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Spectrum Management and Telecommunications Policy

Spectrum Utilization Policy

# **Spectrum Utilization Policy, Technical and Operational Requirements for Licence-exempt Wireless Local Area Networks and Other Radio Services in the 5 GHz Range**

## Industry Canada

### Radiocommunication Act

#### **Notice No. DGTP-003-05 - Spectrum Utilization Policy, Technical and Operational Requirements for Licence-exempt Wireless Local Area Networks and Other Radio Services in the 5 GHz Range**

This Notice announces the release of Issue 2 of the spectrum utilization policy for various services in the 5 GHz range including the mobile, radiolocation, Earth exploration-satellite (active), and space research (active) services.

#### **Introduction**

In June 2003, a World Radiocommunication Conference (WRC-03) was held where administrations from around the world participated in the consideration of many spectrum related radiocommunication issues. Included in the agenda of WRC-03 was the consideration of changes to the use of the 5 GHz band for a number of services and applications, including Radio Local Area Networks, the Earth exploration-satellite (active) service, space research (active) service and radiolocation service. The document, *Consultation on Allocation Changes and Revisions to Spectrum Utilization Policy and Technical Rules in the 5 GHz Band*, was released in February 2004 to seek public comments on proposals to adopt allocation changes, spectrum utilization policies and technical rules for the band 5150-5725 MHz in accordance with the decisions made at WRC-03.

A number of comments were received. Industry Canada has taken these comments into consideration in formulating the spectrum utilization policy. The document *Spectrum Utilization Policy, Technical and Operational Requirements for Licence-exempt Wireless Local Area Networks and Other Radio Services in the 5 GHz Range* (SP 5150 MHz), Issue 2 addresses the principal issues governing the use of the frequency band in the 5 GHz range and replaces *Spectrum Utilization Policy for Licence Exempt Wireless Local Area Networks in the 5 GHz Range*, Issue 1, October 1999.

#### **Obtaining Copies**

Copies of this notice and documents referred to are available electronically on the [Spectrum Management and Telecommunications Web site](http://strategis.gc.ca/spectrum) at: <http://strategis.gc.ca/spectrum>.

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April 22, 2005

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## 1. Introduction

This spectrum utilization policy addresses the principal issues governing the use of the frequency band in the 5 GHz range.

This document replaces Spectrum Utilization Policy 5150 MHz, *Spectrum Utilization Policy for Licence Exempt Wireless Local Area Networks in the 5 GHz Range* (SP 5150 MHz), Issue 1, October 1999.

## 2. Background

In October 1999, Industry Canada released a policy paper entitled *Spectrum Utilization Policy for Licence Exempt Wireless Local Area Networks in the 5 GHz Range* (SP 5150 MHz), which addressed the principal issues governing the use of the frequency bands 5150-5250 MHz, 5250-5350 MHz and 5725-5825 MHz for licence-exempt wireless local area networks (LE-LANs). These provisions were developed in consultation with industry over a period of about two years. Studies were conducted with the participation of stakeholders representing the services allocated to the bands as well as proponents of the new services.

In considering spectrum for services at 5 GHz, the World Radiocommunication Conference<sup>1</sup> 2000 (WRC-00) prepared the following two agenda items (Agenda Items 1.5 and 1.6) for consideration at the 2003 World Radiocommunication Conference (WRC-03):

*Agenda Item 1.5: to consider, in accordance with Resolution 736 (WRC-2000)<sup>2</sup>, regulatory provisions and spectrum requirements for new and additional allocations to the mobile, fixed, Earth exploration-satellite and space research services, and to review the status of the radiolocation service in the frequency range 5 150-5 725 MHz, with a view to upgrading it, taking into account the results of ITU-R studies.*

*Agenda Item 1.6: to consider regulatory measures to protect feeder links (Earth-to-space) for the mobile-satellite service which operate in the band 5 150-5 250 MHz, taking into account the latest ITU-R Recommendations (for example, Recommendations ITU-R S.1426<sup>3</sup>, ITU-R S.1427<sup>4</sup> and ITU-R M.1454<sup>5</sup>).*

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<sup>1</sup> World Radiocommunication Conferences are held approximately every 3-5 years. During the conferences, administrations from around the world participate in considering many spectrum related radiocommunication issues with the view to revising international regulations.

<sup>2</sup> Resolution 736 (WRC-2000): *Consideration by a future competent world radiocommunication conference of issues dealing with allocations to the mobile, fixed, radiolocation, Earth exploration-satellite (active), and space research (active) services in the frequency range 5150-5725 MHz.*

<sup>3</sup> Recommendation ITU-R S.1426: *Aggregate power flux-density limits, at the FSS satellite orbit for radio local area network (RLAN) transmitters operating in the 5 150-5 250 MHz band sharing frequencies with the FSS (RR No. 5.447A).*

<sup>4</sup> Recommendation ITU-R S.1427: *Methodology and criterion to assess interference from radio local area (RLAN) transmitters to non-GSO MSS feeder links in the band 5 150-5 250 MHz.*

In the period leading up to WRC-03 the International Telecommunication Union (ITU) took on the task of examining the technical sharing issues between the existing and proposed services and applications in the 5 GHz band. A substantial amount of work was conducted within the ITU-R Working Parties in the examination of studies and the development of recommendations which could be adopted to facilitate sharing among the different services.

Canada, with the participation of the wireless industry, radiolocation community and space science community, was actively involved in the development of these recommendations. During the same period, and in preparation for participation at the conference, Canada developed a series of proposals, in consultation with industry, for the treatment of these issues.

At WRC-03 in June 2003, decisions were made to adopt a number of changes to the International *Table of Frequency Allocations* to provide new or upgraded allocations to the mobile, Earth exploration-satellite (active), space research (active) and radiolocation services. As well, a number of international footnotes were adopted to facilitate sharing amongst the services in the 5 GHz range. In general, the results of WRC-03 reflect Canada's positions prior to the conference.

In February 2004, the Department issued a consultation document entitled *Consultation on Allocation Changes and Revisions to the Spectrum Utilization Policy and Technical Rules in the 5 GHz Band*. The document proposed frequency allocation changes to the mobile, Earth exploration-satellite (active), space research (active) and radiolocation services, taking into account decisions made at WRC-03. Furthermore, it proposed new or revised policy and technical rules governing the use of wireless local area networks (also known as radio local area networks or RLANS) operating in the 5 GHz band.

The Department received a number of comments from various companies and organizations. They included licence-exempt wireless local area network manufacturers, industry standards organizations, industry alliances, and incumbent licensed operators.

### **3. Frequency Allocation Changes in the 5 GHz Band**

As discussed in the consultation document, a number of allocation changes were made at WRC-03 to the International *Table of Frequency Allocations* in the 5 GHz band. All respondents showed different degrees of support for the Department's proposed changes to the *Canadian Table Frequency of Allocations* as well as the proposed adoption of related international footnotes in the 5 GHz band.

#### **3.1 Radiolocation Service**

Internationally and in Canada, the radiolocation service has a primary allocation in the bands 5250-5350 MHz and 5650-5725 MHz. In the band 5350-5650 MHz, the radiolocation service is allocated on a secondary basis.

