



Telecommunications Division

Ministry of Public Administration & Information

April 2004

# Free Spectrum for All

## **Policy on License Exemption of Systems in the 2.4 GHz and 5.8GHz Bands**

# Table of Contents

Executive Summary .....	1
Introduction.....	2
Motivation.....	4
Background & Applications .....	5
Exemption of Systems in the 2.4GHz Band .....	9
Technical Specifications of Operation in the 2.4GHz Band.....	15
Exemption of Systems in the 5.8GHz Band .....	10
Technical Specifications of Operation in the 5.8GHz Band.....	17
Regulation of the 2.4GHz and 5.8GHz Bands .....	11
Conditions of Operation.....	12
References.....	13

## Executive Summary

1. This policy prescribes the exemption of licensing of systems and/or equipment utilizing:
  - i. The 2.4GHz spectrum band for use within the premises owned, leased or borrowed by the owner and/or operator of the system or between such premises,
  - ii. The 5.8GHz band for both public and private access.

The 2.4GHz and 5.8GHz bands belong to those designated by the International Telecommunications Union (ITU) as the Industrial, Scientific and Medical (ISM) Bands. By making these bands license-exempt, users proposing to use these bands for telecommunication purposes will not have to submit a formal application for a license, subject to operating within defined technical specifications. These engineering specifications for transmission levels, channel bandwidths, and receiver constraints have been defined to govern the operation of systems operating within these bands to promote a congestion-free environment in these exempted bands.

2. The justification for the exemption of licensing in these bands stems from the high availability of equipment manufactured internationally that provides economical communication services to its users. By making these bands license-exempt, it is hoped that wider access to network services, greater productivity and development of innovative applications and transactions will be stimulated, bringing Trinidad & Tobago closer to realizing the goal of an information society. However, the need for co-existence of multiple applications within this band is essential, and therefore criteria have been established to sustain an interference-free, multi-user environment.

3. The specifications have been developed to restrict the operation of 2.4GHz systems to the user's premises such as buildings and campuses or between such premises, and the operation of 5.8GHz systems for wide area network communications systems, in accordance with the proposed Broadband Policy. Considerations for regulating the environment to ensure that imported equipment and activated systems conform to the defined specifications and the conditions under which these systems shall operate are also discussed.

## Introduction

4. Across the world, telecommunications regulators and commissions have observed the exemption of licenses for systems operating in frequencies designated as the Industrial, Scientific and Medical (ISM) Bands. In these particular bands, service providers and operators are not required to apply for licenses to operate wireless systems. Typical applications for such systems are:

- i. Wireless Local Area Networks (WLANs), used for personal, enterprise-wide and campus-wide applications
- ii. Wireless Personal Area Networks (WPANs), used for communications between personal computers, phones and handheld devices
- iii. Cordless devices (cordless phones, wireless modems, remote controlled systems, cordless Private Branch Exchanges (PBXs))
- iv. Inter-building communications, used for connectivity between neighboring sites; this falls within the domain of Dedicated Short Range Communication (DSRC) links used for private purposes

5. These systems appear as standalone or plug-in equipment in fixed, mobile and portable variants, whereby:

- i. Fixed refers to systems whereby the transmitters and receivers of the communications signals are fixed in one position upon installation
- ii. Mobile refers to systems installed in mobile devices and are used while in transit, communicating to fixed or other mobile systems
- iii. Portable refers to standalone systems which are easily carried by the users during use

6. Industrial, Scientific and Medical Applications were originally defined by the International Telecommunications Union (ITU) as the operation of equipment or appliances designed to generate and use locally generated radio frequency energy for industrial, scientific, medical, domestic or similar purposes, excluding applications in the field of *telecommunications*.

7. Administrations around the world have recognized the productivity gains realized by the wider society by facilitating the operation of such wireless systems without the need to undertake the process of licensing such a system, including the significant effort required by the telecommunication authorities in licensing every single deployment. As a result, these administrations have made the 2.4GHz and 5.8GHz bands, along with other identified spectrum bands, license-exempt to permit and encourage the deployment of such systems in an effortless manner.

