

## **ADDENDUM TO THE DRAFT GUIDELINES ON USE OF TELEVISION WHITESPACE (TVWS) IN NIGERIA**

### **15. Licensed TVWS Systems**

#### **(A) Intent**

- (i) Licensed TVWS systems are point-to-multipoint fixed wireless access systems operating in rural areas and are intended for subscriber-based broadband Internet applications.
- (ii) In-band backhaul and other subscriber-based services are permitted at the discretion of NCC, on a case-by-case basis, provided that the main application of the network is subscriber-based broadband access.

#### **(B) Permissible Frequencies of Operation**

- (i) Master and client devices of licensed TVWS systems shall only operate on available frequencies in the 470 to 694 MHz portion of the UHF band within a prescribed geographic area defined by the master device's service contour, as specified in the Spectrum License obtained from NCC.

#### **(C) Authorization Framework**

- (i) 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. TVWS spectrum shall be utilized only by Operating Licence holders of the NCC as specified in the Communications Act.
- (ii) Licensed TVWS systems operators additionally require a Spectrum License for its intended geographic area of operation. The geographic area of operation corresponds to the licensed TVWS system's nominal service contour as provided in (H). The spectrum license will be granted on a no-protection, no-interference basis with respect to broadcasting service license holders and on condition that the licensed TVWS system will not constrain future broadcasting services.
- (iii) NBC and NCC shall evaluate proposed licensed TVWS systems prior to issuing a spectrum license to ensure there will be no harmful interference to TV receivers operating within the TV broadcaster's protected contour on the co-channel and the first and second adjacent channels to the TVWS frequencies requested within the proposed area of license.

- (iv) TVWS Spectrum Licenses will be issued on a first-come, first-served basis. Licenses issued for TVWS systems operating on the co-channel and first and second adjacent channels shall not have overlapping nominal service contours except through the coordination process described in paragraph (J).
- (v) To promote competition, two channels will be assigned to each frequency division duplex (FDD) licensed TVWS system and one channel will be assigned to each time division duplex (TDD) licensed TVWS system. However, for each TDD system, up to two contiguous channels may be assigned, and for each FDD system, a pair of two contiguous channels may be assigned (up to four channels total), depending on the availability of such contiguous channels and provided that the requirements for this extra capacity can be demonstrated.
- (vi) If licensed TVWS operators in an adjacent or overlapping service areas are assigned channels in the same or adjacent frequency range, coordination is required. When potential conflicts between systems cannot be resolved, NCC and NBC shall be advised. Following consultations with the concerned parties, NCC will determine the necessary course of action.

(D) Nominal channel bandwidth and occupied bandwidth

- (i) For equipment having an occupied bandwidth less than or equal to 8 MHz, the nominal channel bandwidth is 8 MHz.
- (ii) For equipment having an occupied channel of greater than 8 MHz, up to a maximum of 16 MHz, the nominal channel bandwidth is 16 MHz, the channel being formed by two contiguous 8 MHz blocks.
- (iii) The maximum permissible nominal channel bandwidth is 16 MHz.
- (iv) The occupied bandwidth shall be greater than or equal to 500 kHz and shall not exceed the nominal channel bandwidth.

(E) Average Conducted Power and Average Conducted Spectral Power Density Limits

- (i) Licensed master TVWS device
  - (a) The average transmitter output power shall not exceed 1 Watt in an 8 MHz bandwidth and the average transmitter power spectral density shall not exceed 14 dBW/100 kHz.

- (ii) Licensed client TVWS device
  - (a) The average transmitter output power shall not exceed 1 Watts in an 8 MHz bandwidth and the average transmitter power spectral density shall not exceed -7 dBW/100 kHz

(F) Antenna Requirements and Height Limits.

- (i) The transmit antenna above ground level shall be limited to less than or equal to 60 meters above ground level.
- (ii) Licensed TVWS master devices
  - (a) The receive antenna is omnidirectional.
  - (b) Antenna discrimination is 14 dB
- (iii) Licensed TVWS client devices
  - (a) The licensed TVWS client device must employ only vertical polarization for transmission, whereas any polarization may be used for reception.
  - (b) The licensed TVWS client device must exhibit at least 14 dB of cross-polarization isolation and a minimum front-to-back ratio of 14 dB.
  - (c) Where the licensed TVWS client operates at an e.r.p. greater than 2.45 W but below 24.5 W, the level of antenna discrimination shall be increased by 1 dB above the value in (b) for every 1 dB increase in e.r.p. above 2.45 W.

(G) Radiated Power and Out-of-Block Radiated Power Limits.

