

## Status update on the use of Dynamic Spectrum Assignment and Television White Spaces in South Africa (April 2017)

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### What is dynamic spectrum assignment / TVWS?

“**Dynamic spectrum assignment**” means a mechanism used to assign the unused spectrum within a frequency band of interest, to secondary users, such that they don't cause any harmful interference with the primary user or licensee.

“**White spaces**” are the frequency bands not used by their primary licensed users at a specific location or at a specific time.

“**Television white spaces**” are white spaces in the terrestrial digital television broadcasting band (470 - 694 MHz (Band IV)).

### What needs to happen?

ICASA needs to finalise regulations which allow TVWS to be used. So far it has published a [Discussion Document](#) (19 October 2015) and a [Findings Document](#) (17 June 2016) and, on 7 April 2017, it published a [Position Paper](#) and [draft Regulations](#). It may not seem like it but ICASA is moving fast to get the regulations in place.

### Why is this important?

Lots of reasons. DSA represents an evolution in spectrum use with the potential to introduce massive efficiency gains and it is gratifying to see South Africa close to the forefront of this process.

### How can you get involved?

The draft regulations are open for comment **until 19 May 2017**.

Read:

- Annexure A is a summary of the Position Paper.
- Annexure B is a summary of the draft Regulations.

### Useful Links

[General information on regulation of white spaces in South Africa](#)

[Information on the Cape Town TVWS Trial](#) (WAPA was a founding member)

[Position Paper](#)

[Draft Regulations](#)

## **Annexure A – Summary of ICASA’s Position Paper on DSA/TVWS**

ICASA has provided the following guidance on how it sees the use of DSA and TVWS in South Africa:

- The concept of DSA applies across all spectrum bands: TVWS will be the first implementation of DSA.
- The need for TVWS is driven by the lack of ubiquitous universal broadband access, and adoption of TVWS is expected to be more rapid in under-served areas.
- At this stage TVWS deployments will be limited to fixed wireless: ICASA may conduct a further investigation into implementing mobile uses. Internet of Things / machine-to-machine applications will be allowed.
- TVWS regulations should be service and technology agnostic.
- An accurate database of frequency assignments and calibrated propagation models (a “geo-location spectrum database”) are key to successful implementation of TVWS, because this will ensure the protection of licensed primary services from harmful interference.
- Certified geo-location spectrum databases will ensure a secure mechanism for registration of devices.
- ECNS licensees using spectrum in the terrestrial broadcast frequency bands must comply with the relevant band plan to ensure that database information is accurate.
- The introduction of TVWS regulations in an increasing number of countries has the potential to accelerate the maturity of TVWS ecosystem.
- TVWS regulations will ensure that white space devices conform to the applicable standard, and are tested and certified.
- As regards licensing for use of TVWS, ICASA will require mandatory registration of information prior to the network roll-out.
- Secondary geo-location spectrum databases must conform to the “Authority’s Reference Database” that performs baseline calculations for the country-wide maps of available TVWS channels and their corresponding maximum allowed power levels of WSD. The maps are to be utilised as regulatory limits by the authorised secondary white space database administrators.
- Operational parameters for white space devices (such as power levels and channel allocations) will be determined and assigned by a database.
- White space devices will be type-approved according to the applicable type approval regulatory framework.
- The use of TVWS is not affected by the digital migration process: these two processes can be implemented simultaneously.
- The concept of TVWS availability does not depend on the allocation or configuration of a broadcast network. Even on a locally occupied TV channel, TVWS might be available at some distant location. There will always be TV white spaces due to the nature of the configuration of terrestrial broadcasting frequency planning.
- Secondary users of the 470 – 694 MHz band are to be migrated in accordance with the latest version of the Radio Frequency Migration Regulations.

## Annexure B – Summary of the draft TVWS regulations

Short version: ECNS licensees with type-approved equipment capable of operating in the band 470 – 694 MHz may deploy white space devices which are linked to another device or a database which sets the operational parameters for the devices so that they do not cause harmful interference.

From here on, it gets technical....

### Purpose of the Regulations

- Support the uptake of affordable broadband services and access.
- Establish a regulatory framework authorising use of DSA for TVWS.
- Establish the conditions under which the TVWS must operate in accordance with the National Radio Frequency Plan.
- Establish standard terms and conditions applicable to the operation of white space devices (WSDs) in the frequency band 470 MHz to 694 MHz.
- Establish standard terms and conditions applicable to the operation of geo-location spectrum databases (GLSDs) in the frequency band 470 MHz to 694 MHz.
- Prescribe conditions for the possession of WSDs.
- Establish mechanisms for ensuring the protection of primary users in the band from harmful interference.