8. However, along with making these bands license-exempt, specific requirements of such systems have been developed, including the requirement to be of digital operation, to employ an appropriate scheme to ensure interference-free transmission and

noise immunity, and the associated transmission levels to be used by these systems. Hence, this policy presents technical specifications by which all systems operating in the 2.4 and 5.8GHz bands must comply.

9. It is worth noting that different parts of the world have identified different bands as their bands exempt from licensing. Table 2 summarizes these bands that have been assigned in various parts of the world.

Region	Frequency/Hz					
	800M	900M (ISM)	2.4G (ISM)	5.2G	5.6G	5.8G (ISM)
	868M – 870M	902M - 928M	2.4G - 2.4835G	5.15G – 5.35G	5.47G – 5.725G	5.725G – 5.85G
<b>US</b>		√	√	√		√
<b>Canada</b>		√	√	√		√
<b>Latin America</b>		√	√	√		√
<b>Europe</b>	√		√	√	√	√
<b>Asia Pacific</b>		√	√	√		√

**Table 1** – Assignment of license-free bands in various regions across the world

10. As such, manufacturers and vendors in these particular regions have developed substantial volumes of equipment that operate in the prescribed ISM bands. Hence, the selection of license-free bands must be guided by the availability of and accessibility to appropriate equipment that operates in these bands. With regards to the bands in question, they are observed as license-exempt bands throughout the world, and hence it is reasonable that Trinidad & Tobago conforms and exempts systems in these bands as well. Exemption of systems in non-ISM bands such as the Radio Local Area Network (RLAN) bands (5.15 – 5.35GHz, 5.47 – 5.725GHz) and other ISM bands, for example 902 – 928MHz, will be addressed in later policies.

11. Furthermore, Trinidad & Tobago belongs to ITU region 2, and hence should readily conform to spectrum practices employed by administrators in this region, whom have exempted systems in the 2.4GHz and 5.8GHz bands.

12. If systems operating in the band are exempted from licensing, there is substantial inducement for a service provider to sell services to its customers using this band, for example, broadband Internet access, due to the minimal cost of administration and licensing. However, administrations around the world have restricted the deployment of commercial services to subscribers using this band, emphasizing the use of the band for private use, industrial and medical applications, and scientific research and development. Conversely, many administrations have allowed provision of both public and private network services with the understanding that quality of service is not guaranteed and no protection can be provided in the event of an operator experiencing harmful interference. Both approaches have their advantages and benefits, with the former approach protecting users deploying such services from interference from public network services offered by carriers and ultimate congestion of the bands, while the latter has promoted growth of public Internet access, usage, affordability and availability.

13. It is recognized however, that if the relevant regulations and specifications are not defined by which devices operating in this band are governed by, the potential for abuse, uncontrolled and undesirable interference, and existence of disruptive systems may arise, which may eventually lead to an unusable band. Regulatory bodies and authorities throughout the world emphasize that although the band is unlicensed, it must still be regulated to some extent. Hence, it is important that any system deployed in these frequency bands meets these specifications, and that an adequate monitoring and control system be established to ensure conformance to these standards.

## **Motivation**

14. There is a growing demand among enterprises and consumers within Trinidad & Tobago to deploy wireless systems for various applications. This policy has been developed to govern the exemption of licenses for systems operating in the 2.4GHz and 5.8GHz bands and define the environment in which these systems shall exist.

15. This policy conforms to the prescription made in the proposed National Broadband Policy for systems in the 2.4GHz and 5.8GHz ISM bands to be made license-exempt in order to facilitate access and encourage greater use of broadband services. In addition, it ensures that bodies that can recognize productivity gains from mobile access to network resources can benefit fully without the associated administrative overhead of licensing. This policy recommends the use of 2.4GHz systems to be deployed within the constraints of or between the user's premises for non-third party applications and 5.8GHz systems to be deployed for both public and private network services, and discusses the conditions of operation that owners and users of systems within the band must recognize and observe.