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<sup>5</sup> Recommendation ITU-R M.1454: *E.i.r.p. density limit and operational restrictions for RLANS or other wireless access transmitters in order to ensure the protection of feeder links of non-geostationary systems in the mobile-satellite service in the frequency band 5 150-5 250 MHz.*

WRC-03 upgraded the status of the radiolocation service to primary in the band 5350-5650 MHz. One key aspect was the protection of the radiolocation service from potential interference from the aggregate emissions of radio local area networks. As well, in order to ensure compatibility of operation between different services, a number of international footnotes were adopted.

In line with the decisions made at WRC-03, the Department adopts the following changes to the *Canadian Table of Frequency Allocations* in the band 5350-5650 MHz and as shown in Appendix 1:

- Upgrade the radiolocation service from secondary to primary status in the band 5350-5650 MHz.
- Adopt new international footnotes 5.448D, 5.450A, and 5.450B, relevant to the operation of the radiolocation service.

### **3.2 Earth Exploration-satellite (Active) and Space Research (Active) Services**

Prior to WRC-03, the Earth exploration-satellite (active) service (EESS) was allocated on a primary basis in the band 5250-5460 MHz. The space research service (SRS) (active) was also allocated on a primary basis in the band 5250-5350 MHz. WRC-03 provided new primary allocations to EESS (active) and SRS (active) in the band 5460-5570 MHz. In addition, WRC-03 allocated the band 5350-5460 MHz to the SRS (active) on a primary basis in order to make available 320 MHz of contiguous bandwidth for both closely related services.

Although few studies were conducted in the band 5350-5460 MHz to examine the compatibility of space research (active) service with other services, it was recognized at the conference that EESS (active) and SRS (active) have similar operation and, based on compatibility studies between the EESS (active) and other services, there was some assurance that both the EESS and SRS will be compatible with other services operating in the same band. Despite the limited number of studies, the conference decided to provide a primary allocation to the SRS (active) in the band 5350-5460 MHz, and inserted a footnote (Footnote 5.448C as shown in Appendix 1) in the International Table to ensure protection to other primary services operating in the same band. A number of additional footnotes were also added to ensure compatibility with other services.

The Department adopts the following changes to the *Canadian Table of Frequency Allocations* in the band 5250-5570 MHz and as shown in Appendix 1:

- Enter a new allocation to the Earth exploration-satellite (active) service on a primary basis in the band 5460-5570 MHz.
- Enter a new allocation to the space research (active) service on a primary basis in the band 5350-5570 MHz.
- Adopt international footnotes 5.448A, 5.448B and 5.448C, relevant to the operation of the Earth exploration-satellite (active) or space research (active) services.

### 3.3 Mobile Service

Since the introduction of *Spectrum Utilization Policy for Licence Exempt Wireless Local Area Networks in the 5 GHz Range* (SP 5150 MHz) in 1999, the LE-LAN industry has experienced significant growth. A number of applications have been envisioned to operate in the 5 GHz band which complements the 2.4 GHz band for LE-LANs. Many innovative broadband products and applications have appeared in the market including last mile connections to homes and offices in urban, as well as rural areas.

The operation of LE-LANs in the 5 GHz range was governed by Canadian Footnote C39A, which designates the bands 5150-5250 MHz, 5250-5350 MHz and 5725-5825 MHz for use by LE-LANs based on not interfering with, nor claiming protection from licensed services. No service allocation entry was made in the Canadian Table. Under the current provisions, a range of fixed and mobile applications and devices (e.g. nomadic or non-nomadic, point-to-point and point-to-multipoint) operate on a licence-exempt basis.

It should be noted that the band 5725-5825 MHz was not considered at WRC-03. This band is part of the 300 MHz of LE-LAN spectrum (operated under Footnote C39A) in Canada.

The conference made available a total of 455 MHz of spectrum to the mobile service on a primary basis for the implementation of wireless access systems including radio local area networks<sup>6</sup> in the bands 5150-5250 MHz, 5250-5350 MHz and 5470-5725 MHz. Along with the changes to the International Table, a number of footnotes, which specify the technical limits on LE-LANs, were inserted in the International Table to ensure compatibility with other service allocations.

The Department recognizes the benefits of economies of scale for consumer products, which are achievable with international harmonization. It will be important for Canada to harmonize its spectrum usage and technical requirements with the international community, in accordance with the decisions of WRC-03. Respondents to the consultation paper expressed the same views.

Therefore, the Department adopts the following changes to the *Canadian Table of Frequency Allocations* in the bands 5150-5350 MHz and 5470-5850 MHz, and as shown in Appendix 1:

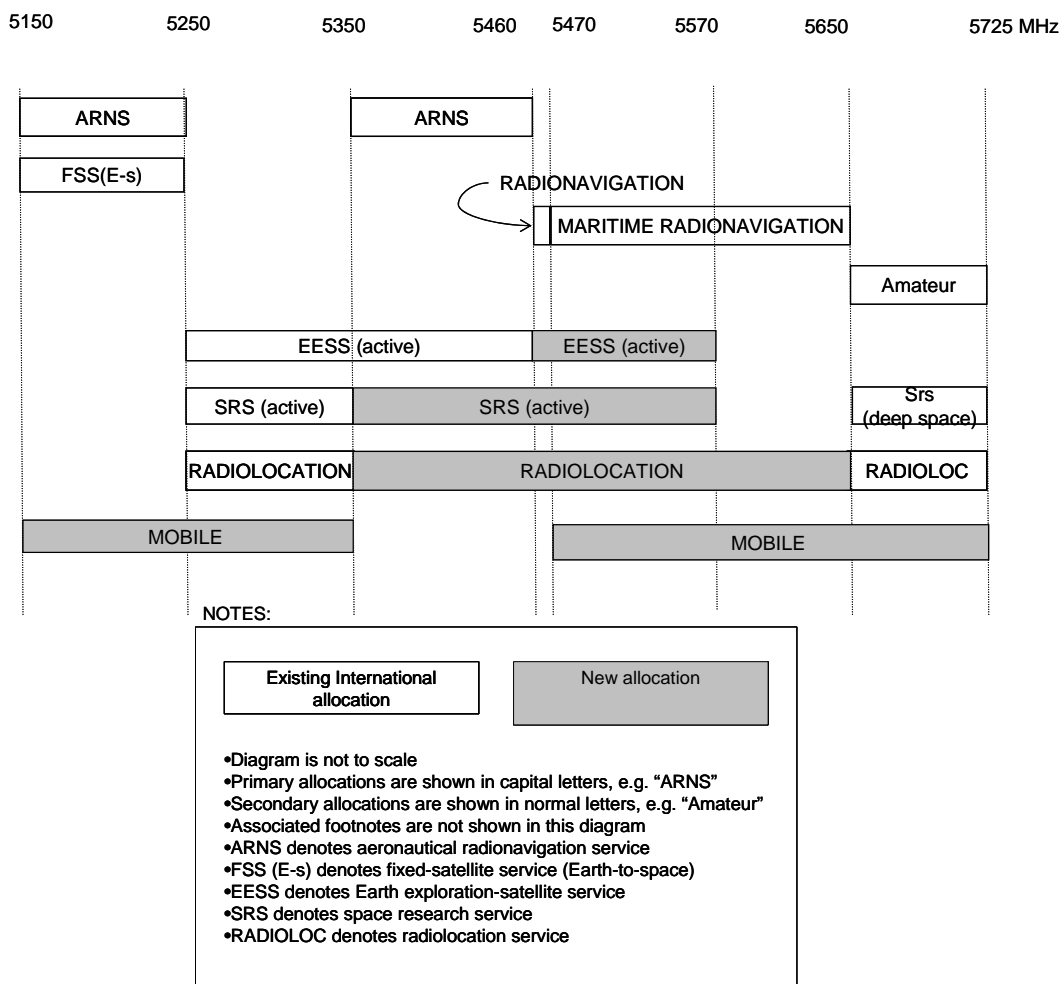
- Enter a new allocation to the mobile service on a primary basis in the bands 5150-5350 MHz and 5470-5725 MHz.
- Adopt new international footnotes 5.446A, 5.446B, 5.447F and 5.450A, relevant to the operation of the mobile service.
- Adopt modified Canadian footnote C39A and add a new footnote C39B to describe the conditions for use of each sub-band by LE-LANs.

