

REGULATORY GUIDELINES FOR DEPLOYMENT OF BROADBAND SERVICES ON THE 5.2-5.9 GHz BAND

PREAMBLE

The Nigerian Communications Commission has opened up the band 5.2 – 5.9 GHz for services in the urban and rural areas of the country. Given the development of services and the increased availability of equipment for these bands, it has developed guidelines for deployment of Wireless Access System in the band.

1. INTRODUCTION

Considerable development in terms of service portfolio, standardization and equipment manufacture has happened since the conclusion of the WRC-03 in the occasion of which the allocations were concluded and especially the allocation to mobile except aeronautical mobile for the deployment of Wireless Access Systems (WAS), as per Resolution 229.

“Wireless Access Systems (WAS) are defined by ITU as end-user radio connections to public or private core networks”. “Technologies in use today for implementing wireless access is also noted by ITU to include cellular, cordless telecommunication, and wireless local area network systems”.

Powerful implementation of various wireless access technologies like Wi-Fi and Wimax sprang up in 2005 alone. These technologies are able to operate not only on the Industrial, Scientific and Medical (ISM) bands of 2.4 and 5.8 GHz bands but other bands like 2.0, 3.5, 5.0, 5.2, 5.3 and 5.4 GHz etc. Each of these promises access to broadband internet services at cheap and affordable rates.

This band can be deployed to provide WiMAX, Wi-Fi, Campus Local Area Network, public access, mass market and other related services.

Consequent upon the above, the NCC is hereby providing regulatory guidelines to facilitate access to spectrum in the 5.2 – 5.9 GHz band for the implementation of these new and innovative wireless services in urban and rural areas of the country.

PURPOSE OF Guidelines

The purpose of this set of guidelines is:

- To harmonize use of frequency bands, set up Technical and operational parameters, specific national procedures for deployment and market access for broadband wireless possibilities in the stated frequency band.
- To ensure easy market entry, interference free operation, and guaranteed quality and grade of service.

OPERATIONAL GUIDELINES

To ensure efficient use of spectrum, a mixture of license exempt and licensed spectrum is hereby made available for broad band roll out.

- (a) The bands under these guidelines are:
- 5.3 GHz band = 5.25-5.35 GHz
 - 5.4 GHz band = 5.47-5.725 GHz
 - 5.8 GHz band = 5.725-5.85 GHz
- (b) In order to accommodate all categories of operators and users, some segment of the spectrum has been identified for commercial use and others set-aside for private use.
- (c) The 5.47 – 5.725 GHz band shall be licensable, while the 5.25-5.35 GHz and 5.725 – 5.875GHz bands shall be license exempt.
- (d) Commercial operators would be licensed to enable them have exclusive rights to allocated spectrum which will enable a more predicable and stable provision of services. A licensed solution for commercial operations will also reduce interference issues and facilitate large coverage.
- (e) Operators/Licensees will have maximum possible flexibility in determining the services they will offer and the technologies they will employ, within the spectrum allocation. The NCC policy on technology neutrality shall be maintained to allow the greatest flexibility for fixed wireless access (FWA) opportunities.
- (f) All categories of operators (commercial and private) will be guided by the same technical specifications and operational restrictions.
- (g) All equipment to be deployed in this band must be type approved by the commission prior to importation in compliance with section 132 of the Nigerian Communications Act 2003.

TYPES OF SERVICES PERMITTED

The three bands are available for Wireless Access Service (WAS) of the many types that are or will become available in the world markets.

The 5.4 GHz band is designated for unshared, coordinated and protected use of WAS. The 5.3 and 5.725 – 5.8 GHz bands are designated for the shared, uncoordinated and unprotected use of wireless access systems (WAS).

Operators are advised to provide services with operational parameters flexible enough to accommodate all classes of users based on the followings:

- (a) Flexible class of service per subscriber.
- (b) Configurable up/down link data rate.
- (c) Configurable RF channel separation.
- (d) Dynamic bandwidth allocation to subscriber station based on demand.
- (e) Remote software downloads.
- (f) Automatic channel search for subscriber stations

There is no coverage restriction imposed on services deployed on the bands; however every technical restriction provided in this guideline must be strictly adhered to.

TECHNICAL CONDITIONS

Technical parameters

- In the 5 250 – 5 350 MHz band, stations in the mobile service shall be limited to a maximum mean e.i.r.p. of 200mW and a maximum mean e.i.r.p. density of 10mW/MHz in any 1 MHz band.
- In the 5 470 – 5 725 MHz band, stations in the mobile service shall be restricted to a output power of 4W (e.i.r.p.)

In the License exempt bands;

- The peak transmit power shall not exceed the lesser of 1 W or 17 dBm + 10logB, where B is the 26-dB emission bandwidth in MHz.
- For frequencies greater than 10 MHz above or below the band the level must be less than -27dBm/MHz.
- Stations in the mobile service that are permitted to be used for either indoors or outdoors may operate up to a maximum mean e.i.r.p. of 1W and a maximum mean e.i.r.p. density of 50 mW/MHz in any 1MHz , and, when operating above a mean e.i.r.p. of 200mW, these stations shall comply with the following e.i.r.p. elevation mask.

