

Report No. 32

Report from the UMTS Forum

November 2003

WLAN Spectrum Report – after WRC-03

This report replaces the Forum Report No. 25.

This report reflects information available by September 2003. Updates will be presented as necessary; the regulatory and technical status of WLAN is still evolving in many countries, including the enabling of Public WLAN services.

Reference is also made to UMTS Forum Report #22 "Impact & Opportunity: Public Wireless LANs and 3G Business Revenues"

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Glossary

CEPT	European Conference of Postal and Telecommunications Administrations
DFS	Dynamic Frequency Selection
e.i.r.p	Equivalent Isotropic Radiated Power (output power + Antenna gain)
ERC	European Radio Committee (prepares Decisions, Recommendations or Reports on behalf of CEPT) Has been replaced by ECC (European Communications Committee)
FCC	Federal Communications Commission
ISM	Industrial, Scientific & Medical applications
ITU	International Telecommunications Union
SPD	Spectral Power Density
SRD	Short Range Devices
TPC	Transmit Power Control
Tx power	Transmitter power (RF power in watts produced by the transmitter)
WAS	Wireless Access System
WiFi	Wireless Fidelity
WLAN	Wireless Local Area Network
WRC	World Radiocommunication Conference

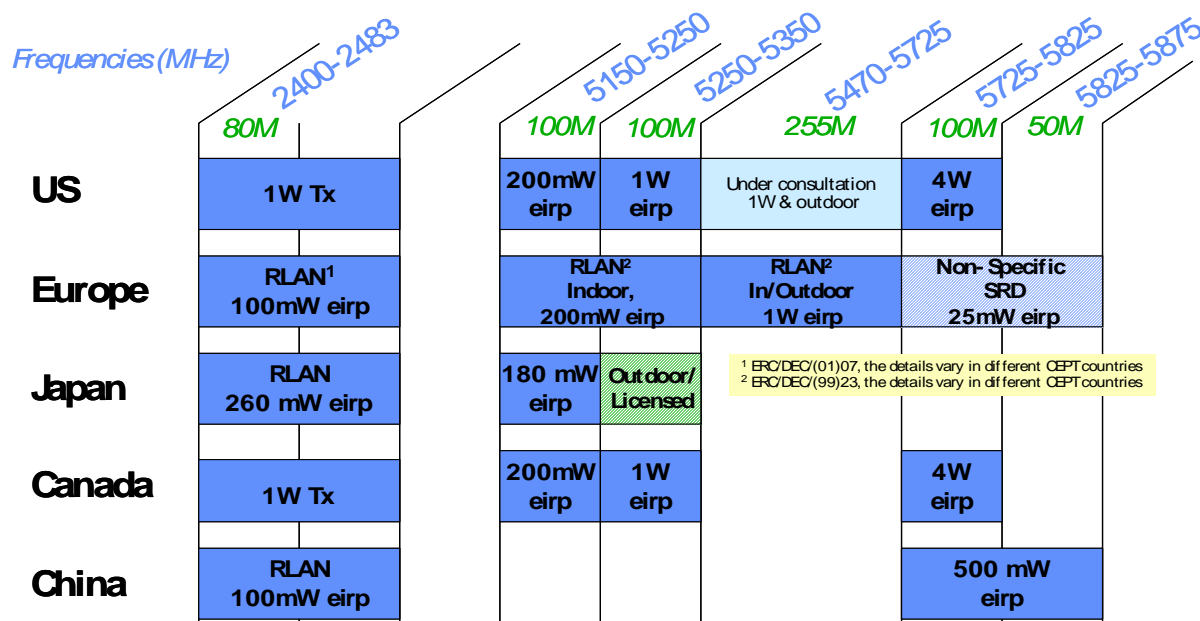
1 Introduction

This Report provides information on the availability of frequency bands at **2.4 and 5 GHz** for the implementation of WLANs (Wireless Local Area Networks), including the licence-exemption status and the required technical conditions for WLAN devices.

In 2002 the UMTS Forum published its Report #22 “Impact & Opportunity: Public Wireless LANs and 3G Business Revenues¹”, which i.a. concluded that UMTS/3G and Wireless LAN are complementary rather than competitive technologies, and that Public WLAN service may be an important source of competitive differentiation for 3G operators.

Regarding the licence-exemption status in many countries all over the world, private WLAN deployment is exempt from individual licensing, which means that anyone can install and use the equipment without requiring individual permission from an administration. Furthermore, administration does not generally register individual equipment. However, the use of equipment can be subject to general provisions or general authorization.

