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GUIDELINES ON THE USE OF TELEVISION WHITE SPACES, 2019

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GUIDELINES ON THE USE OF TELEVISION WHITE SPACES

In exercise of the powers conferred upon it by sections 70 and 123 (1) of the Nigerian Communications Act, 2003 (in these Guidelines referred to as “the Act”), and of all other powers enabling it in that behalf, the NIGERIAN COMMUNICATIONS COMMISSION (herein referred to as the “Commission”) hereby make the following Guidelines

- (A) These guidelines provide a framework to enable license-exempt transmitters to operate in the UHF band, which are allocated on a primary basis to the broadcast television service, on frequencies and at locations where the spectrum is either not assigned to licensed services or not in use at particular times, while protecting primary users from receiving harmful interference.
- (B) These license-exempt radio transmitters will allow for the provision of affordable broadband and Internet access in unserved and underserved areas within Nigeria, and support the development of Internet of Things applications, including agriculture.

1. Objectives

The objectives of these guidelines are as follows:

- (A) Define Television Whitespaces (TVWS) as the unassigned spectrum between broadcast television channels in the 470 to 694 MHz portion of the UHF frequency band that can be utilized to provide Internet access to the underserved and unserved regions of the country, mostly in rural service areas at broadband speeds.
- (B) Support access to, and uptake of, affordable broadband services by the underserved.
- (C) Establish the framework consistent with the Memorandum of Understanding (MoU) between the NBC and NCC, through which the NBC and the NCC may authorize the use of the TVWS spectrum.
- (D) Establish the framework consistent with the ITU Radio Regulations and consistent the recommendation 76 of the 2012 World Radio Conference (WRC-12).
- (E) Establish the conditions under which the use of the TVWS spectrum shall be in accordance with the National Frequency Plan.
- (F) Establish standard terms and conditions applicable to the operation of licence-exempt TVWS devices in the frequency band 470 MHz to 694 MHz.
- (G) Establish standard terms and conditions applicable to the operation of the geo-location and database method for spectrum management in the frequency band 470 MHz to 694 MHz.
- (H) Prescribe conditions for the type-approval of TVWS devices.

- (I) Establish the interference avoidance mechanisms for ensuring the protection of primary users in the band 470 MHz to 694 MHz from harmful interference.

2. Permissible Frequencies of Operation

- (A) License-exempt master TVWS devices shall only operate on available frequencies in the 470 to 694 MHz portion of the UHF band as determined by the database or as described in Section 11.
- (B) License-exempt client TVWS devices shall only operate on available frequencies in the 470 to 694 MHz portion of the UHF band as determined by the database and provided via a master TVWS device or as described in Section 11.

3. Authorization Framework for TVWS Operations

- (A) TVWS spectrum shall be utilized only by Operating Licence holders of the NCC as specified in the Communications Act.
- (B) Any person providing service utilizing the TVWS spectrum shall obtain the relevant operating licence or authorization from the Commission in accordance with applicable guidelines and regulations.
- (C) Licensed-exempt master TVWS devices must access a TVWS database, operated by a TVWS Database Administrator, to receive a list of available channels at that location. A license-exempt master TVWS device may also receive a list of available channels under the procedures described under section 11.
- (D) No person shall provide service or operate as a TVWS Database Administrator without first being duly authorized by the NBC.
- (E) Every TVWS database shall be certified by NBC.
- (F) TVWS devices shall be type approved by the NCC, in accordance with the Nigerian Communications Commission Type Approval Regulations 2008 as may be amended.
- (G) TVWS devices shall not be used airborne.

4. TVWS Devices - Conducted Power and Conducted Spectral Power Density Limits

- (A) Fixed TVWS devices shall have the following thresholds:
 - (i) The maximum conducted power shall be 1 W (30 dBm) within an available channel
 - (ii) The maximum conducted power spectral density shall be 50 mW (17 dBm) as measured within any 100 kHz frequency block within the channel.

(B) IoT TVWS devices shall have the following thresholds:

- (i) The maximum conducted power shall be 50 mW (17 dBm) EIRP within any 100 kHz frequency block within an available channel

(C) Channel bonding and channel aggregation for Fixed TVWS Devices

- (i) The bonding of contiguous available TVWS channels shall be permitted.
- (ii) The aggregation of non-contiguous available TVWS channels shall be permitted.