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<sup>6</sup> Wireless access systems including RLANs are described in Recommendation ITU-R M.1450, which encompasses a range of fixed and mobile applications. In Canada, these systems, operating in the 5GHz range, are referred to as LE-LANs.

### 3.4 Summary of Frequency Allocation Changes in the 5 GHz Band

**Figure 1: Summary of Allocations in the 5 GHz Range**



## 4. Policy Provisions for Licence-exempt Wireless Local Area Networks

### 4.1 General Discussion and Policy Provisions

The use of the frequency bands 5150-5250 MHz, 5250-5350 MHz and 5725-5825 MHz for LE-LANs has been governed by SP 5150 MHz, issued October 1999.

LE-LANs can be characterized as local transmission devices which provide a wide range of applications for high-speed, broadband, digital distribution applications comprising voice, video and data. These systems promise to provide high-speed connectivity for computers and multimedia neighbourhoods and will mainly consist of point-to-point and point-to-multipoint high-speed digital wireless services.



A number of respondents believe that globally harmonized spectrum use, technical rules and deployment flexibility are essential for rapid 5 GHz broadband deployment. Many respondents urged the Department not to adopt “unique” technical restrictions which could result in higher production costs. On the other hand, incumbent licensed operators stressed the importance of their operations and the need for appropriate technical rules for LE-LANs to protect their licensed operations.

Industry Canada recognizes the importance of harmonized technical requirements with the international community, in accordance with the decisions of WRC-03 and the benefits of economies of scale for consumer products. Furthermore, the Department recognizes the need to protect licensed services from potential harmful interference. Therefore, the Department generally supports globally harmonized spectrum use when possible and strives to provide a solution set that will protect incumbent services, while imposing minimum technical restrictions on licence-exempt devices.

Hence, it is appropriate to permit the operation of licence-exempt wireless local area networks in the band 5470-5725 MHz, in addition to the bands 5150-5250 MHz, 5250-5350 MHz and 5725-5825 MHz which are currently available. Similarly, it is appropriate that LE-LANs be operated based on not interfering with, nor claiming protection from, licensed services.

Licence-exempt devices may constitute transmission facilities as defined in the *Telecommunications Act*. The use of such devices in providing telecommunications services to the public for compensation could be subject to the provisions of the Act including those pertaining to Canadian ownership and control requirements.

Operators of these licence-exempt transmission links may be subject to the requirements for seeking approval for antennas and their supporting structures. The Department has instituted procedures for users of the radiofrequency spectrum which give consideration to the following three areas: (i) the environment; (ii) Health Canada's *Limits of Human Exposure to Radiofrequency Electromagnetic Fields in the Frequency Range from 3 kHz to 300 GHz, Safety Code 6*; and (iii) land-use consultation. Details of the responsibilities associated with antenna tower placements can be found in Client Procedures Circular 2-0-03.

The following sections provide discussion, spectrum policy provisions and technical provisions for each sub-band.

## **4.2 Discussion and Provisions for the Band 5150-5250 MHz**

### **4.2.1 Co-existence issues**

The band 5150-5250 MHz is currently allocated on a primary basis to the aeronautical radionavigation service, and to the fixed-satellite service (FSS) in the Earth-to-space direction. Use of the FSS in this band is limited to feeder links for non-geostationary systems in the mobile-satellite service.

WRC-03 added a global allocation to the mobile service in the band for wireless access systems including RLANs on the basis that stations in the mobile service shall not claim protection from earth stations in the fixed-satellite service. In addition, technical limits were imposed on the mobile service in order to ensure compatibility with other services.

International studies have concluded that, with appropriate power levels as well as technical and regulatory provisions, the sharing of spectrum among LE-LAN devices, existing aeronautical radionavigation service, and FSS feeder links for non-geostationary mobile-satellite service networks is feasible.

In the consultation, the Department proposed that the existing rules contained in Radio Standards Specification-210, *Low Power Licence-Exempt Radiocommunication Devices (All Frequency bands)* (RSS-210) be maintained. These rules are consistent with the WRC-03 decisions and ensure that incumbent operation will continue to be protected. The Department notes the indoor-only operational restriction on LE-LANs is necessary and will continue to apply in order to ensure compatibility with the FSS. Power limits currently specified in the RSS are consistent with those adopted by the WRC. In addition, provisions to allow mobile-satellite service operators to monitor emissions from LE-LAN devices in the band, are included in RSS-210 and continue to apply.

Some respondents requested that the Department remove the requirements for integral antenna and unique connectors on LE-LAN devices operating in this band. These issues will be dealt with in the development or revision of an appropriate Radio Standard Specification document.

#### **4.2.2 Spectrum Policy Provisions**

The band 5150-5250 MHz, allocated to the mobile service on a primary basis, is designated for use by LE-LANs, on the basis that such devices cannot claim protection from other radio systems and cannot cause harmful interference to licensed radio services.

#### **4.2.3 Technical and Operational Provisions**

In the band 5150-5250 MHz, the maximum e.i.r.p. of a LE-LAN device shall be limited to 200 mW (further limited to 10 mW in any 1 MHz). The operation of the LE-LANs is restricted to indoor-only. These requirements will be reflected in an appropriate Radio Standards Specification.

### **4.3 Discussion and Provisions for the Band 5250-5350 MHz**

#### **4.3.1 Public Interest Considerations**

As with any new service allocation, the Department recognizes the importance to protect licensed services from potential harmful interference. It also recognizes the advantage to be gained from globally harmonized spectrum, technical rules and flexibility to ensure successful deployment of new services.

The Canadian Space Agency (CSA) currently operates satellite RADARSAT-1 in the band 5250-5350 MHz, which provides imagery data services to customers around the world. There are more than 32 types of applications supported by CSA including agriculture, cartography, disaster management (floods, hurricanes, search and rescue), forestry, hydrology, sea and land ice, defence and intelligence. Future applications may require higher bandwidth to improve the resolution.

Interference from a single LE-LAN device into the EESS may not be significant. However, as wireless consumer devices become more and more affordable, the potential increase in the number of these devices internationally could lead to an increase of the potential for harmful interference. The Department endeavours to balance the needs of all parties by establishing rules for successful co-existence. These rules are discussed below.

#### **4.3.2 Co-existence Issues**

The band 5250-5350 MHz is currently allocated to the Earth exploration-satellite (active), radiolocation, and space research (active) services on a primary basis. This band has been designated in Canada for both indoor and outdoor LE-LAN products since 1999. Outdoor LE-LAN products have been used to provide broadband wireless access to customers for high-speed Internet applications. Prior to WRC-03, Canada was active in the international scene in ensuring that outdoor LE-LAN applications were accommodated while providing protection to the operation of other services in this band. A number of technical and operational restrictions were required in order to achieve this objective.