For public access WLAN, the regulatory status is rapidly changing but, in many countries, the deployment may be subject to a general authorization regime along with specific national restrictions.



2 Figure 1: Overview of the availability of WLAN bands in some countries.

¹ http://www.ums-forum.org/servlet/dycon/ztumts/ums/Live/en/ums/Resources_Reports_22_index

The use of the 2.4 GHz frequency band for WLAN - Overview

2.1 Background information

The 2.4 GHz band (**2400-2500 MHz**) is designated on a **worldwide** basis for Industrial, Scientific and Medical (ISM) applications in ITU-R Radio Regulation 5.150.

ISM devices are non-radiocommunication devices that use radio-frequency energy for such purposes as heating, drying or welding. Some of this energy may leak out of the device and cause interference to radiocommunication services. The most common ISM device in the 2.4 GHz band is the domestic microwave oven.

The 2.4 GHz band is also allocated to various radiocommunication services that must accept any interference caused by ISM applications. This operational constraint has led to the widespread use of the band for non-critical applications including uncoordinated communication systems in cost-free spectrum. Due to the operation of the Mobile-Satellite Service in the band 2483.5 – 2500 MHz, the licence exempt operation is typically limited to the band 2400 – 2483.5 MHz.

Thus, in addition to Fixed Service, SAP/SAB² or military applications, the 2.4 GHz ISM band is currently heavily used by many Short Range Device applications, such as:

- Wireless telemetry, remote controller, movement detection or alarm applications;
- Short Range data transmission (Bluetooth, HomeRFTM or RFID³ etc.);
- WLANs, mainly and originally devoted to private use.

All these Short Range Device applications must operate on a non-interference non-protection basis, and must accept interference from ISM devices.

In Europe, the technical and regulatory conditions applicable for WLAN implementation in the 2400-2483.5 MHz band are harmonized and contained in the **ERC Decision (01)07** (*“ERC Decision of 12 March 2001 on harmonised frequencies, technical characteristics and exemption from individual licensing of Short Range Devices used for Radio Local Area Networks (RLANs) operating in the frequency band 2400 - 2483.5 MHz”*).

In the United States, the FCC expanded its Part 15 rules in 1985 to encompass the operation of low power, unlicensed spread spectrum systems to encompass among other bands, 2400-2483.5 MHz (*See Authorization of Spread Spectrum systems Under Parts 15 and 90*, First Report and Order, Gen. Docket No. 81-413, 50 Fed. Reg. 25234 (June 18, 1985), (adopted May 9, 1985), and finished revising Part 15 rules in 1989 (*See In The matter of Revision of Part 15 of the Rules Regarding the Operation of Radio Frequency Devices Without An Individual License*, First Report and Order, Gen. Docket 87-389, 4 FCC Rcd. 3493 (1989) (adopted Mar. 30, 1989).

In Japan, 26 MHz band (2471 – 2497 MHz) has been allocated for WLAN/ISM in 1993, and further 83.5 MHz band (2400 – 2483.5 MHz) has been allocated to achieve harmonization with Europe and/or the U.S.A. and to cope with IEEE 802.11 activity in 2002.

² Services ancillary to programme making (SAP) and broadcasting (SAB)

³ Radio Frequency Identification systems

2.2 Regulatory and technical conditions for the implementation of WLAN in the 2.4 GHz band⁴ in some countries

Country	Licence Exemption Basis	Public WLAN Applications	Private WLAN Applications	Technical or Operational Restrictions	Comments
Australia	Yes General Licence Regime	Yes	Yes	4 W e.i.r.p	
Austria	Yes	Yes	Yes	100 mW e.i.r.p	Users have been warned that there is no protection against interference.
Belgium	Yes Provision of Public WLAN applications is covered under a 'licensing regime'.	Yes	Yes	100 mW e.i.r.p	Since QoS cannot be guaranteed, voice services may not be offered.
Brazil	Yes	Yes	Yes	1W max Tx power	The power emission on main frequency measured at a distance of 3m from the transmitter must be less than 50 mV/m.
Canada	Yes	Yes	Yes	125 mW Tx power	
China	Yes General License Regime	Yes Indoor	Yes Indoor	10 mW e.i.r.p	
Denmark	Yes	Yes	Yes	100 mW e.i.r.p	
Finland	Yes	Yes	Yes	100 mW e.i.r.p	

⁴ The information collected here is the best available at the end of September 2003. It has to be noted that the regulatory and technical status of WLAN is rapidly changing all over the world, especially for public access WLAN.