### Characteristics of White Space Devices

The draft Regulations provide for the following types of WSDs (capable of transmitting or receiving in the TVWS bands):

- Fixed devices: must be intended to operate in a fixed location only, with either an integral, dedicated or an external antenna.
- Nomadic devices: must be intended to operate within a limited coverage area, with either an integral, dedicated or an external antenna.
- Master devices: must be able to transmit and receive in the TVWS band under specific operational parameters (OPs) limitations. Can be either:
  - A fixed WSD with an internal geo-location capability and Internet access to request and receive from a GLSD; or
  - A nomadic WSD internal geo-location capability and Internet access to request and receive OPs from a GLSD
- Client devices: can be either a:
  - A fixed WSD with an internal geo-location capability and does not have direct access to a GLSD to request and receive Operational Parameters, or
  - A nomadic WSD with an internal geo-location capability and does not have direct access to a GLSD to request and receive Operational Parameters.

And must be able to:

- obtain operational parameters from a Master WSD for use by one Client WSD within a TV white space network served by that Master WSD.

- obtain operational parameters from a Master WSD for use by all Client WSDs within a TV white space network served by that Master WSD.
- transmit and receive within the frequency band 470 MHz - 694 MHz under specific Operational Parameter limitations.

#### Authorisation of WSDs

- Any person granted authorisation by the Authority to operate WSD, must provide the Authority with mandatory certification information from an accredited laboratory during network roll-out.
- A WSD must have the capability to automatically communicate with the GLSD during the WSD initialisation and registration with the GLSD operator.
- The GLSD must provide sufficient security to the user to ensure privacy and protection.

#### Avoidance of Harmful Interference

The GLSD must provide Operational Parameters to protect primary services from possible harmful interference generated by transmissions of WSD.

The GLSD must generate technical parameters in response to requests by Master WSD.

#### Operational Parameters

These must include:

- The lower and upper boundaries of each TV channel within which a WSD may transmit and receive;
- The maximum permitted EIRP spectral density for each TV broadcast channel within which a WSD may transmit;
- The maximum permitted EIRP for each TV channel within which a WSD may transmit;
- The time period during which the Operational Parameters are valid;
- The geographic area within which the Master White Space Device Operational Parameters are valid; and
- The duration (in seconds) within which a Master WSD must regularly check with a GLSD that the Operational Parameters received are still valid.

#### Permitted Channels of Operation

- WSDs may operate in the band 470 to 694 MHz, subject to interference protection requirements, and on available frequencies determined in accordance with the interference avoidance mechanisms contained in the regulations.
- WSD may not operate on a co-channel basis with broadcast television stations in the same area guided by the GLSD.
- Client WSDs may only operate on available frequencies determined by a Master WSD.

#### Location Specific Maximum Permitted Radiated Power Levels

- Maximum EIRP must be in accordance with Table 1 (Schedule 1).
- The GLSD may instruct the Master WSD to operate at lower power level in order to meet the co-channel and adjacent channel suppression limitations.

**Table 1: Location specific maximum permitted EIRP and EIRP spectral density**

Location	Maximum EIRP per 8 MHz channel	EIRP Spectral Density per 100 kHz
Urban	36 dBm	17 dBm
Rural	41.2 dBm	22.2 dBm

#### Operation of WSD Immediately Adjacent to a Broadcast TV Channel

- A WSD operating immediately adjacent to the occupied Television channels must have the out-of-band-emissions based on the Adjacent channel leakage ratios (ACLRs) established for the WSD emission classes prescribed in Table 2.

**Table 2 ACLRs per classes of WSDs on the first adjacent TV channel.**

Device Emission Class	ACLR
Class 1	74 dB
Class 2	74 dB
Class 3	64 dB
Class 4	54 dB
Class 5	43 dB

- Out-of-band power (EIRP) spectral density shall be measured in the first 100 kHz beyond the channel edge and shall be greater than the measured in-band transmit power spectral density over 8 MHz minus the ACLR (-84 dBm).