The CSA operates a RADARSAT satellite in this band, which provides imagery data services to customers around the world.

The band 5250-5350 MHz is also used globally by radiolocation systems.

As discussed, WRC-03 made a global allocation to the mobile service in this band for wireless access systems including RLANs. Under the WRC provisions, stations in the mobile service shall not claim protection from the radiolocation, Earth exploration-satellite (active) and the space research (active) services. In addition, technical limits were imposed on the mobile service in order to ensure compatibility with other services.

The decisions of the WRC-03 represent a compromise among the various competing spectrum needs within the international community. Specifically, due to the potential for interference into sensitive international Earth exploration-satellite instruments, there were strong representations from many countries to restrict the operation of LE-LAN to indoor use only. A number of other countries were of the view that other mitigation techniques could be used to ensure compatibility between systems in the Earth exploration-satellite service and LE-LAN devices. These techniques include the use of an e.i.r.p. elevation angle mask.

Studies have shown that the e.i.r.p. elevation angle mask can be an effective mitigation technique to ensure compatibility with the EESS. Technologies such as the use of tilt sensors that vary the output power as a function of tilt angle of the device have demonstrated success in ensuring compliance with the e.i.r.p. elevation angle mask.

Technical compatibility studies conducted by the International Telecommunication Union, in which Canada was an active participant, have shown that sharing between LE-LAN devices and systems in the radiolocation service is possible provided certain technical constraints on the LE-LAN devices are adopted. These constraints include the use of dynamic frequency selection, as well as emission limits

on LE-LANs. These constraints were adopted by WRC-03 in ITU Resolution 229 (WRC-03) as shown in Appendix 2 of this document.

The Department is of the view that the decisions made at WRC-03 represent a well-balanced compromise among the competing spectrum needs. Of particular importance to Canada is the provision to allow the use of outdoor LE-LANs. The Department is of the view that the capability for LE-LANs to operate outdoors will be essential to connect rural and remote communities. At the same time, the Department recognizes that LE-LANs shall not cause harmful interference into other licensed services, such as the Earth exploration-satellite service and radiolocation service operating in the same band. With all elements of sharing considered, the Department believes that the decision made at WRC-03 will protect the incumbent services appropriately while allowing LE-LANs to operate in indoor and outdoor environments.

Respondents to the consultation document indicated that the majority of the equipment currently being developed or marketed will not be able to comply with the e.i.r.p. elevation angle mask. The Department notes that the majority of LE-LANs will operate with low power (i.e. an e.i.r.p. of less than 200 mW). As stated in Recommendation ITU-R M.1652, the ITU-R expects that only 5 percent of all LE-LAN equipment will operate with e.i.r.p. greater than 200mW. In the case of LE-LANs operating with e.i.r.p. less than 200 mW, no e.i.r.p. elevation angle mask is necessary, that is approximately 95 percent of all LE-LAN equipment will be able to operate without the mask. By imposing the mask on higher power LE-LAN equipment, the potential to cause interference into the operation of a primary service will be lowered. It should be noted that higher-power LE-LAN equipment can be deployed in other 5 GHz bands (e.g. 5470-5825 MHz) without the restriction of an e.i.r.p. mask.

WRC-03 permits administrations to exercise some flexibility in adopting other mitigation techniques, provided that they develop national regulations to meet their obligations to achieve an equivalent level of protection to the EESS (active) and the SRS (active) based on their system characteristics and interference criteria as given in Recommendation ITU-R SA.1632.<sup>7</sup> In the consultation, the Department asked for suggestions for alternate mitigation techniques accompanied with any sound technical analysis. While a few respondents indicated that other mitigation techniques are available, the Department did not receive any specific solution or technical studies to that effect.

The Department is of the view that the decisions adopted by the WRC-03 to impose an e.i.r.p. mask on higher-power LE-LANs are necessary in order to protect incumbent primary licensed users. However, the Department also recognizes that technical studies conducted to date are largely theoretical. To date, no interference from higher-power LE-LANs into the operation of EESS (active) has been reported, which could be due to the fact that the LE-LAN industry is still in its development stage. If in the future LE-LANs are as widely and densely deployed as the wireless industry predicts, the potential for aggregate interference from higher-power LE-LANs into EESS (active) could be realized. Therefore, in order to protect the interests of the primary licensed users, the Department is imposing the use of an e.i.r.p. mask on LE-LAN devices with e.i.r.p. greater than 200 mW. However, the Department recognizes that any changes to existing provisions will require a period of transition to phase out equipment that does not meet the new requirement. During this period, more practical experience will

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<sup>7</sup> Recommendation ITU-R SA.1632: *Sharing in the band 5 250-5 350 MHz between the Earth exploration-satellite service (active) and wireless access systems (including radio local area networks) in the mobile service.*

be gained in terms of actual interference and alternative mitigation techniques. Also, since the interference into other primary licensed users is of an aggregate nature, the interference effect will gradually increase as LE-LAN deployments increase; there will be time for further evaluation of the actual operating environment. Hence, a transition period will be introduced to phase out equipment that does not comply with the new technical provisions (described in Section 4.3.4). However, the Department may review these decisions in the future.

#### **4.3.2.1 Transmitter Power Control**

In the consultation document, the use of transmitter power control (TPC) was proposed and respondents to the consultation have generally supported the use of TPC. However, some respondents indicated that a 6 dB TPC requirement on each device may be excessive and that for devices with less than 500 mW, TPC should not be required.

The Department notes that in accordance with Resolution 229 (WRC-03), two options with respect to TPC are stated. The first option: if TPC is employed, it shall provide, on average, a mitigation factor of at least 3 dB on the maximum average output power of the system. The second option: if TPC is not in use, then the maximum permitted e.i.r.p. of each device shall be reduced by 3 dB.

Therefore, each LE-LAN device must have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. in order to provide, on average, a mitigation factor of at least 3 dB on the maximum average output power of the system. Alternatively, if TPC is not used, then the maximum permitted e.i.r.p. shall be reduced by 3 dB. In the band 5250-5350 MHz, the maximum permitted e.i.r.p. limit is 1 W. Therefore, devices with maximum e.i.r.p. of less than 500 mW do not require TPC.

#### **4.3.2.2 Dynamic Frequency Selection**

The requirement to use Dynamic Frequency Selection (DFS) as a mitigation technique to ensure compatibility with the radiolocation service was adopted by WRC-03. The specific requirements are given in Recommendation ITU-R M.1652.<sup>8</sup> An excerpt from this recommendation is provided in Appendix 3 of this document. In summary, the DFS mechanism has to be able to detect interference signals above a minimum detection threshold of -62 dBm for devices with a maximum e.i.r.p. of less than 200 mW, and -64 dBm for devices with a maximum e.i.r.p. of 200 mW to 1 W averaged over 1  $\mu$ s. The LE-LAN device should be able to perform a channel availability check on a particular channel for 60 seconds to identify whether a radar is operating on that radio channel. The LE-LAN device should also be able to perform in-service monitoring to detect the presence of radars. As well, a channel that has been flagged as containing a radar signal, either by a channel availability check or in-service monitoring, is subject to a 30-minute non-occupancy period where it cannot be used by the LE-LAN device, in order to protect scanning radars.