Country	Licence Exemption Basis	Public WLAN Applications	Private WLAN Applications	Technical or Operational Restrictions	Comments
France	Yes General authorization regime.	Yes A simple notification is needed for certain hot spots and experimental rural areas.	Yes	Indoor: 100 mW e.i.r.p. Outdoor: 10 mW e.i.r.p in the band 2454-2483.5 MHz. 100 mW e.i.r.p in the band 2400-2454 MHz.	
Germany	Yes Provision of Public WLAN services is covered under a general authorization regime.	Yes	Yes	100 mW e.i.r.p	
Greece	Yes	No	Yes Indoor	100 mW e.i.r.p	The provision of Public WLAN services along with an appropriate licence regime is under consideration.
Hong Kong	Yes Provision of Public WLAN services requires a Class Licence and a registration with the Telecommunications Authority.	Yes	Yes		
Hungary	Yes	Yes	Yes	100 mW e.i.r.p Min Processing gain is 10 dB. Max antenna gain is 6 dBi.	WLAN frequencies may be used under General Authorization, Public service provision requires notification to the Authority.
Ireland	Yes Public WLAN service providers need a basic telecommunications service licence.	Yes	Yes	100 mW e.i.r.p	

Country	Licence Exemption Basis	Public WLAN Applications	Private WLAN Applications	Technical or Operational Restrictions	Comments
Italy	Yes	No	Yes	100 mW e.i.r.p	
Japan	Yes Service launch for Public WLAN applications requires an authorization	Yes	Yes	260 mW e.i.r.p. For FH, spectrum bands & SDP restrictions may apply. Self-disciplinary spectrum etiquette rule may apply to avoid mutual interferences	Unlicensed low power data transmission systems in the 2400 - 2483.5 MHz band with 10 mW/MHz SDP⁵ . 2.471-2.497 GHz with 10 mW/MHz SDP⁶ .
Luxembourg	Yes	No	Yes	100 mW e.i.r.p	System provider for third party traffic may require a Telecommunications Act licence.
New Zealand	Yes General User Radio Licence for Short Range Devices	Yes	Yes	1 W e.i.r.p	
Norway	Yes	Yes	Yes	100 mW e.i.r.p	
Portugal	Yes	Yes	Yes	100 mW e.i.r.p	
Russia	Yes	Yes	Yes		Service launch for Public WLAN applications requires an authorization (except mobile operators).
Spain	Yes	No	Yes Indoor or in close proximity	100 mW e.i.r.p	
Sweden	Yes	Yes	Yes	100 mW e.i.r.p	Public WLAN operators are required to notify to the national regulatory authority their intended services offering.

⁵ Spectral Density Power⁶ Spectral Density Power

Country	Licence Exemption Basis	Public WLAN Applications	Private WLAN Applications	Technical or Operational Restrictions	Comments
Switzerland	Yes Provision of Public WLAN applications is covered under a specific authorization regime.	Yes	Yes	100 mW e.i.r.p	
The Netherlands	Yes Outdoor use is subjected to a licence.	Yes	Yes	100 mW e.i.r.p	
UK	Yes	Yes	Yes	100 mW e.i.r.p	
USA	Yes	Yes	Yes	1 W Tx power Max antenna gain is 6 dBi	

3 The use of the 5 GHz frequency bands for WLAN – Overview

The recent proliferation of Short Range Device applications and the growing demand for public access and private use of WLAN technologies are increasing the loading in the 2.4 GHz band. As a consequence, the level of interference is likely to increase with potential impact on the Quality of Service.

In the longer term, it may be expected that the major WLAN operators will strive to avoid the use of the 2.4 GHz band for public access services, since this band will not allow them to provide sufficient Quality of Service to their customers.

An adequate amount of spectrum, among other factors, is a necessary condition to facilitate satisfactory performance in the presence of other uncoordinated users and it is one of the key conditions for market acceptance for these kind of systems. ETSI, ITU-R and CEPT have calculated that the additional spectrum available in the 5 GHz bands is required for WLANs to fulfil the expected future traffic demands.

This led to international and regional regulatory bodies allocating the **5 GHz frequency bands to WLAN type applications**.

3.1 Background information

3.1.1 Before the 2003 World Radiocommunication Conference (WRC-03)

For several years, in many countries, several sub-bands in the 5 GHz frequency range had already been designated or used for WLAN applications, operated on a non-interference non-protection basis.

However, before the the WRC-03, the 5 GHz WLAN bands, and the restrictions on their use, were different in European, American or Asian-Pacific countries.