(D) Transmit Power Control

- (i) A TVWS device shall incorporate transmit power control to limit its operating power to the minimum necessary for a successful communication to be completed.

5. TVWS Devices - Antenna Requirements and Height Limits

(A) Fixed TVWS devices shall meet the following requirements:

- (i) A fixed TVWS device shall have an external antenna.
- (ii) Fixed TVWS devices may be professionally installed. The professional installer shall store accurately in the TVWS device the antenna height of the fixed TVWS device at the time of installation and at any time when an installer relocates a fixed TVWS device more than 100 meters from its previous location.
- (iii) The transmit antenna height shall not be greater than 100 meters above ground level
- (iv) The transmit antenna shall not be located where the height above average terrain (HAAT) is greater than 250 meters

(B) IoT TVWS devices shall meet the following requirement:

- (i) An IoT TVWS device may have an external, permanently attached or integral transmit and receive antenna(s)
- (ii) The transmit antenna of an IoT TVWS device shall be taken by the white spaces database as 1.5 meters above the ground unless the device (if a master device) or its master device (if a client device) notifies the TVWS database otherwise
- (iii) The transmit antenna height shall not be greater than 100 meters above ground level
- (iv) The transmit antenna shall not be located where the height above average terrain (HAAT) is greater than 250 meters

6. TVWS Devices - Radiated Power and In-Block EIRP Spectral Density Limits

(A) Fixed TVWS Devices shall have the following spectral density limits:

- (i) Up to 4 W (36 dBm) EIRP within suburban areas and up to 10 W (40 dBm) EIRP in rural areas, contingent on meeting the co-channel and adjacent channel separation distances.
- (ii) In-block EIRP Spectral Density Limits shall be 50 mW (17 dBm) in any 100 kHz frequency block for a TVWS device with a maximum EIRP of 4W, and 125 mW (21 dBm) in any 100 kHz frequency block for a TVWS device with a maximum EIRP of 10 W
- (iii) If a transmitting antenna of directional gain greater than 6 dBi is used in suburban areas or greater than 10 dBi in rural areas, the maximum conducted output power shall be reduced by the amount in dB that directional gain of the antenna exceeds 6 dBi or 10 dBi respectively.

(B) IoT TVWS Devices shall have the following spectral density limits:

- (i) Up to 50 mW (17dBm) EIRP,
- (ii) If a transmitting antenna of directional gain greater than 0 dBi is used, the maximum conducted output power shall be reduced by the amount in dB that directional gain of the antenna exceeds 0 dBi.

7. TVWS Devices - Out-of-Block EIRP Spectral Density Limits

- (a) The out-of-block EIRP spectral density limit shall conform to ETSI 301 598 v2.1.1 (2018-01) or its successor.
- (b) The out-of-block EIRP spectral density of a TVWS device in 100 kHz shall be less than or equal to the greater of:
 - (i) the in-block EIRP spectral density over 100 kHz in the 8 MHz channel minus the ACLR (dB) or
 - (ii) -84 dBm / (100 kHz)
- (c) The out-of-block EIRP spectral density shall not be applied to the common channel edge for bonded channels
- (d) The ACLR (dB) on the first adjacent channel for the five Device Emission Classes shall be as follows:

<u>Device Emission Class</u>	<u>ACLR (dB)</u>
1	74
2	74
3	64

4	54
5	43

(e) The ACLR (dB) for the second adjacent channel for the five Device Emission Classes shall be as follows:

<u>Device Emission Class</u>	<u>ACLR (dB)</u>
1	79
2	74
3	74
4	64
5	53

- (f) The out-of-block spectral density limit shall not be applied to the common channel edge of (contiguous) bonded channels.
- (g) The out-of-block spectral density limit shall be applied to the non-common channel edge of (contiguous) bonded channels.
- (h) The out-of-block spectral density limit shall be applied to aggregated (non-contiguous) channels.

8. Interference Avoidance Mechanisms

(A) Geo-location Capabilities Requirements

- (i) TVWS devices shall rely on a geo-location capability and database access mechanism to protect broadcast television and other authorized operations in the 470 to 694 MHz portion of the UHF frequency bands.