## Background & Applications

### 2.4GHz connectivity

16. In the context of the proposed Broadband Policy, this policy supplements the motion for enabling broadband access to users by exempting licenses for systems operating in the band. In this context, this policy prescribes that systems operating in the 2.4GHz band offer non-commercial or commercial applications within the premises owned, leased or borrowed by the system operator, and solely private connectivity between locations. This was adopted to protect the subscriber and prevent congestion in the 2.4GHz band. This clarification is illustrated in Figures 1 and 2.

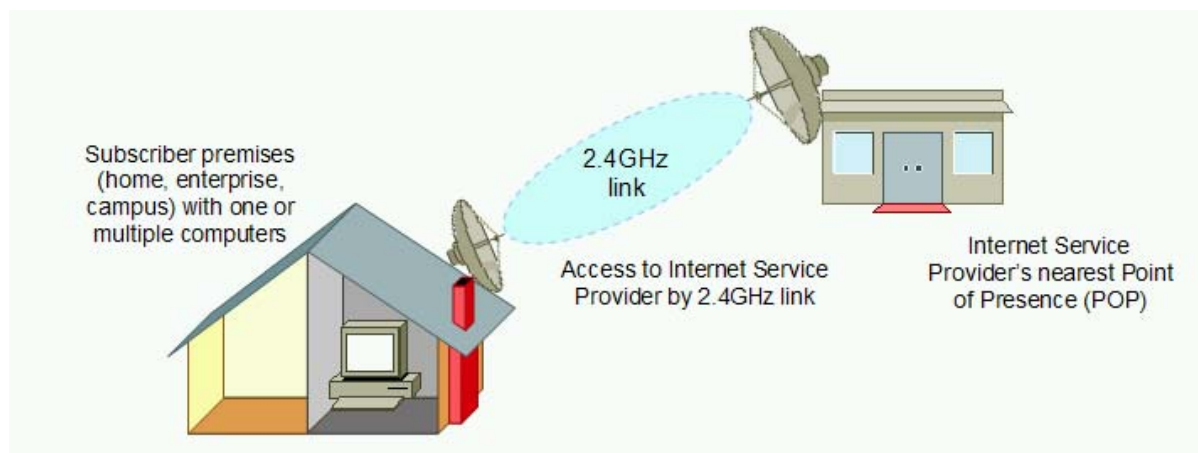


Figure 1 – Subscriber connected to Internet Service Provider using 2.4GHz link – Not allowed