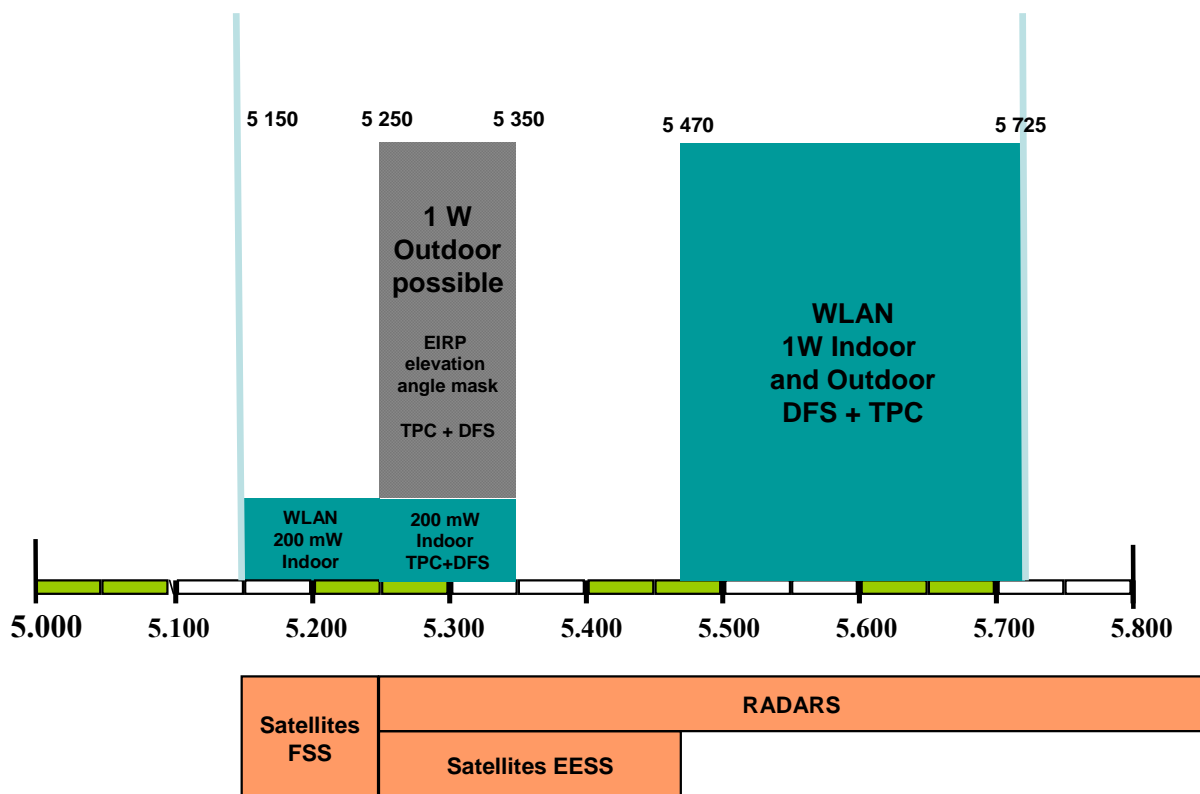
- In Europe, the **5150-5350 MHz** and **5470-5725 MHz** bands were designated for WLAN applications in 1999, according to the **ERC Decision (99)23** (“*ERC Decision of 29 November 1999 on the harmonised frequency bands to be designated for the introduction of High Performance Radio Local Area Networks (HIPERLANs)*”). Some European countries have started the implementation in the 5150-5350 MHz band with an interim solution for equipment not fully compliant with the ERC Decision (99)23. The reason for these interim arrangements is to enable the bands to start to be used in the absence of compliant systems which are equipped with dynamic frequency selection technology (DFS).
- Some countries in the American or Asian-Pacific Regions have started to implement WLANs in the **5150-5350 MHz** frequency band and/or other 5 GHz sub-bands without the DFS requirement.
- In Japan, 5150-5350 MHz band for WLAN has been studied in 1999, concluding the identification of 5150-5250 MHz for indoor use only, due to coexistence & interference issues regarding meteorological radar and/or geological exploratory satellite. To meet the demand for outdoor services, 4900 – 5000 MHz and 5030 – 5091 MHz bands were allocated in 2002 for indoor/outdoor WLAN applications, however, use of the later band should be suspended by 30-November-2007. Allocation of 5250-5350 MHz and 5470 – 5725 MHz bands is under study and a part of which bands may be licensed within next 5 years.

- The **5.8 GHz ISM** band (5725 – 5875 MHz) is also used or partly used for WLAN applications in some countries outside Europe, e.g. in the USA and Canada. Other short-range applications in the 5.8 GHz band include speed/distance measurement, movement detectors, short-range links, traffic monitoring and e-tolling. In Europe the 5.8 GHz band is also available to short-range devices including the intelligent transport systems .