(B) Geo-location Confidence Level Requirements

- (i) Fixed TVWS devices and master IoT TVWS devices that incorporate a geo-location capability shall determine their location and geo-location uncertainty (in meters), with a confidence level of 95%.
- (ii) All geographic coordinates shall be referenced to World Geodetic System 1984 (WGS 84), last revised in 2004.

(C) Requirements for Fixed TVWS Devices

- (i) The geographic coordinates and antenna height above ground level of a fixed TVWS device shall be determined at the time of installation and first activation from a power off condition by either incorporated geo-location capability or a professional installer employed by the operator. The information shall be stored internally in the TVWS device.

- (ii) In the case of professional installation, the party receiving authorization from the NCC to provide service is responsible for assuring the accuracy of the entered coordinates and antenna height of the fixed TVWS device into the TVWS Database.
- (iii) If a fixed TVWS device is moved to another location by more than 100 meters or if its stored coordinates become altered, the party receiving authorization from the NCC to provide service shall re-establish the device's:
 - (a) geographic location and antenna height above ground level and store this information in the TVWS device either by means of the device's incorporated geo-location capability or through the services of a professional installer employed by the operator; and
 - (b) Registration with the TVWS database based on the device's new coordinates and antenna height above ground level.
- (iv) Each fixed TVWS device must access a TVWS database over the Internet to determine the available channels and the corresponding maximum permitted power for each available channel at its geographic coordinates, taking into consideration the fixed device's antenna height above ground level and geo-location uncertainty, prior to its initial service transmission at a given location.
- (v) Operation shall be permitted only on channels that are indicated by the TVWS database as being available for the TVWS device and at a radiated power level no greater than the radiated power limit. Operation on a channel must cease immediately or power must be reduced to a permissible level if the database indicates that the channel is no longer available at the current radiated power level.
- (vi) Each fixed TVWS device shall access the database at least once a day, directly or through another fixed TVWS device, to verify that the operating channels and operating power levels continue to remain available.
- (vii) A fixed TVWS device may not operate on channels provided by a TVWS database for another fixed TVWS device. Where the fixed TVWS device does not have a direct connection to the Internet, if the fixed TVWS device has not yet been initialized and registered with a TVWS database, but can receive the transmissions of another fixed TVWS device, it may transmit to that other fixed TVWS device on either a channel that the other TVWS device has transmitted on or on a channel which the other TVWS device indicates is available for use to access the TVWS database to register its location and receive a list of channels that are available for it to use. Subsequently, the newly registered fixed TVWS device shall only use the channels that the TVWS database indicates are available for it to use.

(D) Requirements for IoT TVWS devices

(i) Master IoT TVWS device

- (a) A Master IoT TVWS device shall use incorporated geolocation capability to determine its location and geo-location uncertainty prior to its initial service transmission at a given location and each time the device is activated from a power-off condition.
- (b) A Master IoT TVWS device shall report over a direct connection to the Internet its geographic location, geo-location uncertainty, and device emission class to the TVWS database, which will determine the available channels and the corresponding maximum permitted power for each available channel at its geographic coordinates
- (c) Operation is permitted only on channels and at power levels that are indicated in the TVWS database as being available for each TVWS device. Operation on a channel must cease immediately or power must be reduced to a permissible level if the database indicates that the channel is no longer available at the current operating level.
- (d) The Master IoT TVWS device shall have the capability of operating on every 200 kHz channel within an available channel.
- (e) Each Master IoT TVWS device shall access the database at least once a day to verify that the operating channel(s) continue to remain available
- (f) A Master IoT TVWS device must access the TVWS database for an updated available channel list if its location changes by more than 100 meters from the location it last established its available channel list.

(ii) Client IoT TVWS device

- (a) A Client IoT TVWS device may only transmit upon receiving a list of available channels from a fixed or IoT TVWS device. A fixed and Master IoT TVWS device may provide a Client IoT TVWS device with a list of available channels only after it contacts its TVWS database, provides the database with the NBC identifier of the Client IoT TVWS device requesting available channels, and receives verification that the NBC ID is valid for operation.
- (b) A fixed and master IoT TVWS device must provide a list of channels to the client IoT TVWS device that is the same as the list of channels available to the master device.
- (c) A Client IoT TVWS device shall be capable of operating over every 200 kHz channel within an available channel.