#### Requirements for White Space Devices to Access the Geo-Location Spectrum Database

- The communication between the GLSD and the Master WSD must comply with the latest version of Protocol to Access White Space Databases (PAWS), Internet Engineering Task Force (IETF), RFC 7545.
- The Master WSD must initiate communication with the GLSD.
- The GLSD must acknowledge the initial request from the Master WSD.
- The Master WSD in registering with GLSD must provide:
  - information specifying that it is a Master device;
  - the Master device's unique identifier;
  - the type approval identification designated by the Authority;
  - information of the Master device owner;
  - information of the device operator;
  - information specifying that the Master device is Fixed;
  - information specifying that the Master device is Nomadic;
  - the geographic location of its antenna expressed in latitude and longitude coordinates;
  - the geo-location uncertainty of its antenna not exceeding 50 metres;
  - storage capacity in the device for geo-location uncertainty; and
  - the confidence interval of 95% report to the GLSD.

- The GLSD must validate the accuracy and authenticity of the information;
- The GLSD must decide on the registration of the Master WSD;
- The Master WSD in requesting for the Operational Parameters from the GLSD, must provide:
  - information specifying that it is a Master device;
  - the Master device's unique identifier;
  - the type approval identification designated by the Authority;
  - information specifying that the Master device is Fixed;
  - information specifying that the Master device is Nomadic;
  - the geographic location of its antenna expressed in latitude and longitude coordinates;
  - the geo-location uncertainty of its antenna not exceeding 50 metres;
  - storage capacity in the device for geo-location uncertainty; and
  - the confidence interval of 95% report to the GLSD.
- The GLSD upon receipt of the request from the Master WSD may provide Operational Parameters;
- Upon receipt of the Operational Parameters the Master WSD must:
  - communicate periodically its usage of TVWS channel to that GLSD;
  - communicate periodically with the GLSD to confirm the validity of the Operational Parameters.
- The GLSD must instruct the Master WSD to end its operation when Operational Parameters are no longer valid.
- When Operational Parameters are no longer valid:
  - Master WSD must communicate an instruction to all Client devices associated to that Master device to stop transmission and stop transmission.
- The Master WSD must perform network initialisation with the Client WSD using the TVWS channels obtained from the GLSD.
- The Client WSD must communicate through the Master WSD the following information to the GLSD for registration purposes:
  - information specifying that it is a client device;
  - the associated Master WSD;
  - the client device's unique identifier;
  - the type approval identification designated by the Authority;
  - information specifying that the client device is Fixed;
  - information specifying that the client device is Nomadic;
  - the geographic location of its antenna expressed in latitude and longitude coordinates;
  - the geo-location uncertainty of its antenna not exceeding 50 metres.
  - storage capacity in the device for geo-location uncertainty; and
  - the confidence interval of 95% report to the GLSD.
- The Master WSD must provide Operational Parameters to the associated client WSD.
- Master WSD must communicate an instruction to all Client WSDs associated to that Master WSD to stop transmission, when Operational Parameters are no longer valid;
- When Operational Parameters are no longer valid the Client WSD must stop transmission.

### Requirements for Installers of White Space Devices

- Fixed WSDs shall be installed by an installer of wireless equipment in possession of a radio dealer certificate issued by the Authority.
- Fixed WSDs shall be installed by an installer of wireless equipment certified by an accredited institution.
- The installer must not reconfigure or tamper with any technical operational features settings of the WSD.
- The installer must ensure that characteristics of the WSD remain constant.
- The installer must ensure that the WSD complies with type approval certificate.

### Antenna Requirements and Limits

- Fixed WSD must at first power-on, and at any time after it has been relocated:
  - store its geo-location;
  - Store the antenna height;
  - The maximum permitted transmit antenna height of Fixed WSD must be 30 m above ground level (AGL);
  - The maximum permitted transmit antenna height must not be located where the height above average terrain (HAAT), as calculated by the GLSD, is greater than 250 m; and The Authority may approve deviations from this restriction on a case-by-case basis, in approving an alternative means of interference mitigation in the GLSD.
- The default antenna height of a Nomadic WSD must be recorded by the GLSD as 1.5 m above ground level, unless the WSD notifies the GLSD otherwise.
- The Nomadic WSD must have 7 dB of power to compensate for in-building penetration loss when operating indoors.

### Frequency of GLSD Access

- A Master WSD must access the GLSD once every twelve (12) hours to verify that the Operational Parameters continue to remain available.
- Each Master WSD must adjust its use of TVWS channels provided the Operational Parameters are still valid.

### Continuous Operations

- The Master WSD may continue to operate up to 48 hours after the last GLSD access whereafter it must cease its operation.
- The Master WSD must re-establish contact with the GLSD and verify its Operational Parameters.
- The client WSD must cease operation immediately if it does not receive a contact verification signal from the associated Master WSD;
- The client WSD must re-establish a contact with the associated master WSD within 900 seconds of last contact.
- The Client WSD device must then receive the Operational Parameters from the associated Master WSD.