3.1.2 Results of the 2003 World Radiocommunication Conference (WRC-03)

The WRC-03 in Geneva (Switzerland), June 2003, agreed on:

- The globally harmonized primary mobile allocation in the Radio Regulations in the bands 5150 – 5350 MHz and 5470 – 5725 MHz (a total of 455 MHz) for the implementation of wireless access systems including RLANs.
- The inclusion, via the Resolution [COM5/16] of the Conference, of mandatory requirements for **DFS**⁷ and **TPC**⁸ on WLAN devices in the bands 5250 – 5350 MHz and 5470 – 5725 MHz to protect radar and satellite systems operations.



⁷ Dynamic Frequency Selection (DFS) allows detection and avoidance of co-channel interference with respect to radar systems. DFS also enables a uniform loading of the WLAN channels across the available bandwidth in the 5 GHz range.

⁸ Transmit Power Control (TPC) shall provide, on average, a mitigation factor of at least 3 dB on the maximum average output power, or if it is not used then the maximum mean e.i.r.p. shall be reduced by 3 dB.

Frequency Band	5150-5250 MHz	5250-5350 MHz	5470-5725 MHz
Max mean EIRP	200 mW	200 mW 200 mW - 1 W under specific conditions (see below)	1 W
Max mean EIRP density	10 mW/MHz or 0,25 mW/25kHz	10 mW/MHz 10 mW/MHz - 50 mW/MHz under specific conditions (see below)	50 mW/MHz
Max Transmit Power	/	/	250 mW ⁹
Indoor/Outdoor	Indoor	Indoor highly encouraged ¹⁰ possible ¹¹ Outdoor	Indoor and Outdoor
TPC	No	Yes 3 dB at least	Yes 3 dB at least
DFS	No	Yes Specifications of the Recommendation ITU-R M.1652	Yes Specifications of the Recommendation ITU-R M.1652

⁹ The Radio Regulations following the WRC-03 state “Administrations with existing regulations prior to this Conference may exercise some flexibility in determining transmitter power limits”.

¹⁰ Administrations are requested to take appropriate measures that will result in the predominant number of WLAN equipment being operated indoor.

¹¹ When equipments are operated with mean EIRP of 200 mW to 1 W (10mW/MHz to 50mW/MHz), Indoor or Outdoor, they shall comply with the following EIRP elevation angle mask, θ the angle above the local horizon plane (of the Earth) :

$$-13 \text{ dB(W/MHz)} \text{ for } 0^\circ \leq \theta < 8^\circ$$

$$-13 - 0,716(\theta - 8) \text{ dB(W/MHz)}$$

$$\text{for } 8^\circ \leq \theta < 40^\circ$$

$$-35,9 - 1,22(\theta - 40) \text{ dB(W/MHz)}$$

$$\text{for } 40^\circ \leq \theta \leq 45^\circ$$

$$-42 \text{ dB(W/MHz)} \text{ for } 45^\circ < \theta$$

3.2 Regulatory and technical conditions for the implementation of WLAN in the 5 GHz bands¹² in some countries

Country	Designated Frequency Bands	Licence Exemption basis	Public WLAN Applications	Private WLAN Applications	Technical or Operational Restrictions	Comments
Australia	5150-5350 MHz	Yes	Yes Indoor	Yes Indoor	10 mW/MHz SDP 200 mW e.i.r.p	General Licence Regime.
	5725-5825 MHz	Yes	Indoor/Outdoor	Indoor/Outdoor	50 mW/MHz SDP 1 W e.i.r.p	
Austria	5150-5350 MHz	Yes	Yes Indoor	Yes Indoor	200 mW e.i.r.p (with TPC & DFS) 60 mW e.i.r.p (limited to the band 5150-5250 MHz, with TPC) 30 mW e.i.r.p (limited to the band 5150-5250 MHz, without TPC)	Operation of IEEE 802.11a equipment is possible in the band 5150-5250 MHz and is under consideration for the 5250-5350 MHz. Other WLAN-standards, such as Draft EN 301-893, are also under consideration.

¹² The information collected here is that which was available by the end of September 2003. It has to be noted that the regulatory and technical status of WLAN is rapidly changing all over the world, especially for Public WLAN.