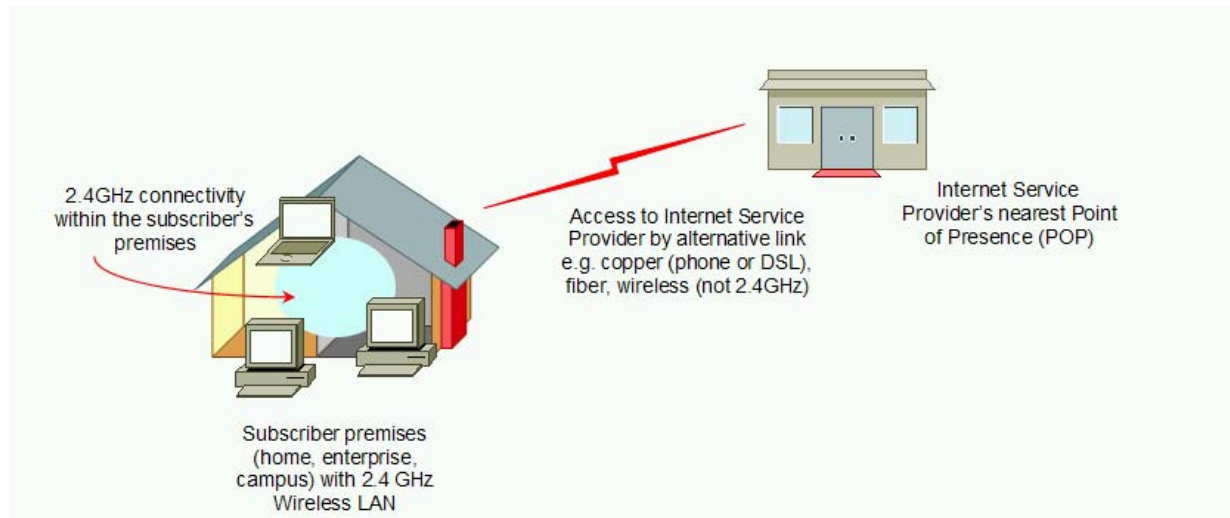


Figure 2 – Subscriber connected to Internet Service Provider, with multiple terminals gaining access using 2.4GHz connectivity within premises - Allowed

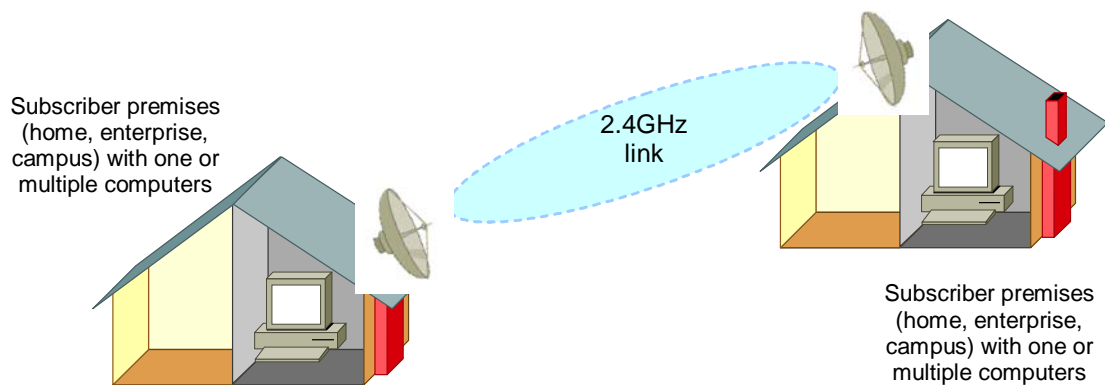
17. Figure 1 illustrates a subscriber, whether home, business office, school and medical facility or otherwise, gaining access to the Internet through a connection to the subscriber's selected Internet Service Provider (ISP). In this illustration, the connection itself is a 2.4GHz link. This particular application is a commercial application operating outside the premises of the ISP, where the subscriber is paying the ISP monthly access fees for the connection to the Internet. This paper recommends against the use of the 2.4 GHz ISM band for these purposes, as this represents an opportunity for the ISP to sell a service at virtually no access cost, and to create an environment that may degenerate rapidly to a congested nature. Similarly, a service provider cannot lease dedicated or switched site-to-site connectivity to end users, provide telephony services for its customers, or offer any other communication service to its subscribers.

18. Figure 2 illustrates the subscriber connected to its ISP via an alternate facility. However, the subscriber can allow multiple devices to access the single connection simultaneously by employing a license-exempt 2.4GHz local area network, in a private or commercial arrangement. In turn, the subscriber, or entity, is only allowed to operate the wireless network on his premises of operation, and:

- i. The entity cannot resale services to third parties in proximity that are not located upon his premises. These third-party premises include locations that may be owned or leased by the entity, but are subsequently leased to third parties.
- ii. The entity can however, allow users located on his premises access to the Internet at a fee, such as the case of Internet cafes and hot spots offered by coffee houses, airports and hotels.

19. In essence, users must not be allowed to gain access to the network, unless they are located on the premises of operation of the subscriber. In addition, the operation of the equipment is governed by specifications defined in Appendix 1 of this document. Conversely, the practice of the sale of Internet access to third parties situated on the premises of the provider, such as Internet cafes and hotel hotspots, is encouraged.