Respondents to the consultation document generally supported the use of DFS. In addition to the detection thresholds and other parameters, the Department notes the importance of channel closing

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<sup>8</sup> Recommendation ITU-R M.1652: *Dynamic frequency selection (DFS) in wireless access systems including radio local area networks for the purpose of protecting the radiodetermination service in the 5 GHz band.*

time<sup>9</sup>, although not included in Recommendation ITU-R M.1652, as an additional effective measure to mitigate interference between LE-LANs and the radiolocation service. The Department also notes that other countries have already adopted a maximum limit on channel closing time of 260 ms.

### 4.3.3 Spectrum Policy Provisions

The band 5250-5350 MHz, allocated to the mobile service on a primary basis, is designated for use by LE-LANs, on the basis that such devices cannot claim protection from other radio systems and cannot cause harmful interference to licensed radio services.

The technical and operational provisions described in this policy applicable to the band 5250-5350 MHz shall be in effect immediately. Accordingly, RSS-210 will be revised to reflect the provisions specified in this spectrum utilization policy. New products being developed which will meet these parameters will be certified as compliant with the new regulatory provisions.

There are a number of licence-exempt products being certified, distributed and operated under the previous technical rules contained in RSS-210 (Issue 5, November 2001). It is in the public interest to ensure that Canadians continue to have a range of consumer devices to meet their communication needs and convenience. Hence, the Department will continue to allow the certification of equipment meeting those rules for a period of 3 years from the release of this policy document. During this period the Department will monitor the market conditions for licence-exempt devices and their potential impact on licensed services in the band. The Department will review the requirements based on an evaluation of the operating environment and experience gained in terms of the actual interference environment and alternative mitigation techniques. After this review, the Department may serve appropriate notification to cease the certification of new equipment under the previous rules. Further, the Department may evaluate whether there is a requirement to impose restrictions on the distribution of equipment certified under those rules.

### 4.3.4 Technical and Operational Provisions

The band 5250-5350 MHz is intended to be used predominantly for indoor LE-LAN applications. However, outdoor operation is also permitted.

LE-LAN devices shall be limited to a maximum of 1W e.i.r.p. However, devices with maximum e.i.r.p. greater than 200 mW shall implement an e.i.r.p. elevation mask in accordance with Resolution 229 (WRC-03).

LE-LANs shall implement dynamic frequency selection in accordance with Recommendation ITU-R M.1652. Furthermore, a channel closing time of 260 ms, as defined in Section 4.3.2.2, shall apply.

Each LE-LAN device must have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. in order to provide, on average, a mitigation factor of at least 3 dB on the maximum average output power of the system. Alternatively, if TPC is not used, then the maximum permitted e.i.r.p. limit shall be reduced by 3 dB. The maximum permitted e.i.r.p. limit is 1 W with a corresponding maximum

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<sup>9</sup> Channel closing time is the aggregate duration of transmission of LE-LANs during the channel move time.

e.i.r.p. density of 50 mW/MHz in any 1 MHz band. Therefore, devices with maximum e.i.r.p. of less than 500 mW are not required to implement TPC.

These requirements will be reflected in an appropriate Radio Standards Specification.

#### **4.4 Discussion and Provisions for the Band 5470-5725 MHz**

##### **4.4.1 Public Interest Considerations**

The band 5470-5725 MHz is shared by a number of radio services (see Appendix 1) including the radiodetermination service, Earth exploration-satellite (active) service and space research (active) service in various sub-bands within this frequency range.

The sub-band 5600-5650 MHz in particular, is heavily used in Canada for national meteorological radars. These radars provide weather related data primarily for use by Environment Canada. The meteorological radar network in Canada operates 24 hours per day, 7 days per week and covers all major cities and over 90 percent of the Canadian population. It enables meteorologists to detect the development, intensity and location of precipitation such as rain, snow or freezing rain. More importantly for the safety of the general public, Doppler weather radars measure the dynamics within storms and detect conditions that could lead to a tornado or other dangerous severe weather.

As indicated earlier, the Department recognizes the requirement to protect licensed services from potential harmful interference. It also recognizes the importance of globally harmonized spectrum, technical rules and flexibility to ensure successful deployment of new services.

The Department would like to stress the importance of weather radars and how they directly impact the safety of the general public. To ensure safe and continued operation of these radars, the Department endeavours to prescribe effective mitigation measures to balance the needs of all parties. These measures are discussed below.

##### **4.4.2 Co-existence Issues**

As discussed in Section 2, WRC-03 made a global allocation in the mobile service for wireless access systems including RLANS in this band. Under the WRC provisions, stations in the mobile service shall not claim protection from the radiodetermination service. In addition, technical limits were imposed on the mobile service in order to ensure compatibility with other services.

Similar to the band 5250-5350 MHz, Earth exploration-satellite systems will utilize the band 5470-5725 MHz for many applications. However, sharing between LE-LANs and the Earth exploration-satellite systems is less restrictive in the band 5470-5725 MHz than in the band 5250-5350 MHz. This enables the LE-LANs to operate with higher power and fewer operational restrictions compared to the band 5250-5350 MHz.

Furthermore, as discussed in the previous section, the use of dynamic frequency selection as a mitigation technique to ensure compatibility with the radiolocation service was adopted by WRC-03.

The band 5600-5650 MHz is used heavily in Canada for national meteorological radars. These radars provide weather related data for Environment Canada. Their operation is different than conventional terrestrial scanning radars. In order to protect their operation from aggregate emissions of LE-LAN devices, the ITU-R has developed special provisions in Recommendation ITU-R M.1652 for the band 5600-5650 MHz. An excerpt from this recommendation is given in Appendix 3 of this document. In this Recommendation, it is stated that “in the band 5600-5650 MHz, if a channel has been flagged as containing a radar, a 10-minute continuous monitoring of the flagged channel is required prior to use of that channel. Otherwise, other appropriate methods such as channel exclusion would be required.” This 10-minute continuous monitoring requirement may be performed either during or after the 30-minute non-occupancy period. The non-occupancy period is described in Section 3.2 of this document. Some respondents were of the view that the requirement, applicable to the band 5600-5650 MHz, presents a Canada-only scenario, which could be detrimental. The Department disagrees with this view. The requirements in 5600-5650 MHz are in accordance with Recommendation ITU-R M.1652, which was incorporated by reference through Resolution 229 at WRC-03. The 10-minute requirement or channel exclusion requirement is part of Recommendation ITU-R M.1652 in dealing with various types of radiolocation systems operating in the 5 GHz band; it is not a Canada-only solution.

Respondents to the consultation document generally had the same comments for TPC in the band 5470-5725 MHz as with the band 5250-5350 MHz (discussed in Section 4.3.2.1). Similar to the band 5250-5350 MHz, each LE-LAN device should have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. in order to provide, on average, a mitigation factor of at least 3 dB on the maximum average output power of the system. Alternatively, if TPC is not used, then the maximum permitted e.i.r.p. limit should be reduced by 3 dB. In the band 5470-5725 MHz, the maximum permitted e.i.r.p. limit is 1W. Therefore, devices with maximum e.i.r.p. of less than 500mW are not required to implement TPC.

#### **4.4.3 Spectrum Policy Provisions**

The band 5470-5725 MHz, allocated to the mobile service on a primary basis, is designated for use by LE-LANs, on the basis that such devices cannot claim protection from other radio systems and cannot cause harmful interference to licensed radio services.

The spectrum policy provisions, technical and operational provisions applicable to the band 5470-5725 MHz shall be in effect immediately. With respect to the requirements which will protect the operation of weather radars in the band 5600-5650 MHz from interference, the Department may consider other mutually acceptable mitigation techniques.