### Geo-location Spectrum Database Security Mechanisms

- Communications security must be instituted to ensure that GLSDs are protected from unauthorised data input.
- Authentication procedures must be instituted to ensure that GLSDs are protected from unauthorised alteration of stored data.
- Communications between the GLSD and WSDs must be secured to prevent unauthorised parties from accessing information during transmission.
- GLSDs must incorporate sufficient security measures to prevent the unauthorised WSDs from accessing GLSDs.

### Responsibilities of Geo-Location Spectrum Database Operators

- Reference GLSD: ICASA will, directly or through a designated entity, develop and operate a reference GLSD and will:
  - maintain a reference GLSD that contains information about incumbent licensees to be protected;
  - implement propagation algorithms and interference parameters issued by Authority to calculate country-wide map of baseline Operating Parameters for WSDs.
  - The maps are to be utilised as regulatory limits when verifying accuracy of secondary GLSDs;
  - update the algorithms or parameter values as necessary for good spectrum coordination;
  - establish a technical procedure for approving entities wishing to operate secondary GLSDs; and
  - from time to time use the reference GLSD for verification and monitoring purposes on the accuracy of results given by secondary GLSD operators
- Secondary GLSD: ICASA may designate entities to operate secondary GLSDs after undertaking a technical examination. Each secondary GLSD operator designated by the Authority must:
  - maintain a database that contains information about incumbent licensees to be protected;
  - establish a process in the secondary GLSD for synchronising and acquiring necessary technical information from the reference GLSD at least once a week to include newly licensed facilities or any changes to licensed facilities;
  - establish a process for registration of Master WSDs;
  - implement propagation algorithms and interference parameters prescribed by the Authority to calculate and provide accurate Operational Parameter to Master WSDs;
  - establish protocols and procedures to ensure that all communications and interactions between the GLSD and Master WSDs are accurate and secured so that unauthorised parties cannot access or alter the database or the Operational Parameters;
  - respond in a timely manner to verify, correct and/or remove, as appropriate, data in the event that the Authority or a party brings a claim of inaccuracies in the GLSD to its attention.
  - have functionality such that upon request from the Authority it can indicate that no TVWS channels are available when queried by WSDs;
  - not discriminate between WSDs in providing the minimum information levels; and
  - may provide additional information to certain classes of devices.
- Service fees: A secondary GLSD operator may charge a fee to the TVWS network operators for:



- registration of WSDs; and
- the provision Operational Parameters to Master WSDs.

#### Display of Available Channels

- A Master WSD must incorporate the capability to display a list of TVWS channels given to it by the GLSD including the channels selected for use;
- The Master WSD must fulfil this requirement by a built-in display.

#### Labelling Requirements

- A WSD must bear the following statement in conspicuous location on the device:

*"This device complies with applicable regulations promulgated by the Authority. Operation is subject to the following conditions: (1) this device may not cause harmful interference. (2) This device must accept any interference received."*

#### User Instructions Regarding Correction of Harmful Interference

- The text of the user manual for a WSD, in whatever form it is provided (printed, electronic or on-line) shall include the following statement placed in a prominent location within the manual:

*"This equipment has been tested and found to comply with the technical rules and regulations for WSDs, consistent with all applicable regulations issued by the Authority.*

*These rules have been formulated to furnish reasonable protection against harmful interference. This equipment generates radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to protected primary services. If this equipment does cause harmful interference to radio or television reception, the user shall correct the interference by one or more of the following measures:*

*(1) Reorient or relocate the receiving antenna of the WSD and/or broadcast receiver.*

*(2) Increase the separation between the equipment and the receiver.*

*(3) Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.*

*(4) Consult the manufacturer, dealer or an experienced radio / TV technician for help.*

*(5) If the interference cannot be resolved, operation of this device shall be discontinued."*

#### Compliance with Radio Frequency Exposure Requirements

- A fixed WSD must be accompanied by instructions on measures to ensure that persons maintain a distance of at least 7.5m from the device during operation, as well as any necessary hardware that may be needed to implement that protection. These instructions shall be displayed in all formats of the user manual.

#### WSD Operations near International Borders

- WSDs must operate in a manner that will not cause harmful interference to broadcasting and other services in neighbouring countries.

#### Offences, Contraventions and Penalties

- Operations in the TVWS without authorisation and in contraventions of these regulations is a criminal offense and subject, on conviction, to:
  - A fine not less than R100,000, but not exceeding R1,000,000; and/or
  - Imprisonment of not less than a month, but not exceeding six months.

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