20. A third application that is proposed to exist in the 2.4GHz band is the connection of distant offices for private use. This is illustrated in Figure 3.



**Figure 3** – Subscriber connecting distant offices with 2.4GHz link - Allowed



21. This particular form of connectivity is provided between a party's premises that are separated by a significant geographic distance. Connectivity between two distinct parties with a mutual arrangement is allowed, provided a sale arrangement is not engaged. Point-to-point systems in this band are not for use for resale of services.

22. These particular applications will require highly directive antennae, and modulation techniques with high noise immunity should be employed, as they will be required to operate among similar connections within its vicinity. These systems will also be prohibited both by its transmission levels and by its received signal level to ensure only the power that is required is actually used.

### **Omni-directional Applications**

23. Typical wireless systems comprise of an access point or devices that transmit its signals in all directions. These systems typically comprise a stationary (but possibly portable, not necessarily fixed) central station that communicates with multiple mobile and portable devices. It is suggested that operators of such systems position these access points such that the maximum signal at the edge of the user's premises is acceptable for the receivers of these signals, but low enough to avoid the possible signal reception by parties in close proximity. Omni directional systems are the most common-typed systems that are found in the 2.4GHz band. Typical examples of omni directional systems are Wireless Local Area Networks (WLANs), Wireless Personal Area Networks (WPANs) and cordless devices. These systems typically do not require Line of Sight (LOS) to operate, and desirable signal propagation characteristics through walls is attainable, requiring strict levels of transmission levels to be defined.

### **Fixed, Point-to-Point Applications**

24. Fixed, point-to-point operation is the transmission between two stations using directive transmission. These are typically used to provide communication between two offices within a building, for example across floors, or between buildings. Use of the 2.4 GHz band for fixed, point-to-point applications is permitted, once it for the sole purpose of private use. A service provider establishing direct links in the 2.4GHz band for his customer between the customer's offices, and establishing a maintenance contract is permitted. Examples of uses of dedicated connections in the 2.4GHz band that are not supported are:

- i. Providing access to the Internet to a subscriber or third party;
- ii. Providing point-to-point carriage for third parties for a recurring fee. This includes a carrier providing access services from its backbone to its subscribers using spectrum in the 2.4GHz band.

25. No additional allowances are made for this type of operation in terms of transmission levels, and hence those installing such services are to ensure that specifications defined in this document are observed by the systems. Fixed, point-to-point operation excludes the use of point-to-multipoint and multiple co-located antennae

systems. These particular systems should not be allowed to operate within the 2.4GHz band. Fixed, point-to-point applications require high directivity as defined in Table 2 of Appendix 1.

### **5.8GHz connectivity**

26. This policy also exempts systems in the 5.8GHz band. However, both public and private services are permitted at this frequency in order to promote increased penetration of broadband Internet access to the general public. By permitting public service access in this band, the cost of providing wireless Internet access to homes will be substantially lowered, and hence it can be foreseen that lower Internet access costs will be available.

27. Furthermore, due to the lower cost of service provision, it is foreseeable that affordable access can be provided to remote and rural areas, hence promoting the universal access thrust of the Government of Trinidad & Tobago.

28. However, service providers cannot provide any guarantees in terms of quality of service levels to their respective subscribers, as the Telecommunications Authority will not offer any interference protection due to the absence of license procedures.

29. Consequently, service providers in this band will be mandated to inform their customers in their marketing communications and upon commencement of subscription service to a customer of the conditions by which service is offered, and the possible unavailability of service. In the event where a provider fails to provide this information, the Telecommunications Authority may fine the respective operator, subject to the rules and penalties defined by the Authority

30. Operators in the 5.8GHz band may operate fixed point-to-point, omni-directional or multipoint systems, subject to the technical specifications defined in Table 3 of Appendix 1 of this policy.

## **Exemption of Systems in the 2.4GHz Band**

31. In conformance with the ITU's recommendations and the practice of the rest of the world, systems operating in the 2.4GHz band will be license exempt for the primary purpose of supporting private, educational, industrial, scientific and medical applications. Systems that operate between the frequencies 2.4 – 2.4835 GHz shall be designated as operating within the 2.4GHz ISM band.

