

REGULATORY GUIDELINES FOR THE USE ISM BAND

Introduction

Radio Frequency Spectrum is a limited natural scarce resource which should be used efficiently and effectively without interference between users. Spectrum is used to facilitate different radio communication services such as mobile telephony, broadcasting, satellite communications, scientific applications and others many as agreed in ITU World Radio communication Conference. The World Radio communication Conference (WRC) is among the organ of International Telecommunication Union (ITU) which is held every 3 or 4 years to decide usage of bands of spectrum for different services. The regulatory agencies allocate and licence frequencies to different industries on country basis with proper regards to ITU guidelines.

In accordance with the above mandate and following requests from the service providers and the public for use of ISM band, the Rwanda Utilities Regulatory Agency has developed the guidelines to enable use of the band for the various applications.

Objective of the ISM guidelines

The main objective of setting the guidelines is to ensure interference-free operation by all users of the band and to ensure that a guaranteed grade of service is available to the subscribers through established quality of service benchmarks, and consumer code of practice.

ISM frequencies as per ITU table of allocation

The following bands are designated for industrial, scientific and medical (ISM) applications:

6 765-6 795 kHz (centre frequency 6 780 kHz),

433.05-434.79 MHz (centre frequency 433.92 MHz)

61-61.5 GHz (centre frequency 61.25 GHz),

122-123 GHz (centre frequency 122.5 GHz), and

244-246 GHz (centre frequency 245 GHz)

The following bands are also designated for industrial, scientific and medical (ISM) applications:

13 553-13 567 kHz (centre frequency 13 560 kHz),

26 957-27 283 kHz (centre frequency 27 120 kHz),

40.66-40.70 MHz (centre frequency 40.68 MHz),

902-928 MHz in Region 2 (centre frequency 915 MHz),

2 400-2 500 MHz (centre frequency 2 450 MHz),

5 725-5 875 MHz (centre frequency 5 800 MHz), and

24-24.25 GHz (centre frequency 24.125 GHz)

The ITU regulations states that, ISM equipment operating in these bands is subject to the conditions which are stipulated in the provision No. **15.13**. This provision states as follows:-
“Administrations shall take all practicable and necessary steps to ensure that radiation from equipment used for industrial, scientific and medical applications is minimal and that, outside the bands designated for use by this equipment, radiation from such equipment is at a level that does not cause harmful interference to a radio communication service and, in particular, to a radio navigation or any other safety service operating in accordance with the provisions of these Regulations”

Type approval

Any persons (individuals and business entities) intending to use radio communication and telecom equipment should first ensure that the equipment has been type approved for use in Rwanda. The granting of type approval to radio communication and telecommunication equipment simply means that the equipment conforms to defined regulatory standards and requirements and is therefore least likely to cause disruptions when used in public communications networks.

As well as ensuring that the equipment conforms to defined national regulations, the type approval process is carried out to:

- a) Protect public radio communication and telecommunication networks from any harm/damage that may be caused to the existing network equipment by the connection of new terminal equipment and/or any associated wiring procedures.
- b) Protect the safety of end-users of telecommunications and radio communications equipment from possible dangers that may arise out of connection of new equipment to existing communication networks.
- c) Prevent the connection of non-standard equipment to existing public communication networks, a practice that could easily compromise the integrity of an existing network.
- d) Maintain the acceptable quality of service levels and end-to-end network performance of radio and telecommunications networks.
- e) Protect the general public from harmful and sometimes fatal emissions from faulty or obsolete communications equipment.
- f) Protect the environment from possible dangers arising out of sub-standard equipment connected to communication networks.
- g) Enable the general public become aware of the need to ensure that all radio communication and telecommunication equipment conforms to national regulations and standards before use in both private and public communication networks.

Opening up the ISM frequencies for use

The ISM band which is opened for commercial purpose is 2.4 and 5.8GHz. The other ISM band will not be used for commercial operations. RURA strongly supports the opening of the ISM frequencies for use of the public and commercially without the necessary government licensing requirements typically required for radio services. However, it is imperative to ensure that this resource is only used using certified devices and as such the AGENCY should continue to regulate and type-approve devices in order to minimize interference problems. RURA is also of the position that service providers using this resource register the topology of their networks as well as any changes in their network to provide the Agency with the necessary information for its administrative functions

1. OPERATIONAL GUIDELINES

- (a) Access to the spectrum will be on shared basis. There will be no exclusive assignment to any individual or organizations, whether for private, public or commercial use.
- (b) All users, both private and commercial service providers will be guided by the same technical specifications and operational restrictions
- (c) All equipment to be deployed must be type approved by the Agency
- (d) ISM band will be permitted for both indoor and outdoor use.
- (e) Wide area deployment will not be allowed on the ISM bands, coverage or transmission distance from a single hotspot must be within the distance stipulated in the technical specification. Transmit power, antenna height and gain must be selected in order to keep emission within stipulated distances.

All customer premises equipment supplied by the operator must conform to the items listed in the section **TECHNICAL SPECIFICATIONS**.