- (d) Contact initiation signal to a master device - A Client IoT TVWS device may transmit in an available channel used by a fixed or Master IoT TVWS device only by sending a contact initiation signal to one of these devices and successfully receiving a contact verification signal.
- (e) Periodic contact verification signal to a master device – At least once every 600 seconds, except when in sleep mode, a client IoT TVWS device must either receive a contact verification signal from the fixed, or master IoT TVWS device that provided its current list of available channels or contact another fixed IoT TVWS device to re-verify/re-establish channel availability
- (f) In the event of a loss of the contact verification signal – A Client IoT TVWS device must cease operation immediately if it does not receive a contact verification signal or is not able to re-establish a list of available channels through contact with a fixed IoT TVWS device
- (g) If a fixed or Master IoT TVWS device loses power and obtains a new channel list, it must signal all Client IoT devices it is serving to acquire and use a new channel list.

(E) Identifying information

- (i) Fixed TVWS devices shall transmit identifying information. The identification signal must conform to a standard established by a recognized industry standards setting organization. The identification signal shall carry sufficient information to identify the device and its geographic coordinates

(F) Continuing operation

- (a) If a fixed or master IoT device fails to successfully contact the TVWS database during any given day, it may continue to operate until 11:59 p.m. of the following day at which time it must cease operations until it re-establishes contact with the TVWS database and re-verifies the list of available channels.

(G) Security

- (i) TVWS devices shall not allow a user of the device to input, configure, reconfigure or alter any technical or operational settings or features of the TVWS device in a way which would affect the device parameters or any other technical characteristics of the device which are communicated to a TVWS database, or its operation in accordance with operational parameters.

9. TV Whitespace Database

(A) The TV Whitespace database shall serve the following purposes:

- (i) To protect authorized services operating in the TV bands from receiving harmful interference from TVWS devices.
- (ii) To determine and provide to a license-exempt TVWS device, upon request, the available channels in the UHF frequency band provided in Section 2(A) at the TVWS device's location and the maximum radiated power level for each channel. Available channels are determined based on the interference protection requirements of analogue and digital television broadcasts and any other authorized services operating in the UHF frequency band as provided by NBC.
- (iii) In making lists of available channels available to a licence-exempt TVWS device, the TVWS database shall ensure that all communications and interactions between the TVWS database and the TVWS device include adequate security measures such that unauthorized parties cannot access or alter the TVWS database or the list of available channels sent to TVWS devices or otherwise affect the TVWS database system or TVWS devices in performing their intended functions
- (iv) To register the identification information and location of fixed license-exempt TVWS devices.
- (v) To verify that the NCC identifier of a master or client TVWS device seeking access to its services is valid.
- (vi) To register protected locations and channels as required that are not otherwise recorded in the licensing database of the NBC , and
- (vii) To provide a list of available channels at a given location to devices not-operating in the TV bands such as those used by prospective license-exempt TVWS system service providers and for educational purposes.

(B) Information in the TVWS database shall include the following:

- (i) Analog and digital broadcast television facilities already recorded in the NBCs database. Identification and location information, and interference protection requirements shall be provided by the National Broadcasting Commission.
- (ii) Other facilities, as required, that are not recorded in the National Broadcasting Commission's database. Identification and location information, and interference protection requirements shall be provided by the NBC or the NCC, as appropriate, and entered into the TVWS database in accordance with the procedures established by the TVWS Database Administrator(s).

- (iii) A list of type-approved TVWS devices in Nigeria with valid IDs issued by the Commission. The IDs of those TVWS devices is to be obtained from the NCC.

(C) Determination of available channels

- (i) The calculation engine in the TVWS database shall determine the available channels and maximum radiated powers at a location using the interference protection requirements provided by the NBC, the location and height information supplied by the TVWS device, and the data for protected stations / locations in the database.
- (ii) The list of available channels and maximum radiated power for each, provided by the TVWS database for a location shall ensure a low probability of harmful interference to primary and other authorized services caused by the transmission of TVWS devices in compliance with:
 - A. The ITU GE06 agreement;
 - B. The National Frequency Table of Allocations;
 - C. The Frequency Assignment Tables

