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

Telkom supports certain aspects of the approach adopted by the UK regulator OFCOM:

- Commercial, multiple operators of the databases with no cost to or levied by the regulator.
- The regulator is responsible for providing source licensee data and for ensuring the protection of primary spectrum users.
- All potential database providers are rigorously tested by the regulator before approval, and once approved that authorization is placed online. All devices are required to consult this online approval before making a request for spectrum from a database to ensure only authorized and legitimate databases are used.
- The regulator will only periodically authorize databases and thus control the number available, similarly only commercially operational databases will be authorized.
- Databases do not have a public interface as such but are required to provide a specific interface available to the regulator for enforcement purposes.

Telkom is of the view that the abovementioned approach represents a low risk to the Authority in regulatory terms whilst also allowing maximum control over the selection and operation of the database providers.

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

As with any other technology capable of providing broadband access, TVWS has the potential to contribute to economic growth, increase social inclusion, enhance productivity and create jobs. However, the realisation of these benefits are underpinned by, *inter alia*, the adoption of harmonised TVWS standards and appropriate regulatory frameworks.

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

Urban settings contain fewer TV white spaces as compared to rural areas thus increasing the possibility of harmful interference and possibly constraining TVWS deployment. Furthermore, majority of urban areas are already within the coverage footprint of operators that offer high quality fixed and mobile services.

Rural settings on the other hand have higher availability of TV whitespaces, thus facilitating the unconstrained deployment of TVWS technology. In addition, rural settings have low levels of broadband coverage and therefore stand to benefit greatly from technologies, such as TVWS, which are geared toward providing broadband access, albeit at unpredictable levels of quality of service. The cost of providing TVWS networks and services is also key and will determine the uptake of these services; in particular in initial years the cost could be high until economies of scale is reached (which could take several years).

Q33. Please provide proposals on the regulatory framework (including none at all) for TVWS

Telkom proposes a TVWS regulatory framework, which addresses the following, *inter alia*:

- **Licencing Method** – The adoption of the mixed licensing regime as proposed in section 5.2.5 is supported.
- **Type Approval** – Type approval of all TVWS equipment and databases in accordance with internationally harmonised standards.
- **Spectrum Fees** – Application of the AIP regime in order to levy a fee proportionate to the use of spectrum and covering at least the cost in managing the spectrum.
- **Geolocation Database Management** - Management of geolocation databases as per the response to question 30 above.

- **Interference Management** – The Authority should be responsible for the definition or development of clearly defined technical standards that will permit the interference free operation of TVWS devices. These should be developed in collaboration with industry. Moreover, the Authority should be responsible for the resolution of cases of harmful interference, as is currently the case.

Q34. What are the advantages and disadvantages of different methods?

It is unclear what the Authority means by different methods and therefore Telkom cannot provide an informed response to this question. Given that “different methods” refers to the licensing methodology, Telkom directs the Authority to our response to question 27 above.

Q35. How should South Africa define TVWS?

Telkom supports the following definition of TVWS, which has been adapted from section 2 of the Discussion Paper:

“TVWS refers to bandwidth within the 470 – 694 MHz frequency range that is not used by primary licenced users at a specific location or at a specific time.”

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

This question requires clarification before a meaningful response can be provided thereto. In particular, Telkom requires clarification regarding the area of non-compliance addressed in Q.36.

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

Telkom supports authorisation of TVWS in accordance with the mixed licensing regime proposed in section 5.2.5 of the Discussion Paper.

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

Mixed licencing is a hybrid regime which will utilise both fully licensed and licence exempt managed approaches in parallel. Therefore, the benefits of the licence exempt approach will be realised.

Q39. If a licence-exempt managed assignment approach is adopted, what registration requirements, if any, might apply?

Telkom is of the firm view that all TVWS devices should be required to register with a geolocation database prior to being allowed to access available channels. This is a crucial requirement for identification of offending devices in scenarios where harmful interference occurs.

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

TVWS operators will deploy a network that will be used for the provision of an electronic communications service, thereby prompting the requirement for an ECNS licence, as per section 7 of the Electronic Communications Act of 2005, as amended.

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

Telkom is of the view that a hybrid database/sensing should be adopted, where spectrum sensing will be used in conjunction with the geolocation base. It is envisaged that the hybrid system will enhance channel identification and interference resolution capabilities.

Q42. What additional measurements should be adopted for greater accuracy?

TVWS devices should validate database entries with real-time in-field measurements and provide feedback to the database to possibly amend inaccurate records. Furthermore, new TVWS device's operating characteristics should be reported to the database.

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

Telkom is of the view that sensing should be a mandatory requirement for future TVWS deployments. The absence of appropriate sensing measures will result in a scenario where the identification of available channels is entirely predicated on the basis of a theoretical model. However, Telkom does acknowledge that TVWS spectrum sensing systems are in the early stages of development and are yet to be commercially deployed.

Q44. What mechanisms should be put in place to ensure that database providers obtain information required to protect incumbent operations (e.g. location of TV transmitters)?