Country	Designated Frequency Bands	Licence Exemption basis	Public WLAN Applications	Private WLAN Applications	Technical or Operational Restrictions	Comments
	5470-5725 MHz Band is identified but not available yet	—	—	—	1 W e.i.r.p (with TPC & DFS)	
Belgium	5150-5350 MHz	Yes Provision of Public WLAN applications is covered under a 'licensing regime'.	Yes Indoor	Yes Indoor	200 mW e.i.r.p (with TPC & DFS)	Prepared to open the band 5150-5350 MHz without TPC and DFS (but with reduced power) for the use of IEEE 802.11a.
	5470-5725 MHz Band is identified but not available yet	—	—	—	1 W e.i.r.p (with TPC & DFS)	
Brazil	5785-5850 MHz	Yes	Yes	Yes	1W max Tx power	The power emission on main frequency measured at a distance of 3m from the transmitter must be less than 250 μ V/m.
Canada	5150-5250 MHz	Yes	Yes Indoor	Yes Indoor	10 mW/MHz SDP 200 mW e.i.r.p	
	5250-5350 MHz	Yes	Yes Indoor/Outdoor	Yes Indoor/Outdoor	250 mW Tx power 11 dBm/MHz SDP 1 W e.i.r.p	

Country	Designated Frequency Bands	Licence Exemption basis	Public WLAN Applications	Private WLAN Applications	Technical or Operational Restrictions	Comments
	5725-5825 MHz	Yes	Yes Indoor/Outdoor	Yes Indoor/Outdoor	1 W Tx power 17 dBm/MHz SDP 4 W e.i.r.p 23 dBi max antenna gain	
China	5725-5850 MHz	Yes General Licence Regime	No	Yes Indoor/Outdoor	500 mW e.i.r.p	
Denmark	5150-5350 MHz	Yes	Yes Indoor	Yes Indoor	200 mW e.i.r.p (with TPC & DFS) 50 mW e.i.r.p (limited to the band 5150-5250 MHz, without DFS & TPC)	
	5470-5725 MHz Band is identified but not available yet	—	—	—	1 W e.i.r.p (with TPC & DFS)	
Finland	5150-5350 MHz	Yes	Yes Indoor	Yes Indoor	200 mW e.i.r.p (with TPC & DFS) 120 mW e.i.r.p (without DFS) 60 mW e.i.r.p (without DFS & TPC)	National interim arrangement allowing IEEE 802.11a equipment in the band 5150-5350 MHz .

Country	Designated Frequency Bands	Licence Exemption basis	Public WLAN Applications	Private WLAN Applications	Technical or Operational Restrictions	Comments
	5470-5725 MHz	Yes	Yes Indoor/Outdoor	Yes Indoor/Outdoor	1 W e.i.r.p (with TPC & DFS)	
France	5150-5350 MHz	Yes General authorization regime.	Not really (very specific conditions)	Yes Indoor	200 mW e.i.r.p (with TPC & DFS in the band 5250-5350 MHz)	France will implement the 5470-5725 MHz band when the efficiency of the mitigation techniques TPC and DFS is ensured.
	5470-5725 MHz Band is identified but not available yet	—	—	—		
Germany	5150-5350 MHz	Yes	Yes Indoor	Yes Indoor	200 mW e.i.r.p (with TPC & DFS) 60 mW e.i.r.p (limited to the band 5150-5250 MHz, without DFS) 30 mW e.i.r.p (limited to the band 5150-5250 MHz, without DFS & TPC)	Provision of Public WLAN services is covered under a general authorization regime. National interim arrangement allowing IEEE 802.11a equipment in the band 5150-5250 MHz .
	5470-5725 MHz	Yes	Yes Indoor/Outdoor	Yes Indoor/Outdoor	1 W e.i.r.p (with TPC & DFS)	
Greece	5150-5350 MHz Limited to 5250-5255 MHz	—	No	Yes Indoor	200 mW e.i.r.p (with TPC & DFS)	Modifications are needed in the National Frequency Allocation Table for the WLAN

Country	Designated Frequency Bands	Licence Exemption basis	Public WLAN Applications	Private WLAN Applications	Technical or Operational Restrictions	Comments
	5470-5725 MHz Band is not available	—	—	—		applications to be possible. Greece has no intention to refuse licences for the offer of Public WLAN applications. However, it is necessary to put in place an appropriate licensing procedure, since provision of public services is only permitted under licence by the National Regulatory Authority.
Hong Kong	5150-5350 MHz	Yes	Yes	Yes		
	5725-5850 MHz	Provision of Public WLAN services requires a Class License and a registration with the Telecommunications Authority.	Yes	Yes		
Hungary	5150-5350 MHz Since April 2003	Yes	Yes Indoor	Yes Indoor	200 mW e.i.r.p (with TPC & DFS)	WLAN frequencies may be used under General Authorization, Public service provision requires notification to the Authority.
	5470-5725 MHz Band is identified but not available yet	—	—	—	1 W e.i.r.p (with TPC & DFS)	