(D) Fixed and IoT TVWS device initialization

- (i) Every Fixed TVWS device shall provide its location and required identification information to the TVWS database.
- (ii) A Fixed TVWS device shall not transmit unless it receives from the TVWS database a list of available channels and may only transmit on the list of available channels provided by the TVWS database.
- (iii) A Fixed TVWS devices shall register and receive a list of available channels from the TVWS database by connecting to the Internet, either directly or through another fixed TVWS device that has a direct connection to the Internet.
- (iv) A fixed TVWS device that provides a list of available channels to an IoT TVWS device shall notify the TVWS database of the Commission's identifier of IoT TVWS device and receive verification that the said identifier is valid before providing the list of available channels to the IoT TVWS device.
- (v) A fixed TVWS device with an antenna height above ground level that exceeds 100 meters or an antenna height above average terrain (HAAT) that exceeds 250 meters shall not be provided a list of available channels. The HAAT for fixed TVWS devices is to be calculated using the same computational software that is used to calculate HAAT for broadcast television stations.

(E) Fixed TVWS device registration

- (i) Prior to operating for the first time, after changing location by more than 100 meters, or having not contacted the TVWS database for 3 months, a fixed TVWS device shall register or re-register with the TVWS database.
- (ii) The registration information shall include the following:
 - (a) The NCC's identifier of the device,
 - (b) Manufacturer serial number of the device,
 - (c) Device emission class,
 - (d) Device's geographic coordinates (latitude and longitude),
 - (e) Device's antenna height above ground level (meters),
 - (f) Name of the individual or business that owns the device,
 - (g) Name of a contact person responsible for the device's operation,
 - (h) Address for the contact person,
 - (i) E-mail address for the contact person,
 - (j) Phone number for the contact person,
- (iii) The NCC shall authenticate either the address, e-mail address or phone number of the contact person responsible for the device's operation.
- (iv) The party responsible for a fixed TVWS device shall ensure that the TVWS device registration database has the most current, up-to-date information for that device.

(F) Master IoT TVWS device information provided to the TVWS database shall include the following:

- (i) The Commission's device identifier,
- (ii) Device emission class,
- (iii) Manufacturer serial number of the device,
- (iv) Device's geographic coordinates (latitude and longitude),

- (v) Device's height above ground level, which shall be optional

(G) The information contained in the TVWS database shall include the following:

- (i) Digital and analogue television station's
 - a. Transmitter coordinates (latitude and longitude)
 - b. Effective radiated power (ERP)
 - c. Height above average terrain of the transmitting antenna (HAAT)
 - d. Horizontal transmit antenna pattern (if the antenna is directional)
 - e. Amount of electrical and mechanical beam tilt (degrees depression below horizontal) and orientation of mechanical beam tilt (degrees azimuth clockwise from true north)
 - f. Polarization
 - g. Channel number, and
 - h. Station call sign

(H) Requests from the Commission

- (i) A TVWS database administrator shall provide to the NCC or the NBC , upon request, any information contained in the TVWS database
- (ii) A TVWS database administrator shall delete information from the TVWS database, upon the direction of the NCC.

(J) TVWS database shall have the functionality such that it can indicate that no channels are available when queried by a specific TVWS device or model or model of TVWS devices, upon the request of the Commission.

(K) Security

- (i) The TVWS database shall employ protocols and procedures to ensure that all communications and interactions between the TVWS database and fixed and master IoT TVWS devices are accurate and secure and that unauthorized parties cannot access or alter the database or the list of available channels sent to a fixed and master IoT TVWS device.
- (ii) Communications between fixed and master IoT TVWS devices and TVWS databases, and between different TVWS databases, shall be secure to prevent corruption or unauthorized interception of data. A TVWS database shall be protected from unauthorized data input or alteration of stored data
- (iii) A TVWS database shall verify that the Commission's identification number supplied by a fixed or master IoT TVWS device is for a certified device and may not provide service to an uncertified device for purposes of operation. TVWS database administrators shall obtain a list of certified TVWS devices from the Commission's Equipment Authorization System and check the System for updates weekly.