Telkom is of the view that a memorandum of understanding should be established between the database providers and the Authority in order to establish a well-defined process for information exchange. Moreover, it may be necessary that database providers are bound by certain agreements in order to maintain the confidentiality and integrity of data provided by the Authority. Moreover, the primary user of the band (in this case broadcasters) should have access to the database and must also ensure (for their own benefit and protection) that all information is accurate and up-to-date.

Q45. What mechanisms should be put in place to ensure that broadcasters and/or signal distributors provide the Authority and database operators with accurate updated information?

Telkom is of the view that primary spectrum users should be granted access to the database in order to ensure that the information contained therein is accurate and up to date.

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

In general, these should be the technical parameters required for interference analysis and identification of available TVWS. Possible parameters for inclusion in the database are, inter alia:

- Operator Name
 - Technology Type (i.e. BC or TVWS)
 - Location (co-ordinates)
 - Antenna height
-

- Centre frequency
- Bandwidth
- Transmit-power
- Antenna gain
- Antenna radiation pattern
- Feeder loss
- Total EIRP
- Receive sensitivity/modulation table
- Interference rejection ratio
- UL/DL timeslot allocation (for TDD)

Q47. What criteria should be used to certify, recognise, or authorise TVWS databases?

Telkom is of the view that the following, *inter alia*, should be assessed when certifying TVWS databases:

- Compliance with the standards adopted for the identification of available TVWS and for interference resolution.
- Existence of a specific interface, which is accessible by the Authority for enforcement purposes.
- Adherence to data security standards
- Ability to provide redundancy should a particular TVWS database fail

Q48. How should the Authority approach issues such as non-discrimination, security, and quality of service?

Telkom is of the view that the most effective means to address the aforementioned issues is the development of relevant regulations via a public consultation process.

Q49. Should the Authority require the registration of some or all devices? If only some, which devices?

Telkom recommends that any TVWS device which has the potential (sufficient transmit power) to cause harmful interference should be subject to registration.

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

Telkom suggests that the introduction of mobile device types be implemented only after fixed TVWS devices demonstrate sustained interference free operation in commercial deployments. If mobile devices are implemented, the FCC/Canadian approach seems viable.

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

Telkom is of the view that the operation of fixed TVWS devices should be governed by exercising control over the following, *inter alia*:

- Transmit power limits
- Automatic transmit power control (ATPC)
- Database dependant frequency assignment
- frequency sensing (listen before talk) with database feedback

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

Telkom does not support the introduction of mobile device types prior to fixed TVWS devices demonstrating sustained interference free operation in commercial deployments. Telkom can only provide a meaningful response to this question once the behaviour of fixed TVWS devices has been thoroughly investigated.

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

Telkom suggests that the introduction of mobile device types be delayed until fixed TVWS devices demonstrating sustained interference free operation in commercial deployments. Nevertheless, different device types could have different stipulated maximum transmit power levels. For example, fixed links with highly directional antenna will cause less interference than a mobile device with an omni-directional antenna or even a PTMP network with a sectorial antenna therefore justifying different power levels. The determination of specific power levels is complex and will require substantial work.

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

Yes, Telkom supports the implementation of automatic transmit power control.

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

Yes, Telkom supports the adoption of maximum power levels that are aligned with harmonised technical standards. See also response to Q53 above. In particular the Authority may wish to consider adoption of the standards adopted by OFCOM in order to promote regional harmonised use of TVWS>

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

Yes, licensed TVWS operators, unlike licence-exempt operators, will endeavour to offer services at a defined level of quality. As a result, licenced operators should be allowed to utilise higher transmit powers. Moreover, licensed operators should be allowed to utilise higher transmit powers on the basis that they are charged for spectrum utilisation, unlike their licence exempt counterparts.

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

Yes, licensed TVWS operators, unlike their licence-exempt counterparts, will endeavour to offer services at a defined level of quality. As a result, licenced operators should be allowed to utilise higher transmit powers. Moreover, licensed TVWS operators should be allowed to utilise higher transmit powers on the basis that they are charged for spectrum utilisation, unlike their licence exempt counterparts. In general licence exempted operations have much lower transmit power levels in order to facilitate protection of the primary services operating in the band.

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

Telkom wishes to highlight that certain television receivers may have poor adjacent channel rejection ratios, thus enhancing their susceptibility to harmful interference. This is particularly true for older television receivers, which have been designed with “cheaper” filters. The issue of adjacent channel interference between mobile IMT systems operating above 694 MHz and the protection of broadcasting receivers operating below 694 MHz (on channel 48; adjacent channel) was one of the most problematic and contentious issues to be resolved at WRC-15. Density of the interference source was a key element in this regard.

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?

Telkom supports the adoption of technical criteria that are aligned with international standards. The TVWS device OOBE levels will determine whether adjacent channel operations with broadcasting receivers are possible or not (see response to Q58 above). Again, density of deployment of TVWS devices will have an impact.