Country	Designated Frequency Bands	Licence Exemption basis	Public WLAN Applications	Private WLAN Applications	Technical or Operational Restrictions	Comments
Ireland	5150-5350 MHz	Yes	Yes Indoor	Yes Indoor	200 mW e.i.r.p (with TPC & DFS) 50 mW e.i.r.p (limited to the band 5150-5250 MHz, without DFS & TPC)	Public WLAN service providers need a basic telecommunications service licence. National interim arrangement allowing IEEE 802.11a equipment in the band 5150-5250 MHz .
	5470-5725 MHz	Yes	Yes Indoor/Outdoor	Yes Indoor/Outdoor	1 W e.i.r.p (with TPC & DFS)	
Italy	5150-5350 MHz	Yes	No	Yes Indoor	200 mW e.i.r.p (with TPC & DFS) 30 mW e.i.r.p (limited to the band 5150-5250 MHz, without DFS & TPC)	Current debate on a new regulation that may allow Public WLAN applications in the 5 GHz bands, but no decision has been made yet. National interim arrangement allowing IEEE 802.11a equipment in the band 5150-5250 MHz .
	5470-5725 MHz Band is identified but not available yet	Yes	No	Yes Indoor/Outdoor	1 W e.i.r.p (with TPC & DFS)	
Japan	4900-5000 MHz	Yes Licence Regime for Public WLAN	Yes Indoor/Outdoor	Yes Indoor/Outdoor	Licensed for 50 mW/MHz with max 250 mW, License exempt for 10 mW/MHz with max 197 mW.	These bands are newly allocated to WLANs. However, they are not compatible with the ITU-R candidate bands for harmonization.
	5150-5250 MHz	Yes	Yes Indoor	Yes Indoor		

Country	Designated Frequency Bands	Licence Exemption basis	Public WLAN Applications	Private WLAN Applications	Technical or Operational Restrictions	Comments
	5030-5091 MHz	Yes Licence Regime for Public WLAN	Yes Indoor/Outdoor	Yes Indoor/Outdoor	Licensed for 50 mW/MHz with max 250 mW, License exempt for 10 mW/MHz with max 197 mW.	This band will be available by 30 November 2007.
Luxembourg	5150-5350 MHz	Yes	No	Yes Indoor	200 mW e.i.r.p (with TPC & DFS)	System provider for third party traffic may require a Telecommunications Act licence.
	5470-5725 MHz Band is identified but not available yet	—	—	—	1 W e.i.r.p (with TPC & DFS)	
New Zealand	5150-5250 MHz	Yes	Yes Indoor	Yes Indoor	250 mW e.i.r.p	Submitted to a General User Radio Licence for Short Range Devices
	5250-5350 MHz	Yes	Yes Indoor/Outdoor	Yes Indoor/Outdoor	1 W e.i.r.p	
Norway	5150-5350 MHz	Yes	Yes Indoor	Yes Indoor	200 mW e.i.r.p (with TPC & DFS) 50 mW e.i.r.p (limited to the band 5150-5250 MHz, without DFS & TPC)	National interim arrangement allowing IEEE 802.11a equipment in the band 5150-5250 MHz.
	5470-5725 MHz	Yes	Yes Indoor/Outdoor	Yes Indoor/Outdoor	1 W e.i.r.p (with TPC & DFS)	

Country	Designated Frequency Bands	Licence Exemption basis	Public WLAN Applications	Private WLAN Applications	Technical or Operational Restrictions	Comments
Portugal	5150-5350 MHz	Yes	Yes Indoor	Yes Indoor	200 mW e.i.r.p (with TPC & DFS)	
	5470-5725 MHz	Yes	Yes Indoor	Yes Indoor	1 W e.i.r.p (with TPC & DFS)	
Russia	Under consideration					
Spain	5150-5350 MHz	Yes	Yes Indoor	Yes Indoor	200 mW e.i.r.p (with TPC & DFS) 120 mW e.i.r.p (without DFS) 60 mW e.i.r.p (without DFS & TPC)	<p>The possibility of allocating parts of these bands for WLAN applications will be considered in the future.</p> <p>In view of the development of new technologies for access to Information Society services, the possibility of allowing provision of public WLAN applications over these bands is currently being considered.</p> <p>National interim arrangement allowing IEEE 802.11a equipment in the band 5150-5350 MHz.</p>
	5470-5725 MHz Band is identified but not available yet	Licence is required for Outdoor WLAN applications.	Yes Indoor/Outdoor	Yes Indoor/Outdoor	1 W e.i.r.p (with TPC & DFS)	
Sweden	5150-5350 MHz	Yes	Yes Indoor	Yes Indoor	200 mW e.i.r.p (with TPC & DFS)	