#### **4.4.4 Technical and Operational Provisions**

The band 5470-5725 MHz may be used for both indoor and outdoor LE-LAN operation.

LE-LAN devices shall be limited to a maximum e.i.r.p. of 1 W with a maximum transmitter power of 250 mW.



LE-LANs shall implement dynamic frequency selection in accordance with Recommendation ITU-R M.1652. Furthermore, a channel closing time of 260 ms, as defined in section 4.3.2.2, shall apply.

Each LE-LAN device must have the capability to operate at least 6 dB below the maximum permitted e.i.r.p. in order to provide, on average, a mitigation factor of at least 3 dB on the maximum average output power of the system. Alternatively, if TPC is not used, then the maximum permitted e.i.r.p. limit shall be reduced by 3 dB. The maximum permitted e.i.r.p. limit is 1W with a corresponding maximum e.i.r.p. density of 50mW/MHz in any 1 MHz band. Therefore, devices with maximum e.i.r.p. of less than 500 mW are not required to implement TPC.

These requirements will be reflected in an appropriate Radio Standards Specification.

#### **4.5 Discussion and Provisions for the Band 5725-5825 MHz**

The band 5725-5825 MHz is currently allocated to radiolocation service on a primary basis and to the amateur service on a secondary basis. In addition, the band has been available for LE-LAN operation since 1999. This band was not considered by WRC-03, hence, it was not part of the Department's consultation. The Department sees no requirement to change the existing spectrum policy or technical and operational provisions applicable to LE-LAN operation in this band.

##### **4.5.1 Spectrum Policy Provisions**

The band 5725-5825 MHz, under Canadian footnote C39A, is for the implementation of LE-LANs on the basis that such devices cannot claim protection from other radio systems and cannot cause harmful interference to licensed radio services.

The band 5725-5875 MHz, which overlaps the 100 MHz for LE-LANs, is designated internationally for industrial, scientific and medical (ISM) applications. Thus, radiocommunication services operating within this band must accept harmful interference which may be caused by ISM devices. In addition to the ISM applications, low-powered licence-exempt devices using spread spectrum techniques are permitted in the 5725-5850 MHz band.

##### **4.5.2 Technical and Operational Provisions**

There is no change to existing rules. The technical provisions are described in Radio Standards Specifications.

## **5. Implementation**

In accordance with the spectrum policy and technical and operation limits specified in this document, appropriate Radio Standards Specification(s) will be revised.

Issued under the authority  
of the *Radiocommunication Act*

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Robert McCaughern  
Director General  
Spectrum Engineering Branch

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Larry Shaw  
Director General  
Telecommunications Policy Branch

## Appendix 1 - Canadian Table of Frequency Allocations

### MHz

5 150 - 5 250	<p>AERONAUTICAL RADIONAVIGATION          FIXED-SATELLITE (Earth-to-space) 5.447A          MOBILE except aeronautical mobile 5.446A 5.446B</p> <p>5.446 5.447B 5.447C C39B</p>
5 250 - 5 255	<p>EARTH EXPLORATION-SATELLITE (active)          RADIOLOCATION          SPACE RESEARCH 5.447D          MOBILE except aeronautical mobile 5.446A 5.447F</p> <p>5.448A C39B</p>
5 255 - 5 350	<p>EARTH EXPLORATION-SATELLITE (active)          RADIOLOCATION          SPACE RESEARCH (active)          MOBILE except aeronautical mobile 5.446A 5.447F</p> <p>5.448A C39B</p>
5 350 - 5 460	<p>AERONAUTICAL RADIONAVIGATION 5.449          EARTH EXPLORATION-SATELLITE (active) 5.448B          RADIOLOCATION 5.448D          SPACE RESEARCH (active) 5.448C</p>
5 460 - 5 470	<p>RADIONAVIGATION 5.449          EARTH EXPLORATION-SATELLITE (active)          SPACE RESEARCH (active)          RADIOLOCATION 5.448D</p> <p>5.448B</p>
5 470 - 5 570	<p>MARITIME RADIONAVIGATION          MOBILE except aeronautical mobile 5.446A 5.450A          EARTH EXPLORATION-SATELLITE (active)          SPACE RESEARCH (active)          RADIOLOCATION 5.450B</p> <p>5.452 C39B 5.448B</p>

5 570 - 5 650	MARITIME RADIONAVIGATION MOBILE except aeronautical mobile 5.446A 5.450A RADIOLOCATION 5.450B  5.452 C39B
5 650 - 5 725	RADIOLOCATION MOBILE except aeronautical mobile 5.446A 5.450A Amateur Space Research (deep space)  5.282 C39B
5725 - 5850	RADIOLOCATION Amateur  5.150 C39A

**C39A** The band 5725-5825 MHz is designated for use by licence-exempt wireless local area networks and devices with established maximum power levels and based upon not interfering with, or claiming protection from, licensed services.

**C39B** The use of the bands 5150-5250 MHz, 5250-5350 MHz, and 5470-5725 MHz by the mobile service is in accordance with spectrum policy and technical and operational limits established for the implementation of wireless local area networks and devices.

**5.446A (WRC-03)** The use of the bands 5 150-5 350 MHz and 5 470-5 725 MHz by the stations in the mobile service shall be in accordance with Resolution **229 (WRC-03)**.

**5.446B (WRC-03)** In the band 5 150-5 250 MHz, stations in the mobile service shall not claim protection from earth stations in the fixed-satellite service. Number **5.43A** does not apply to the mobile service with respect to FSS earth stations.

**5.447F (WRC-03)** In the band 5 250-5 350 MHz, stations in the mobile service shall not claim protection from the radiolocation service, the Earth exploration-satellite service (active) and the space research service (active). These services shall not impose on the mobile service more stringent protection criteria, based on system characteristics and interference criteria, than those stated in Recommendations ITU-R M.1638 and ITU-R SA.1632.

- 5.448A (WRC-03)** The Earth exploration-satellite (active) and space research (active) services in the frequency band 5 250-5 350 MHz shall not claim protection from the radiolocation service. Number **5.43A** does not apply.
- 5.448B (WRC-03)** The Earth exploration-satellite service (active) operating in the band 5 350-5 570 MHz and space research service (active) operating in the band 5 460-5 570 MHz shall not cause harmful interference to the aeronautical radionavigation service in the band 5 350-5 460 MHz, the radionavigation service in the band 5 460-5 470 MHz and the maritime radionavigation service in the band 5 470-5 570 MHz.
- 5.448C (WRC-03)** The space research service (active) operating in the band 5 350-5 460 MHz shall not cause harmful interference to nor claim protection from other services to which this band is allocated.
- 5.448D (WRC-03)** In the frequency band 5 350-5 470 MHz, stations in the radiolocation service shall not cause harmful interference to, nor claim protection from, radar systems in the aeronautical radionavigation service operating in accordance with No. **5.449**.
- 5.450A (WRC-03)** In the band 5 470-5 725 MHz, stations in the mobile service shall not claim protection from radiodetermination services. Radiodetermination services shall not impose on the mobile service more stringent protection criteria, based on system characteristics and interference criteria, than those stated in Recommendation ITU-R M.1638.
- 5.450B (WRC-03)** In the frequency band 5 470-5 650 MHz, stations in the radiolocation service, except ground-based radars used for meteorological purposes in the band 5 600-5 650 MHz, shall not cause harmful interference to, nor claim protection from, radar systems in the maritime radionavigation service.