Q60. Should the Authority mandate a particular propagation model for database providers?

Yes, Telkom supports the mandatory adoption of the appropriate propagation model/s (and parameters) as this will ensure that database providers achieve similar results when conducting interference analyses. In ITU sharing and compatibility studies, the establishment of common technical and operational parameters for all involved systems, as well as the propagation model and its parameters, is key prior to the commencement of studies.

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

Choosing an appropriate propagation model for interference assessments is very important and also complex. Generally, there are several propagation standards involved that could be adopted. Without going into details, Telkom refers the Authority to Annex 2 of Document JTG 4-5-6-7/715 (see Attachment 5). Although this document speaks specifically to the mobile (IMT) versus broadcasting sharing and compatibility in UHF as part of the WRC-12 preparations, it is a good starting point for addressing this matter.

Q62. Which model or models maximise spectral efficiency?

See Telkom's response to Q61.

Q63. Which models best protect incumbent operations?

See Telkom's response to Q61.

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

A possible method would entail a database specifying a channel and prescribing technical parameters for TVWS devices, with a view of ensuring that the protection criteria for broadcasting services, such signal to noise ratio or percentage of degradation in location probability, is strictly adhered to. See also response to Q61.

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

In general, TVWS technologies offer the benefit of extending broadband coverage and increased spectrum utilisation whilst introducing the risk of potential interference towards primary broadcasting services. The determination of whether the benefits of TVWS outweigh the risks will require, *inter alia*, detailed technical and economic studies. Telkom has not performed the aforementioned studies neither do we have knowledge of the existence of same. In principle Telkom would say that the benefits will outweigh the potential risks, as these risks can be managed.

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

Thorough theoretical studies as well as detailed trials and pilots over extended periods are required in order to determine the interference mitigation potential of a particular technology. In view of the fact the Telkom has not participated in any trials or pilots utilising the above technologies, we are unable to provide a more detailed response to Q66.

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

Telkom supports the inclusion of GPS location capability in all TVWS devices as this will expedite the resolution of cases of harmful interference.

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?

Telkom supports the provision of 3D data, which may enhance the accuracy of propagation analyses and the subsequent identification of TV white spaces.

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?

Accuracy of the information in the geo-location database is critical in order to eliminate the potential for harmful interference. A definite concern is when these devices and networks are installed by non-professionals resulting in inaccurate data being entered into the database. In addition, unfortunately, there is also the possibility that some operators will deliberately try to manipulate the system by supplying wrong or false information in order to obtain an approval for their planned operations. These issues must be addressed through regulations as best as possible (non-compliance to technical and regulatory limits in other licence exempted frequency bands are very common). Therefore, it is ideal that installers should receive the appropriate training and are certified as competent. Telkom recommends an automated approach for the notification of the location details. In particular, the Authority should explore granting certified installers the ability to upload location data to the TVWS database. Moreover, the Authority should develop regulation which prescribes, *inter alia*, the requirements for installer certification and the timeframe within which an installer is required to notify the location of a device.

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

Telkom is of the view that it is premature to consider extending DSA to other frequency bands when the technical and commercial feasibility of TVWS technologies have yet to be proven. Moreover, the 470 – 694 MHz band is well suited for the implementation of DSA technologies as broadcasting deployments are static and operate in accordance with a predefined broadcasting frequency plan. This is not the case in other frequency bands such as those used for mobile access technologies, which constantly extend coverage footprints thereby eliminating the availability of white spaces.

Q71. If so, which bands should be considered next?

Telkom does not support implementation of DSA in other frequency bands at this stage.

Q72. Are the study questions above the most relevant?

Whereas the study questions in section 5.12 are relevant, Telkom proposes supplementing same with additional questions that are considered equally relevant.

Q73. Are there additional study questions that you would propose?

- Can existing primary services co-exist with secondary DSA deployments? Note, the cumulative interference effect should also be taken into account here.
- Is the long-term availability of whitespace guaranteed?
- What frequency bands are being considered in other jurisdictions?
- What is the potential level of scalability, resiliency and reliability that DSA service providers can offer? Will these levels be sustainable in front of increases in demand and increased sharing of white spaces?
- Is DSA deployment in a particular band a short-term solution or a long-term connectivity strategy?
- How does utilising a particular band for the deployment of DSA technology fit into a long-term national ICT strategy?

Q74. Are there any additional devices or services in the 470-698 MHz UHF DTT band that should be considered in authorising use of TVWS?

This band is also used for SAP/SAB as indicated previously. STL links are proposed for migration to other bands such as F.1098. Further, the band 606-614 MHz is also allocated to the radio astronomy service on a primary basis in the African Broadcasting Area (ITU RR 5.304). It is understood that this service is used at the radio astronomy observatory at Hartebeesthoek and therefore needs to be protected. Further, the SKA rules as prescribed under the Astronomy Advantage Act will also apply within the declared astronomy advantage areas in this Northern Cape within the entire band 470-694 MHz.