2.0 TECHNICAL SPECIFICATIONS

2.1 Basic Specifications: IEEE802.11b (Industry open standard)

- (a) Operating Frequency:
- (b) Maximum Data Rate:
- (c) Multiple Access Method:
- (d) Digital Modulation Scheme:
- (e) Maximum Coverage Distance:
- (f) Media Access Protocol: Collision Avoidance Technique

2.2 **Operational Features:**

Transmitter parameter limits

Transmitter Power Limits (EIRP)

The peak power spectral density should not exceed 17dB in any 1MHz

Equipments using FHSS modulation < -10 dBW (100 mW) per 100 KHz EIRP

Other types of modulation < -20 dBW (10mW) per MHz EIRP.

2.3 Automatic Transmit Power Control (ATPC) ATPC feature should be declared with the ranges and the related tolerances and subject to tests.

2.4 Dynamic Frequency Selection/Adaptive Frequency Hopping Technique

The equipment should have the capability for dynamic frequency selection from the range of hopping frequencies.

The number of hopping channels should not be less than 75.

Occupancy on any frequency should not be more than 0.4s in any 30s period

2.5 Bandwidth and Carrier Separation

Carrier frequencies must be separated by at least 25kHz or the 20dB bandwidth of the hopping channel, whichever is greater.

Maximum bandwidth must not exceed 1 MHz.

2.6 Modulation

The Modulation type shall be wideband digital modulation system, using spread spectrum techniques to transmit and receive.

2.7 Adaptive Frequency Hopping/Adaptive Dynamic Polling

All systems must be capable of Adaptive Frequency Hopping/Adaptive Dynamic Polling to enable dynamic allocation of hopping channels.

FHSS modulation

Number of channels > 75

Channel separation = separated by channel bandwidth as measured at 20 dB

Below peak power

Dwell time per channel < 0.4 seconds

2.8 Spurious emissions The spurious emissions of the transmitter shall not exceed the values in tables 1 and 2 in the indicated bands.

Frequency range	Limit when operating	Limit when in standby
30 MHz – 1 GHz	- 36 dBm	- 57 dBm
Above 1 GHz – 12.57 GHz	- 30 dBm	- 47 dBm

Table 1: Transmitter limits for wideband s purious emissions

Frequency range	Limit when operating	Limit when in standby
30 MHz – 1 GHz	-80 dBm/Hz	- 107 dBm/Hz
Above 1 GHz – 12.75GHz	- 80 dBm/Hz	- 90 dBm/Hz

Table 2

3.0 QUALITY OF SERVICE

3.1 Interference No interference shall be caused to any systems operating in any of the primary allocations in the band (e.g. FSS and Radiolocation)

3.2 Availability of Connection

The Service provider is to guarantee 95% availability of its service to its subscribers.

3.3 Security The provider should take adequate measure to protect the data traffic to uphold the subscriber's right to privacy.

3.4 After-sale Support and Maintenance There shall be adequate support system to the subscriber in terms of repairs of equipment, upgrade facilities and other service failure reports on mutually acceptable terms and conditions.

3.5 Service Agreement The Service Agreement between the provider and subscriber shall be subject to approval by the Agency.

3.6 Bit Error Rate

BER objective: 10^{-5} Max.

3.7 Hotpots The number of permissible hotspots in any given area will take cognizance of acceptable quality of service, and the interference factor.

4.0 TYPE APPROVAL

4.1 All equipment must be type-approved by the Regulatory Agency before commissioning.

4.2 Where necessary the vendor may be required to make a presentation to the Regulatory Agency on the service to be provided with the equipment.

4.3 The time frame for the type approval will be a maximum of 3 months after application.

5.0 BACKHAUL FREQUENCIES

For the purpose of connecting Wi-Fi hotspots to the nearest switch/router for onward connection to the internet or other global/national networks, the under-listed point-to-point backhaul methods will be permitted.

5.1 Exclusive (FWA) Backhaul Frequency

FWA licensees or other operators with frequency licenses consisting of multiple channels/slots are free to reserve one of the slots for Point-to-Point backhaul links. This can be used to backhaul their Wi-Fi hotspot traffic or to service ISPs and cyber-café. The rest of the slots can then be used for Point-to-Multipoint broadcast channels.

5.2 Microwave Backhaul Frequencies

_Operators requiring secured high-capacity backhaul links are free to apply for additional microwave link frequency license under the same conditions applicable to telephone network backhaul in the 15 GHz band.

5.3 Satellite Backhaul

Operators with existing domestic satellite licenses can use satellite backhaul to concentrate Wi-Fi hotspot traffic.

5.4 Leased Backhaul Links

_Operators, private individuals or organizations can lease bandwidth from Long Distance Operators or from domestic satellite providers for the purpose of linking their hotspot to internet access points or for concentrating hotspot traffic.

6.0 APPLICABLE INDUSTRY STANDARDS

The above specifications are broadly based on ITU recommendations, IEEE standards and Wireless Internet Compatibility Alliance (WECA) guidelines.