-13 dB (W/MHz)	for $0^\circ \leq \theta < 8^\circ$
-13 - 0.716 (θ - 8) dB (W/MHz)	for $8^\circ \leq \theta < 40^\circ$
-35.9 - 1.22 (θ - 40) dB (W/MHz)	for $40^\circ \leq \theta < 45^\circ$
-42 dB (W/MHz)	for $45^\circ < \theta$

Where θ is the angle above the local horizontal plane (of the earth).

- Systems deployed in any of the license exempt bands shall employ transmitter power control (TPC), but if TPC is not used, the maximum mean e.i.r.p. and maximum mean e.i.r.p. density must be halved.
- The Radio equipment should have capability to choose within the range of hopping frequencies, a channel or frequency optimized for the desired service.
- For systems operating in any of the license exempt bands, in addition to DFS and TPC where applicable, the mitigation techniques shall ensure that the probability of selecting a given channel will be the same for all available channels. The intention is to provide, on average, a near-uniform spread of the loading of the spectrum.
- The peak power spectral density should not exceed 17dBm/MHz e.i.r.p.

- There must be at least 75 hopping frequencies.
- The average time of occupancy on any frequency should not be greater than 0.4 seconds within a 30 second period.

For point-to-multipoint use;

- An antenna gain of not more than 6 dBi should be normally allowed with 1W transmitter output power, which, with a 20 MHz bandwidth, results in an e.i.r.p. of 4W.
- Transmitting antennas of directional gain greater than 6 dBi should be allowed, but the peak transmit power and the peak power spectral density must be reduced by the amount (in dB) that the directional gain of the antenna exceeds 6 dBi.

For point-to-point use

- Fixed point-to-point WAS devices operating in this band may employ transmitting antennas with an unlimited directional gain without any corresponding reduction in the transmitter peak output power or peak power spectral density.

Fixed, point-to-point operation excludes the use of point-to-multipoint systems, omnidirectional applications, and multiple co-located transmitters transmitting the same information. However, in the case of point-to-multipoint systems transmission in the direction of the nodal point is considered to be point-to-point.

In the three bands;

- Indoor and outdoor operations are permitted.
- Mean e.i.r.p. refers to e.i.r.p. during the transmission burst which corresponds to the highest power, while using APC.
- Coordination criteria set out in Recommendations ITU-R M.1638 and ITU-R SA.1632. (WRC-03) for coordination with other services with primary allocation shall be observed.
- The mitigation measures found in annex 1 to recommendation ITU-R M 1652 shall be implemented by systems deployed to ensure compatible operations with radio determination systems.
- Systems operating in any of the three bands must meet the systems characteristics and interference criteria as stated in ITU Recommendation ITU-R SA. 1632 for protection against EESS (Active) and SRS (active).
- On the boundary of the coverage area (States/Regions)of the frequency license, the power flux density shall not exceed -122.5 dBW/m² measured with a reference bandwidth of 1 MHz. Adjacent spectrum users may agree to deviate from the maximum power density level.

- At the boundary between Nigeria and foreign States, the power flux density shall not exceed -122.5 dBW/m² measured with a reference bandwidth of 1 MHz unless a coordination agreement has been entered into.

In cases of Frequency hopping systems, the following criteria should be strictly adhered to for both point to point and point to Multipoint systems:

- No limit on the antenna gain.
- Carrier frequencies need to be separated by at least 25kHz or by the 20dB bandwidth of the hopping channel, whichever is greater.
- The maximum 20 dB bandwidth of the hopping channel is 1 MHz.
- The system must hop pseudo-randomly.
- Frequency hopping systems should have hopping channel carrier frequencies separated by a minimum of 25 kHz or the 20 dB bandwidth of the hopping channel, whichever is greater.
- The system should hop to channel frequencies that are selected at the system hopping rate from a pseudo-randomly ordered list of hopping frequencies.
- Each frequency must be used equally on the average by each transmitter.
- The system receivers shall have input bandwidths that match the hopping channel bandwidths of their corresponding transmitters and shall shift frequencies in synchronization with the transmitted signals.
- For all systems, devices should automatically discontinue transmission in case of either absence of information to transmit or operational failure.

Frequency (GHz)	Output Power (e.i.r.p)	Restrictions	Power Spectral Density (mW/Mhz)
5.25 – 5.35	1W (WRC=200mW)	DFS/TPC Allow outdoor	50
5.47 – 5.725	4W		
5.725 – 5.850	4W (1W TX)		50

Modulation Schemes

- The modulation type shall be flexible digital modulating schemes, multiple access schemes such as CDMA, FDMA, OFDMA, SOFDMA, etc to increase system's overall performance.