## Appendix 2 – Resolution 229 (WRC-03)

### Use of the Bands 5 150-5 250 MHz, 5 250-5 350 MHz and 5 470-5 725 MHz by the Mobile Service for the Implementation of Wireless Access Systems Including Radio Local Area Networks

The World Radiocommunication Conference (Geneva, 2003),

*considering*

- (a) that this Conference has allocated the bands 5 150-5 350 MHz and 5 470-5 725 MHz on a primary basis to the mobile service for the implementation of wireless access systems (WAS), including radio local area networks (RLANs);
- (b) that this Conference has decided to make an additional primary allocation for the Earth exploration-satellite service (EESS) (active) in the band 5 460-5 570 MHz and space research service (SRS) (active) in the band 5 350-5 570 MHz;
- (c) that this Conference has decided to upgrade the radiolocation service to a primary status in the 5 350-5 650 MHz band;
- (d) that the band 5 150-5 250 MHz is allocated worldwide on a primary basis to the fixed-satellite service (FSS) (Earth-to-space), this allocation being limited to feeder links of non-geostationary-satellite systems in the mobile-satellite service (No. **5.447A**);
- (e) that the band 5 150-5 250 MHz is also allocated to the mobile service, on a primary basis, in some countries (No. **5.447**) subject to agreement obtained under No. **9.21**;
- (f) that the band 5 250-5 460 MHz is allocated to the EESS (active) and the band 5 250-5 350 MHz to the space research service (active) on a primary basis;
- (g) that the band 5 250-5 725 MHz is allocated on a primary basis to the radiodetermination service;
- (h) that there is a need to protect the existing primary services in the 5 150-5 350 MHz and 5 470-5 725 MHz bands;
- (i) that results of studies in ITU-R indicate that sharing in the band 5 150-5 250 MHz between WAS, including RLANs, and the FSS is feasible under specified conditions;
- (j) that studies have shown that sharing between the radiodetermination and mobile services in the bands 5 250-5 350 MHz and 5 470-5 725 MHz is only possible with the application of mitigation techniques such as dynamic frequency selection;
- (k) that there is a need to specify an appropriate e.i.r.p. limit and, where necessary, operational restrictions for WAS, including RLANs, in the mobile service in the bands 5 250-5 350 MHz and 5 470-5 570 MHz in order to protect systems in the EESS (active) and SRS (active);
- (l) that the deployment density of WAS, including RLANs, will depend on a number of factors including intrasystem interference and the availability of other competing technologies and services,

*further considering*

- (a) that the interference from a single WAS, including RLANs, complying with the operational restrictions under *resolves 2* will not on its own cause any unacceptable interference to FSS receivers on board satellites in the band 5 150-5 250 MHz;

- (b) that such FSS satellite receivers may experience an unacceptable effect due to the aggregate interference from these WAS, including RLANs, especially in the case of a prolific growth in the number of these systems;
- (c) that the aggregate effect on FSS satellite receivers will be due to the global deployment of WAS, including RLANs, and it may not be possible for administrations to determine the location of the source of the interference and the number of WAS, including RLANs, in operation simultaneously,

*noting*

that, prior to WRC-03, a number of administrations have developed regulations to permit indoor and outdoor WAS, including RLANs, to operate in the various bands under consideration in this Resolution,

*recognizing*

- (a) that in the band 5 600-5 650 MHz, ground-based meteorological radars are extensively deployed and support critical national weather services, according to footnote No. **5.452**;
- (b) that the means to measure or calculate the aggregate pfd level at FSS satellite receivers specified in Recommendation ITU-R S.1426 are currently under study;
- (c) that certain parameters contained in Recommendation ITU-R M.1454 related to the calculation of the number of RLANs tolerable by FSS satellite receivers operating in the band 5 150-5 250 MHz require further study;
- (d) that the performance and interference criteria of spaceborne active sensors in the EESS (active) are given in Recommendation ITU-R SA.1166;
- (e) that a mitigation technique to protect radiodetermination systems is given in Recommendation ITU-R M.1652;
- (f) that an aggregate pfd level has been developed in Recommendation ITU-R S.1426 for the protection of FSS satellite receivers in the 5 150-5 250 MHz band;
- (g) that Recommendation ITU-R SA.1632 identifies a suitable set of constraints for WAS, including RLANs, in order to protect the EESS (active) in the 5 250-5 350 MHz band;
- (h) that Recommendation ITU-R M.1653 identifies the conditions for sharing between WAS, including RLANs, and the EESS (active) in the 5 470-5 570 MHz band;
- (i) that the stations in the mobile service should also be designed to provide, on average, a near-uniform spread of the loading of the spectrum used by stations across the band or bands in use to improve sharing with satellite services;
- (j) that WAS, including RLANs, provide effective broadband solutions;
- (k) that there is a need for administrations to ensure that WAS, including RLANs, meet the required mitigation techniques, for example, through equipment or standards compliance procedures,

*resolves*

- 1 that the use of these bands by the mobile service will be for the implementation of WAS, including RLANs, as described in Recommendation ITU-R M.1450;
- 2 that in the band 5 150-5 250 MHz, stations in the mobile service shall be restricted to indoor use with a maximum mean e.i.r.p.<sup>1</sup> of 200 mW and a maximum mean e.i.r.p. density of 10 mW/MHz in any 1 MHz band or equivalently 0.25 mW/25 kHz in any 25 kHz band;

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<sup>1</sup> In the context of this Resolution, “mean e.i.r.p.” refers to the e.i.r.p. during the transmission burst which corresponds to the highest power, if power control is implemented.

3 that administrations may monitor whether the aggregate pfd levels given in Recommendation ITU-R S.1426<sup>2</sup> have been, or will be exceeded in the future, in order to enable a future competent conference to take appropriate action;

4 that in the band 5 250-5 350 MHz, stations in the mobile service shall be limited to a maximum mean e.i.r.p. of 200 mW and a maximum mean e.i.r.p. density of 10 mW/MHz in any 1 MHz band. Administrations are requested to take appropriate measures that will result in the predominant number of stations in the mobile service being operated in an indoor environment. Furthermore, stations in the mobile service that are permitted to be used either indoors or outdoors may operate up to a maximum mean e.i.r.p. of 1 W and a maximum mean e.i.r.p. density of 50 mW/MHz in any 1 MHz band, and, when operating above a mean e.i.r.p. of 200 mW, these stations shall comply with the following e.i.r.p. elevation angle mask where  $\theta$  is the angle above the local horizontal plane (of the Earth):

$$\begin{array}{llll}
 -13 \text{ dB(W/MHz)} & \text{for} & 0^\circ & \leq \theta < 8^\circ \\
 -13 - 0.716(\theta-8) \text{ dB(W/MHz)} & \text{for} & 8^\circ & \leq \theta < 40^\circ \\
 -35.9 - 1.22(\theta-40) \text{ dB(W/MHz)} & \text{for} & 40^\circ & \leq \theta \leq 45^\circ \\
 -42 \text{ dB(W/MHz)} & \text{for} & 45^\circ & < \theta;
 \end{array}$$

5 that administrations may exercise some flexibility in adopting other mitigation techniques, provided that they develop national regulations to meet their obligations to achieve an equivalent level of protection to the EESS (active) and the SRS (active) based on their system characteristics and interference criteria as stated in Recommendation ITU-R SA.1632;