32. Commercial operation is restricted to the premises of the operation of the owner of the system operating in the 2.4GHz band. In this case, third party users must be located within these premises in order to use the services offered upon the systems. In the event where the owner of a system operating in the 2.4GHz leases a portion of his premises, the owner cannot provide access to the lessee for commercial fees, as this constitutes a third party commercial application. The use of the 2.4GHz band outside the premises owned, leased or borrowed by the owner of the system is not permitted.

33. The use of the 2.4GHz band outside the premises of the owner of the system is limited to dedicated communication links for private use. In this case, commercial applications are not supported. The communication links must be highly directional, and must conform to the same technical specifications as systems that operate within the boundaries of the premises of the owner, as defined in Table 2 of Appendix 1.

34. Systems operating in this band shall operate on a no protection basis and must be willing to accept interference from ISM equipment. If systems operating in the ISM band cause harmful interference to any licensed system operating outside of the license-exempt bands, due to spurious or harmonic effects or otherwise, the system will be required to make the necessary adjustments to reduce such interference, or be turned off.

## **Exemption of Systems in the 5.8GHz Band**

35. In conformance with the ITU's recommendations and the rest of the world, systems operating in the 5.8GHz band will be license-exempt for the primary purpose of supporting private, educational, industrial, scientific and medical applications. Both omni-directional within private premises and fixed, point-to-point systems between sites are permitted by this proposal. Systems that operate between the frequencies 5.725 – 5.85 GHz shall be designated as operating within the 5.8GHz ISM band.

36. Commercial operation is permitted outside of the premises of the operation of the owner of the system operating in the 5.8GHz band. In the event where the owner of a system leases a portion of his premises, the owner may provide access to the lessee for commercial fees.

37. Systems operating in this band shall operate on a no protection basis and must be willing to accept interference from ISM equipment. If systems operating in the ISM band cause interference to any licensed system operating outside of the license-exempt bands, due to spurious or harmonic effects or otherwise, the system will be required to make the necessary adjustments to reduce such interference, or be turned off.

## Regulation of the 2.4GHz and 5.8GHz Bands

38. In order to ensure that the systems operate within defined constraints, the following mechanisms must be instilled.

### Import controls and practice

39. All transmitting equipment must be inspected by the Authority to determine their frequency of transmission, and hence may be withheld in Customs & Excise until clearance from the Authority is provided. If transmitting equipment is deemed to operate within the 2.4GHz band (2.4 – 2.4835GHz) and the 5.8GHz band (5.725 – 5.85GHz), the following must be performed:

- i. It must be ensured that the peak transmission power level must be below 100mW for 2.4GHz equipment and below 1W for 5.8GHz equipment. If equipment operates at a higher power level, it must be ensured that the transmission power level is variable, so that it can be reduced appropriately. FCC or Wi-Fi certification is acceptable as a substitute for the above information;
- ii. It must be demonstrated that digital spread spectrum modulation (frequency hopping FH or direct sequence DS) is used from the manufacturer's operation manual;
- iii. A copy of the specifications of operation in the respective band should be provided by the person/body responsible for the equipment to the Authority to facilitate the necessary type approval.

### Monitoring and Auditing Mechanisms

40. Proactive monitoring is required in order to ensure that systems operating within the 2.4 and 5.8GHz bands are within the specifications detailed in this report. In the event where it is reported that a particular user is operating in infringement of specifications, the Telecommunications Authority is authorized to perform the necessary tests to ensure the frequency range, EIRP levels, and receiver threshold levels are observed. If it is determined that the system is operating outside the specifications defined, the Authority has the right to request the owner of the system to turn off their system.

### Registration of equipment & systems

41. Parties selling a range of equipment, or providing commercial services are **required** to register their equipment with the Authority to ensure that the equipment or systems they are selling conforms to the specifications defined for operation in the 2.4GHz band and 5.8GHz bands prior to market sales.