10. TV Whitespace Database Administrator

- (a) The NBC shall designate one or more entities to operate as a TVWS database administrator.
- (b) The NBC may, at its discretion, permit the functions of a TVWS database, such as a data repository, registration, and query services, to be performed by a single entity or divided among multiple entities. However, a specific entity shall be designated to be a TVWS database administrator responsible for coordination of the overall functioning of the database and providing services to TVWS devices.
- (c) Each TVWS database administrator designated by the NBC shall:
 - (i) Maintain a database that contains the information described in Section 9 above
 - (ii) Establish a process for acquiring and storing in the TVWS [database](#) necessary and appropriate information from the NBC database and synchronizing the database with the current NBC database at least once a week to include newly licensed facilities or any changes to licensed facilities.
 - (iii) Establish a process for registering fixed and master IoT TVWS devices and registering and including in the TVWS database facilities and locations designated for protection but not contained in the NBC database.
 - (iv) Provide accurate lists of available channels and the corresponding maximum permitted power for each available channel to fixed TVWS devices that submit to it the information required under Section 9 based on their geographic location and provide accurate lists of available channels and the corresponding maximum permitted power for each available channel to fixed TVWS devices requesting lists of available channels for IoT TVWS devices. TVWS database administrators may allow prospective operators of TVWS devices to query the database and determine whether there are vacant channels at a given location.
 - (v) Establish protocols and procedures to ensure that all communications and interactions between the TVWS database and fixed and Master IoT TVWS devices are accurate and secure and that unauthorized parties cannot access or alter the database or the list of available channels sent to a TVWS device consistent with Section 9
 - (vi) Make its services available to all license-exempt TVWS device users on a non-discriminatory basis
 - (vii) Respond in a timely manner to verify, correct and / or remove, as appropriate, data if NBC or a party brings a claim or inaccuracies in the database to its attention. This requirement applies only to information that NBC requires to be stored in the TVWS database.

- (viii) If more than one TVWS database is developed, the TVWS database administrators shall cooperate to develop a standardized process to coordinate on a daily basis, to ensure consistency in the records of the protected facilities.
- (ix) Remove from the database the registrations of fixed TVWS devices that have not checked the database for at least 3 months to update their channel lists.
- (x) Transfer its TVWS database along with the IP address and URLs used by its customers to access the TVWS database and list of registered fixed TVWS devices, to another designated TVWS database administrator in the event it does not continue as a database administrator at the end of its term. It may charge a reasonable fee for such conveyance to cover costs.

11. Temporary procedure to authorize operation of operators prior to certification of the TVWS database

The TV white space devices that are deployed before the certification of the TVWS Database shall comply with the procedure below in order to obtain a list of channels and each channel's maximum radiated powers at a location. All communications / requests made in the framework of this temporary procedure should be made by email to tvws@nbc.gov.ng.

- Request for channel availability - Before the certification of the TVWS database, the applicant must send an email to NBC requesting the availability of channels for these devices. The request must be accompanied by the following information so that the request is valid:
 - (ii) Name of the person / entity responsible for the device
 - (iii) Contact details of the person / entity responsible for the device: Physical address, mail electronic and telephone (landline or mobile)
 - (iv) For each of the white space devices to be deployed:
 - Brand (or name of manufacturer) and model;
 - Geographical coordinate of the location where it will be deployed, in datum WGS-84;
 - State where it will be deployed.
 - Total number of channels required.
 - Maximum radiated power levels required

Within 10 business days following the submission of the request, NBC will respond to said e-mail, determining if the request is valid. If the applicant does not receive such communication in the aforementioned period, the request must be understood as rejected. Upon NBC approval, the applicant must obtain an operating license from the NBC under Section 3.

(B) Request for clarification of incomplete or invalid applications

(i) In case the application does not have all the required information, contains factual errors, or is not clear, NBC will inform the applicant that the request is not valid and will request via the contact information provided that the applicant make corrections.

(ii) The applicant must answer the request within 3 business days following the notification from NBC, otherwise the request will be considered abandoned.

(iii) If NBC receives the applicant's response within this period and if the answer(s) are satisfactory, the request will be valid, otherwise it will be rejected.

(C). Channel availability

i. For valid requests, NBC will send an e-mail informing the applicant of the availability of channels for the devices to be deployed, their maximum radiated power, and their validity time. The applicant now becomes a license-exempt TVWS spectrum user.