Automatic Transmit Power Control (ATPC)

- ATPC implementation should be declared and applied without exceeding the assignment criteria.

- Dynamic Frequency Selection is obligatory in license exempt bands.

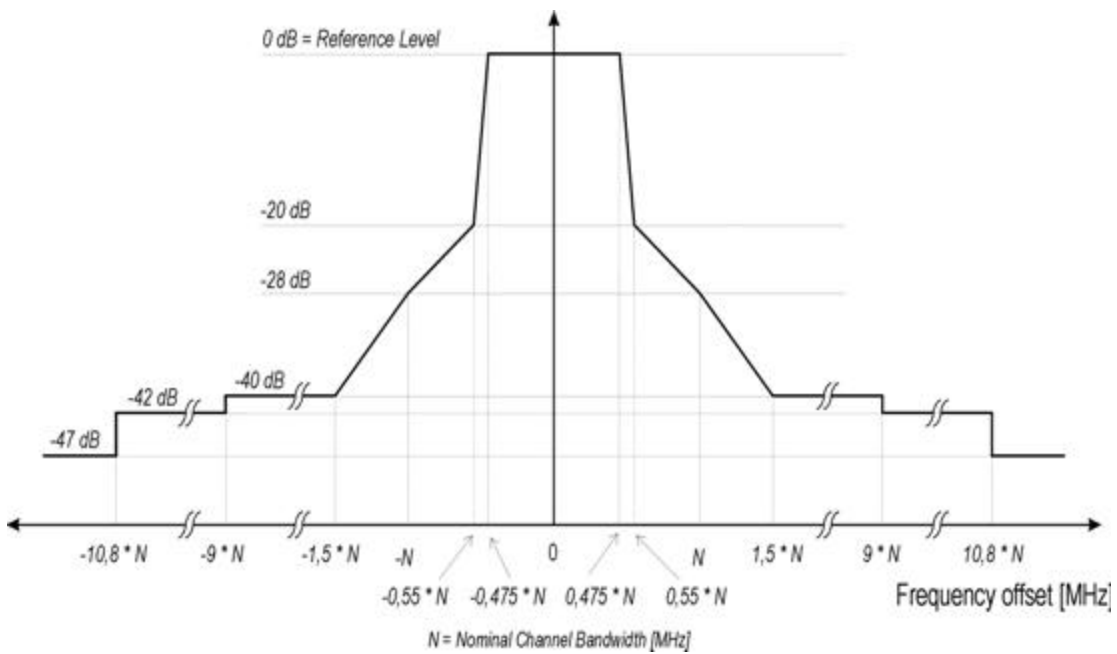
IEEE Protocols

- The equipment should have capability for providing services using flexible protocols such as 802.11 a, b, and g; 802.16 – 2004; 802.16 e; 802.16 d etc.

Spectral Masks

The spectral mask below shall apply to all the bands. The Spectral mask is set to establish clear boundaries between adjacent licenses.

Fig 1. Transmit Power spectral mask



NOTE: dBc is the spectral density relative to the maximum spectral power density of the transmitted signal.

Spectrum sharing

- Operators are to optimize spectrum usage and ensure protection of other licensed users by avoiding harmful interference.

Configurable Equipment

- The Radio equipment should possess configurable RF channel width and Bandwidth to allow the system to fit available spectrum, data transmission requirements and other changing circumstances.

LICENSING CONDITIONS

- The 5.47 – 5.725GHz band is licensable.
- The 5.25 – 5.35GHz and 5.725 – 5.875GHz bands is license exempt.
- All sites deploying license exempt bands must be registered with the Commission.
- Licensees would only require frequency authorization (i.e. frequency assignment) that will enable them deploy appropriate technologies to meet their business requirements.
- A reliable customer billing system must be installed and guaranteed.
- Licensees are encouraged to deploy any appropriate technology within the spectrum allocation and assignment.
- All customers premises equipment supplied by the operator must conform to the items listed in the section TECHNICAL SPECIFICATION.

Management of Interference (For License exempt portion)

Should intolerable interference occur, in the case of a fixed device, a user/operator may;

- Relocate or reposition the device so that it is shielded from the source of interference
- change the frequency, or the frequency band (such as changing the band from 5.25-5.35 to 5.725-5.875 GHz)
- tilt the antenna, or, in extreme cases, use an antenna of higher gain and a better ability to reject the interference.

QUALITY OF SERVICE

- Subscribers will be given opportunity to choose the type of service they wish to subscribe to depending on the quality of service and data speed they can afford. Operators will be able to offer different levels of guaranteed QoS and data rates.
- Frequency coordination would be required between operators/licensees in adjacent service areas in order to avoid interference at all levels.
- Operators may be required to use mitigation techniques such as antenna discrimination, polarization, frequency offset and power control to facilitate co-existence with systems of other service providers.