Country	Designated Frequency Bands	Licence Exemption basis	Public WLAN Applications	Private WLAN Applications	Technical or Operational Restrictions	Comments
	5470-5725 MHz	Yes	Yes Indoor/Outdoor	Yes Indoor/Outdoor	1 W e.i.r.p (with TPC & DFS)	
Switzerland	5150-5350 MHz	Yes Provision of Public WLAN applications is covered under a specific authorization regime.	Yes Indoor	Yes Indoor	200 mW e.i.r.p (with TPC & DFS) 120 mW e.i.r.p (without DFS or TPC) 60 mW e.i.r.p (without DFS & TPC)	Opening of the band 5470-5725 MHz / 1 W e.i.r.p for WLAN devices, with both mandatory TPC and DFS, is under investigation (exclusive military band).
	5470-5725 MHz Band is not available yet	—	—	—		
The Netherlands	5150-5350 MHz	Yes	Yes Indoor/Outdoor	Yes Indoor/Outdoor	200 mW e.i.r.p (with TPC & DFS)	
	5470-5725 MHz	Yes Outdoor use may be subject to a licence.	Yes Indoor/Outdoor	Yes Indoor/Outdoor	1 W e.i.r.p (with TPC & DFS)	

Country	Designated Frequency Bands	Licence Exemption basis	Public WLAN Applications	Private WLAN Applications	Technical or Operational Restrictions	Comments
UK	5150-5350 MHz	Yes	Yes Indoor	Yes Indoor	200 mW e.i.r.p (with TPC & DFS) 120 mW e.i.r.p (without DFS) 60 mW e.i.r.p (without DFS & TPC)	National interim arrangement allowing IEEE 802.11a equipment in the band 5150-5350 MHz.
	5470-5725 MHz	Yes	Yes Indoor/Outdoor	Yes Indoor/Outdoor	1 W e.i.r.p (with TPC & DFS)	
USA	5150-5250 MHz	Yes U-NII ¹³ band	Yes Indoor	Yes Indoor	50 mW Tx power 4 dBm/MHz SDP 200 mW e.i.r.p 6 dBi max antenna gain	
	5250-5350 MHz	Yes U-NII band	Yes Indoor/Outdoor	Yes Indoor/Outdoor	250 mW Tx power 11 dBm/MHz SDP 1 W e.i.r.p 6 dBi max antenna gain	

¹³ Unlicensed National Information Infrastructure

Country	Designated Frequency Bands	Licence Exemption basis	Public WLAN Applications	Private WLAN Applications	Technical or Operational Restrictions	Comments
	5725-5825 MHz	Yes U-NII band	Yes Indoor/Outdoor	Yes Indoor/Outdoor	1 W Tx power 17 dBm/MHz SDP 4 W e.i.r.p 6 dBi max antenna gain	

Some reference documents and useful web sites

UMTS Forum Report #22 (*“Impact & Opportunity: Public Wireless LANs and 3G Business Revenues”*)

http://www.ums-forum.org/servlet/dycon/ztumts/ums/Live/en/ums/Resources_Reports_22_index

ERC Decision (01)07 (*“ERC Decision of 12 March 2001 on harmonised frequencies, technical characteristics and exemption from individual licensing of Short Range Devices used for Radio Local Area Networks (RLANs) operating in the frequency band 2400 - 2483.5 MHz”*)

ERC Decision (99)23 (*“ERC Decision of 29 November 1999 on the harmonised frequency bands to be designated for the introduction of High Performance Radio Local Area Networks (HIPERLANs)”*)

ECC Report 11 (*“Strategic Plans for the Future Use of the Frequency Bands 862-870 MHz and 2400-2483.5 MHz for Short Range Devices”*, may 2002)

ERO web site, <http://www.ero.dk/>

European Commission, http://europa.eu.int/information_society/index_fr.htm

Federal Communications Commission (USA) web site, <http://www.fcc.gov/> (FCC rules, part 15, section 15.247 E and 15.407 E)

Australian Communications Authority web site, <http://www.aca.gov.au/>

Japan: MPHPT Information and communications Site (English),
http://www.soumu.go.jp/joho_tsusin/eng/index.html