*Validity of channel availability

ii. The availability of channels will have associated a validity time outside of which, said availability it will not be valid. Therefore, if the license-exempt TV White Spaces spectrum user wants to continue the operation of its TVWS devices, it must make a new request for channels to NBC before the end of this period, so that the TV White Space devices always make use of valid available channels.

iii. If any change is made in the allocation or assignment of frequencies of a primary service or secondary service, NBC will inform the license-exempt TV White Spaces spectrum user sufficiently in advance for it to carry out a new channel request or turn off the TV white space devices that are using those frequencies.

iv. If there is a need to change the responsible person, the devices, the location of devices or any of the data supplied in the application, it is necessary to send a new request for channels to NBC before making such a change. NBC shall review as per the procedure above.

*Use of channels with invalid availability

v. A TVWS device that makes use of a channel whose availability is not valid, constitutes a breach of the provisions of these rules, in which case the provisions xxx of the Nigerian Code [for infractions and sanctions] applies.

12. Information Display Requirements

(a) Capability to display available channels

A fixed TVWS device must incorporate the capability to provide a list of available channels and its operating channel

(b) Labelling requirements

A TVWS device shall bear the following statement in a conspicuous location on the device:
“This device complies with applicable interference safeguard standards. Operation is subject to the following conditions: (1) this device may not cause harmful interference. (2) This device must accept any interference received”

(c) Instructions to users regarding correction of harmful interference

The instructions furnished to the user of a TVWS device shall include the following statement, placed in a prominent location in the text of the manual whether in paper form, on a computer disk, or over the Internet:

“This equipment has been tested and found to comply with the rules for TVWS devices, pursuant to the Commission’s rules which are designed to provide reasonable protection against harmful interference. This equipment generates, uses and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try and correct the interference by one of more of the following measures:

- i. Reorient the receiving antenna
- ii. Increase the separation between the TVWS equipment and the receiver
- iii. Connect the TVWS equipment into an outlet on a circuit different from that to which the receiver is connected.
- iv. Consult the TVWS device manufacturer, dealer or an experience radio / TV technician for help.
- v. In the event that the interference persists, a report should be made to the NBC, as stated in the MoU between the NBC and NCC.

(d) Compliance with radio frequency exposure requirements

- (i) A Master TVWS device shall be accompanied by instructions for protecting human body from possible exposure to electromagnetic fields when the device is in active operation, this instruction shall be displayed in all formats of user manual detailing exposure limited expressed in terms of Specific Absorption Rate (SAR) in accordance with the latest version of the International Commission on Non-Ionizing Radiation Protection (ICNIRP)

13. Operations Near International Borders

- (a) TVWS operations near national borders shall not cause harmful interference to broadcasting and other services in neighbouring countries.
- (b) TVWS signals near national borders shall be at noise floor level.

14. Definitions

In these Guidelines terms defined in the Act shall have the same meanings as in the Act and in addition to the following:

- (A) "Act"- The Nigerian Communications Act 2003
- (B) "Adjacent Channel Leakage Ratio (ACLR) – The ratio of the in-band TVWS device transmit power measured in an eight-megahertz (8 MHz) TV channel, to the out-of-band emission measured in the first 100 kHz in an adjacent TV channel.
- (C) "Authentication" – The ability to verify that a message was truly sent by the asserted sender
- (D) "Available Channel" - A 8 MHz television channel in the UHF TV Band that is not being used by an authorized incumbent service at or near the same geographic location as the TVWS device and is acceptable for use by a license exempt device under the provisions of these technical rules.
- (E) "Client device" - A fixed or IoT TVWS device that does not use an automatic geo location capability and access to a geo location database to obtain a list of available frequencies. A client device must obtain a list of available frequencies on which it may operate from a master device. A client device may not initiate a network of fixed and/or IoT TVWS devices, nor may it provide a list of available frequencies to another client device for operation by such device.
- (F) "NCC" – Nigerian Communications Commission.
- (G) "NBC" – National Broadcasting Commission
- (H) "Contact verification signal" - An encoded signal broadcast by a master device for reception by client devices to which the master device has provided a list of available frequencies for operation. Such signal is for the purpose of establishing that the client device is still within the reception range of the master device for purposes of validating the list of available frequencies used by the client device and shall be encoded to ensure that the signal originates from the device that provided the list of available frequencies. A client device may respond only to a contact verification signal from the master device that provided the list of available frequencies on which it operates. A master device shall provide the information needed by a client device to decode the contact verification signal at the same time it provides the list of available frequencies.
- (I) "dBm" – decibels of power referenced to one milliWatt
- (J) "Device emission class" – The classification declared by the manufacturer that identifies the level of ACLR for the device