## Conditions of Operation

42. As the band shall be license-exempt, owners or operators of systems in these bands shall observe the following:

- i. No application to operate the system within these spectrum bands is required. Operators should ensure that their system conforms to the specifications installed in this document, and resellers and service providers should register their equipment with the Telecommunications Authority as stated by the rules and regulations of the Authority.
- ii. The specifications of operation have been developed to reduce the possibility of interference. However, no guarantee of an interference-free environment can be ensured. Users have no recourse if another user in close proximity interferes with or affects the performance of their system, once the other user is operating within specifications. Unlike a license, these frequencies are not reserved for the operator within their region of operation.
- iii. The Telecommunications Authority has the right to ensure that a system operating within this band is operating within specifications, and to investigate into the usage of the band to ensure the band is not being used to provide commercial services outside of the premises of the operations of the owner in accordance with the conditions stated within this instrument.
- iv. Technical specifications are subject to change upon passage of time and observation of the environment. Furthermore, the use of the spectrum may be reviewed to achieve pertinent and relevant social objectives.
- v. Users operating in such bands are expected to employ an attitude of professional courtesy, in which appropriate spectrum scans are performed before activation of links to ensure other users do not experience harmful interference.

## References

1. Federal Communications Commission (FCC), August 2003, *FCC Part 15 Rules – Radio Frequency Devices*, FCC Office of Engineering & Technology, USA
2. European Technical Standards Institute (ETSI), 2003-2004, *Data Transmission equipment operating the 2.4GHz ISM band and using spread spectrum techniques*, ETSI Standard Document # ETSI EN 300 328 v 1.4.1, European Union (EU)
3. European Technical Standards Institute (ETSI), 1999-2002, *Technical Characteristics and test methods for High Data Rate (HDR) data transmission equipment operating in the 5.8GHz Industrial, Scientific and Medical (ISM) Band*, ETSI Standard Document # ETSI ES 200 674-1 v 1.1.1, European Union (EU)
4. European Technical Standards Institute (ETSI), 1999-2002, *Technical Characteristics and test methods for Low Data Rate (LDR) data transmission equipment operating in the 5.8GHz Industrial, Scientific and Medical (ISM) Band*, ETSI Standard Document # ETSI ES 200 674-2 v 1.1.1, European Union (EU)
5. Jonghyun Paik et al., July 2002, *The Regulation Strategies of Wireless Service using the License-Exempt Radio Frequency Bands*, Technical Regulation Team, Ministry of Information Communications of Korea
6. Clarke et al, February 2001, *Recommendations on the Licensing of the 5GHz frequency bands*, UK 5GHz advisory group
7. Atheros Communications, 2003, *Worldwide Regulatory Process for Wireless LANs*, Atheros Communications White Paper
8. Carter et al., May 2003, *OSP Working Series - Unlicensed and Unshackled: A Joint OSP – OET White Paper on Unlicensed Devices and their Regulatory Issues*, Federal Communications Commission (FCC), Office of Strategic Planning (OSP) and Policy Analysis, USA
9. Leeson, Helena et al, July 2000, *Demand for Use of the 2.4GHz ISM Band Final Report*, Aegis Spectrum Engineering, Spectrum Management Advisory Group

10. Federal Communications Commission, November 2002, “*Report of the Unlicensed Devices and Experimental Licenses Working Group*”, FCC Spectrum Policy Task Force, USA

11. Industry Canada, October 1999, “*Spectrum Utilization Policy for Licence Exempt Wireless Local Area Networks in the 5 GHz Range*”, Telecommunications Policy Branch, Canada

12. Nigerian Communications Commission (NCC), “Commercial Operation in the ISM Bands”, NCC Press Release March 2002, [www.ncc.gov.ng](http://www.ncc.gov.ng), Last accessed January 2004