- (i) Licensed master TVWS devices
  - (a) The radiated power limit is 30 W e.i.r.p.
- (ii) Licensed client TVWS devices
  - (a) The radiated power limit is 4 W e.i.r.p. (2.45 W e.r.p).

- (b) The use of higher e.r.p. may be permitted by the Commission, in consultation with NBC, were justified by difficult propagation conditions and the more stringent antenna discrimination requirements in (E).
- (iii) The power of unwanted emissions in the measurement bandwidth shall be attenuated below the average conducted power in the 8 MHz bandwidth by the following amount:
  - (a) For frequency separation from the channel edge between 50 kHz and 8 MHz, the out-of-channel attenuation is given by  $44.9 + 1.1 * (\text{frequency separation})^{1.6}$  dB.
  - (b) For frequency separation from the channel edge between 8 MHz and 16 MHz, the out-of-channel attenuation is given by  $37.8 + 4.4 * (\text{frequency separation})$  dB.
  - (c) For frequency separation from the channel edge between 8 MHz and 16 MHz, the out-of-channel attenuation is given by  $37.8 + 4.4 * (\text{frequency separation})$  dB.
  - (d) For frequency separations greater than 24 MHz within the 470-694 MHz band, the out-of-channel attenuation is given by 100.8 dB.
- (iv) The measurement bandwidth for the out-of-channel attenuation in (i) is 100 kHz.

(H) Licensed Master TVWS Device Nominal Service Contour

- (i) The nominal service contour of a licensed master TVWS device corresponds to a field strength of 30.8 dBuV/m at a receive antenna height of 10 meters

(I) Licensed TVWS System Site Restrictions

- (i) A licensed TVWS master device must be sited sufficiently outside the protected contour of any television broadcast station to protect the broadcasting service from co-channel interference and adjacent channel interference up to the second adjacent channel above and below the broadcast channel. Prior to issuing the Spectrum License, NCC, in consultation with NBC, shall determine the distance beyond the protected contour for the proposed licensed TVWS system based on the licensed TVWS master device's radiated power, receiver protection

ratios, height above average terrain, and an approved atmospheric propagation model.

- (ii) A licensed TVWS master device may operate within the protected contour of a broadcast TV station on the third adjacent channel and above. The licensed TVWS system operator is responsible for addressing complaints from users of television receivers within 1 km of the master device.
- (iii) All licensed TVWS client devices must be sited at least 6 km outside the protected contour of the broadcaster television station when operating co-channel, at least 500 m outside the protected contour of the broadcast television station when operating on the first adjacent channel, and outside the protected contour of the television station when operating on the second adjacent channel. Client devices operating on the third adjacent channel and higher may be sited within the protected contour.
- (iv) Protected contour for broadcast television stations
  - (a) Analog:  $64 - 20 \log(615 / (\text{center frequency of channel}))$  in dBuV/m
  - (b) Digital:  $41 - 20 \log(615 / (\text{center frequency of channel}))$  in dBuV/m

(J) Licensed Master TVWS Device Coordination

- (i) With other Licensed Master TVWS Devices
  - (a) A new Licensed TVWS system shall not create a E-field strength greater than 37.5 dBuV/m at the nominal service contour of a neighboring licensed TVWS system or at an E-field strength greater than 15.0 dBuV/m at a neighboring licensed TVWS system's base station operating on the co-channel, without having coordinated in advance
  - (b) A new Licensed TVWS system shall not create a E-field strength greater than 69.0 dBuV/m at the nominal service contour of a neighboring licensed TVWS system or at an E-field strength greater than 46.1 dBuV/m at a neighboring licensed TVWS system's base station operating on the first adjacent channel (above and below), without having coordinated in advance.
  - (c) A new Licensed TVWS system shall not create a E-field strength greater than 91.6 dBuV/m at the nominal service contour of a neighboring licensed

TVWS system or at an E-field strength greater than 68.6 dB $\mu$ v/m at a neighboring licensed TVWS system's base station operating on the second adjacent channel (above and below), without having coordinated in advance

(ii) With License-Exempt Master TVWS Devices

- (a) Licensed TVWS operators must provide TV whitespace database administrators or NCC (if Section 11 applies), the geo-coordinates, height above ground level, average conducted power, radiated power, antenna type, and polarization of the master device, and the geographic extent of its service contour, prior to commencing operations.
- (b) Licensed TVWS operators that do not comply with (a) will forfeit their ability to claim protection from harmful interference from license-exempt TVWS systems.

(K) Limits on Operations near International Borders.

- (i) Licensed TVWS systems operating near national borders shall not cause harmful interference to broadcasting and other services in neighbor