- (K) “EIRP” – Equivalent isotropic radiated power, which is the product of the power supplied to an antenna and the absolute or isotropic antenna gain in a given direction relative to an isotropic antenna.
- (L) “EIRP spectral density” – EIRP over a specified bandwidth
- (M) “ETSI” – European Technical Standards Institute
- (N) “ETSI EN 301 598 V2.1.1 (2018-01)” – The ETSI Harmonized Standard for “White Space Devices (WSD); Wireless Access Systems operating in the 470 MHz to 790 MHz TV broadcast band; Harmonised Standard covering the essential requirements of article 3.2 of Directive 2014/53/EU.
- (O) “Fixed TVWS device” - A TVWS device that transmits and/or receives radio communication signals at a specified fixed location. A fixed TVWS device is required to have incorporated geo-location capability. A fixed device may select channels for operation from a list of available channels provided by a TVWS database and initiate and operate a network by sending enabling signals to one or more fixed, personal/portable and/or IoT TVWS devices.
- (P) “Geo location capability”- The capability of a TVWS device to determine its geographic coordinates and geographic uncertainty in WGS84 format. This capability is used with a TVWS database approved by the Commission to determine the availability of frequencies at a TVWS device’s location.
- (Q) “Geo location uncertainty” – The estimated positioning error in the TVWS device’s antenna geographic coordinates and height above ground level with respect to its actual position, at a 95 percent confidence, as reported to the TVWS database.
- (R) “Integral antenna” – The antenna designed as a fixed part of the TVWS transmitter, without the use of an external connector, which cannot be disconnected from the equipment by the user with the intent to connect to another antenna. An integral antenna may be fitted internally or externally. In the case where the antenna is external, a non-detachable cable can be used.
- (S) “Internet of Things (IoT) TVWS device” – A fixed or transportable TVWS device, operating in a channel of no greater than 100 kHz within an available channel, that incorporates a contention based or scheduled spectrum access mechanism, intended for low-bandwidth data transmission applications.
- (T) “Master TVWS device” - A fixed or IoT TVWS device that uses a geo location capability and access to a TVWS database, either through a direct connection to the Internet or through an indirect connection to the Internet by connecting to another master device, to obtain a list of available frequencies. A master device may select a frequency range from the list of available frequencies and initiate and operate as part of a network of TVWS devices, transmitting to and receiving from one or more TVWS devices. A master device may also enable client devices to access available

frequencies by (1) querying a database to obtain relevant information and then serving as a database proxy for the client devices with which it communicates; or (2) relaying information between a client device and a database to provide a list of available frequencies to the client device.

- (U) “MHz” - megahertz
- (V) “Network initiation” - The process by which a master device sends control signals to one or more TVWS devices and allows them to begin communications.
- (W) “Operating channel” - An available frequency used by a TVWS device for transmission and/or reception.
- (X) “Out-of-block emissions” – Unwanted emissions outside of the TVWS device’s operating channel(s) that fall within the other channels in the UHF and VHF broadcast television bands.
- (Y) “Sleep mode” – A mode of operation when the TVWS device is inactive but not powered down.
- (Z) “Television White Spaces (TVWS)” –Frequencies within the VHF or UHF spectrum bands which have been identified by a TVWS database for use by a TVWS device
- (AA) “TVWS database” - Database system approved by the Commission which can communicate with TVWS devices and upon request provides information on TVWS availability and maximum power levels
- (BB) “TVWS device” - An intentional radiator that operates on a license exempt basis on available frequencies in the VHF and UHF television broadcast bands.
- (CC) “UHF TV Band” – UHF Band (470-694 MHz)
- (DD) “Rural area” – A proxy measure for a rural area in Nigeria. It is a location where greater than half of the channels in the 470 to 694 MHz portion of the UHF band is available for TVWS operations. A Rural area is a geographic area that is located outside cities with sparse population.
- (EE) “Sub-urban area” – A suburban area is a residential district located on the outskirts of a city.

These guidelines may be cited as the Guidelines on the use of Television White Spaces, 2019

MADE AT ABUJA THIS _____ DAY OF _____ 2019.

**PROFESSOR UMAR GARBA DAMBATTA
EXECUTIVE VICE-CHAIRMAN**