## Appendix 1

### Technical Specifications of Operation in the 2.4GHz Band

Parameter	Maximum Value	Comments
Peak Output power of Intentional Radiator	100mW	
Modulation scheme	Digital	Any digital modulation technique e.g. BPSK, QPSK
Multiple Access technique	Frequency Hopping Spread Spectrum (FHSS) Direct Sequence Spread Spectrum (DSSS)	
Minimum Channel Bandwidth	FHSS (20dB) – 25kHz DSSS (6dB) – 500kHz	FHSS shall use at least 15 well-defined, non-overlapping channels separated by the channel bandwidth. The dwell time per channel shall not exceed 0.4s within a period of 0.4n, where n is the number of channels employed
Frequency Range	2.4 – 2.4835 GHz	
Narrowband Transmitter spurious emission limits	<b>Operating</b> 30MHz – 1GHz = -36dBm 1GHz to 12.75GHz = -30dBm  <b>Standby</b> 30MHz – 1GHz = -57dBm 1GHz to 12.75GHz = -47dBm	

Narrowband Receiver spurious emission limits	30MHz – 1GHz = -57dBm 1GHz to 12.75GHz = -47dBm	
Wideband Transmitter spurious emission limits	<b>Operating</b> 30MHz – 1GHz = -86dBm/Hz 1GHz to 12.75GHz = -80dBm/Hz  <b>Standby</b> 30MHz – 1GHz = -107dBm/Hz 1GHz to 12.75GHz = -97dBm/Hz	
Wideband Receiver spurious emission limits	30MHz – 1GHz = -107dBm/Hz 1GHz to 12.75GHz = -97dBm/Hz	
Maximum Spectral Power density	FHSS – 100mW/100kHz DSSS – 10mW/1MHz	
<b>Fixed Point-to-Point Systems</b>		
Minimum Antenna Gain	20dBi	Only one of the first two criteria is required to be satisfied
Maximum Antenna Beamwidth	15°	
Maximum Received Signal Level (RSL) at receiver	Receiver threshold + 3dBm	This criteria must be satisfied

**Table 2** – Technical parameters of systems operating in the 2.4GHz band

These specifications were developed with reference to FCC Part 15 rules, and the ETSI standards document EN 300 328.

### Technical Specifications of Operation in the 5.8GHz Band

Parameter	Maximum Value	Comments
Peak Output power of Intentional Radiator	1W	
Modulation scheme	Digital	Any digital modulation technique e.g. BPSK, QPSK
Multiple Access technique	Frequency Hopping Spread Spectrum (FHSS) Direct Sequence Spread Spectrum (DSSS)	
Maximum Channel Bandwidth	FHSS (20dB) – 1MHz	
Minimum Channel Bandwidth	FHSS (20dB) – 25kHz DSSS (6dB) – 500kHz	FHSS shall use at least 75 well-defined, non-overlapping channels separated by channel bandwidth. The dwell time per channel shall not exceed 0.4s within a period of 30s
Frequency Range	5.725 – 5.85 GHz	
Narrowband Transmitter mask	<b>Un-modulated</b> $F_{tx} \pm 3$ to 14MHz = -49dBm  <b>Modulated</b> $F_{tx} \pm 3$ to 8MHz = -32dBm $F_{tx} \pm 2$ to 14MHz = -35dBm	

Transmitter spurious emission limits	<b>Operating</b> 25MHz – 1GHz = -69dBm 1GHz to 40GHz = -63dBm  <b>Standby</b> 25MHz – 1GHz = -90dBm 1GHz to 40GHz = -80dBm	
Receiver spurious emission limits	25MHz – 1GHz = -90dBm 1GHz to 40GHz = -80dBm	
Maximum Spectral Power density	FHSS – 1W/100kHz DSSS – 10mW/3kHz	
<b>Fixed point to point systems</b>  Maximum Received Signal Level (RSL) at receiver	Receiver threshold + 3dBm	

**Table 3** – Technical parameters of operation for systems in the 5.8GHz band

These specifications were developed with reference to FCC Part 15 rules, and the ETSI standards document ES 200 674-1.