6 that in the band 5 470-5 725 MHz, stations in the mobile service shall be restricted to a maximum transmitter power of 250 mW<sup>3</sup> with a maximum mean e.i.r.p. of 1 W and a maximum mean e.i.r.p. density of 50 mW/MHz in any 1 MHz band;

7 that in the bands 5 250-5 350 MHz and 5 470-5 725 MHz, systems in the mobile service shall either employ transmitter power control to provide, on average, a mitigation factor of at least 3 dB on the maximum average output power of the systems, or, if transmitter power control is not in use, then the maximum mean e.i.r.p. shall be reduced by 3 dB;

8 that, in the bands 5 250-5 350 MHz and 5 470-5 725 MHz, the mitigation measures found in Annex 1 to Recommendation ITU-R M.1652 shall be implemented by systems in the mobile service to ensure compatible operation with radiodetermination systems,

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<sup>2</sup>  $-124 - 20 \log_{10} (h_{SAT}/1\,414) \text{ dB(W/(m}^2 \cdot 1 \text{ MHz))}$ , or equivalently,  
 $-140 - 20 \log_{10} (h_{SAT}/1\,414) \text{ dB(W/(m}^2 \cdot 25 \text{ kHz))}$ , at the FSS satellite orbit,  
 where  $h_{SAT}$  is the altitude of the satellite (km).

<sup>3</sup> Administrations with existing regulations prior to this Conference may exercise some flexibility in determining transmitter power limits.



*invites administrations*

to adopt appropriate regulation if they intend to permit the operation of stations in the mobile service using the e.i.r.p. elevation angle mask in *resolves* 4, to ensure the equipment is operated in compliance with this mask,

*invites ITU-R*

- 1 to continue work on regulatory mechanisms and further mitigation techniques to avoid incompatibilities which may result from aggregate interference into the FSS in the band 5 150-5 250 MHz from a possible prolific growth in the number of WAS, including RLANs;
- 2 to continue studies on mitigation techniques to provide protection of EESS from stations in the mobile service,
- 3 to continue studies on suitable test methods and procedures for the implementation of dynamic frequency selection, taking into account practical experience.

## **Appendix 3 – Excerpts from Annex 1 to Recommendation ITU-R M.1652**

### **Dynamic Frequency Selection in Wireless Access Systems Including Radio Local Area Networks for the Purposes of Protecting the Radiodetermination Services in the 5 GHz Band**

#### **Annex 1 to Recommendation ITU-R M.1652**

#### **The use of DFS in WAS including RLANs for the purpose of protecting the radiodetermination service in the 5 GHz band**

## **1. Introduction**

### **1.1 DFS**

Resolution 736 (WRC-2000) calls, *inter alia*, for studies on the feasibility of sharing between the mobile service for WAS<sup>2</sup> and the radiodetermination service in the frequency bands 5 250-5 350 and 5 470-5 725 MHz. Link budget calculations have shown that interference mitigation techniques are required to enable sharing of WAS with other services such as radar systems. This Recommendation describes the interference mitigation technique(s) DFS<sup>3</sup> as specified in the 5 GHz RLAN standards, with performance calculations based on typical implementations.

WAS and radars operating in the 5 GHz band will interfere when operating at the same frequencies and within range of each other.

DFS has then been envisaged to:

- ensure a spread of the loading across the available spectrum of the WAS under the field of view of a satellite to reduce the aggregate emission levels at the satellites of the FSS (feeder links) and EESS (active) from WAS; and
- avoid co-channel operation with other systems, notably radar systems.

Extension of the use of DFS as described herein allows WAS to avoid interfering with the radiodetermination service. The general principle applied is that WAS should detect interference and identify radar interferers and shall not use those frequencies used by the radar.

### **1.2 Objective of the use of DFS with respect to radars**

The objective of using DFS in WAS is to provide adequate protection to radars in the 5 GHz band. This is achieved by avoiding the use of, or vacating, a channel identified as being occupied by radar equipment based on detection of radar signals.

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<sup>2</sup> Throughout this Recommendation the term “WAS” denotes “wireless access systems including RLANs”.

<sup>3</sup> The DFS feature was specified in the 5 GHz RLAN standards initially in order to mitigate interference among uncoordinated RLAN clusters, and to provide optimized spectral efficiency for high-capacity, high bit-rate data transmission.

For the purpose of this Annex, a discussion of radiodetermination systems in the 5 GHz range utilized in determining DFS characteristics can be found in Annex 3.

The implementation of radar detection mechanisms and procedures used by WAS are outside the scope of this Annex. The main reasons for this are that:

- WAS design affects implementation;
- practical experience may lead to innovative and more efficient means than can be formulated today;
- different manufacturers may make different implementation choices to achieve the lowest cost for a given level of performance; therefore only performance criteria rather than specifications for a particular mechanism should be given in regulatory documents.

## **2. DFS performance requirements**

The DFS performance requirement is stated in terms of response to detection of an interference signal.

5 GHz WAS should meet the following detection and response requirements.

Procedures for compliance verification should be incorporated in relevant industry standards for RLANs.

### **2.1 Detection requirements**

The DFS mechanism should be able to detect interference signals above a minimum DFS detection threshold of  $-62$  dBm for devices with a maximum e.i.r.p. of  $< 200$  mW and  $-64$  dBm for devices with a maximum e.i.r.p. of  $200$  mW to  $1$  W<sup>4</sup> averaged over  $1$   $\mu$ s.

This is defined as the received signal strength (RSS) (dBm), normalized to the output of a  $0$  dBi receive antenna, that is required to be detected within the WAS channel bandwidth.

### **2.2 Operational requirements**

The WAS should be able to perform channel availability check: A check during which the WAS listens on a particular radio channel for  $60$  s to identify whether there is a radar operating on that radio channel.

The WAS should be able to perform in-service monitoring: Monitoring of the operating channel to check that a co-channel radar has not moved or started operation within range of the WAS. During in-service monitoring the radar detection function continuously searches for radar signals in-between normal WAS transmissions. This requires the use of quiet spaces between successive WAS transmissions (See Annex 4) [Not attached in this document].

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<sup>4</sup> In practice, it may not be necessary for each device to implement full DFS functionality, provided that such devices are only able to transmit under the control of a device that ensures that all DFS requirements are fulfilled.

If the WAS has not previously been in operation or has not continuously monitored the channel with in-service monitoring, it should not start transmission in any channel before completion of a channel availability check.

### 2.3 Response requirements

A channel that has been flagged as containing a radar signal, either by a channel availability check or in-service monitoring, is subject to a 30 min period (non-occupancy period) where it cannot be used by the WAS device in order to protect scanning radars. The non-occupancy period should start at the time when the radar signal is detected.

Additionally, in the band 5 600-5 650 MHz, if a channel has been flagged as containing a radar, a 10 min continuous monitoring of the flagged channel is required prior to use of that channel. Otherwise, other appropriate methods such as channel exclusion would be required.

Channel move time is defined as the period of 10 s needed by a WAS to cease all transmissions on the operating channel upon detection of an interfering signal above the DFS detection threshold. Transmissions during this period will consist of normal traffic for typically less than 100 ms and a maximum of 200 ms after detection of the radar signal. In addition, intermittent management and control signals can be sent during the remaining time to facilitate vacating the operating channel. The aggregate time of the intermittent management and control signals are typically less than 20 ms.

### 2.4 Summary of the requirements

Table 1 provides a summary of the requirements described above. An example of the operating procedures is given in Annex 2 [Not attached in this document].

**Table 1**

<b>Parameter</b>	<b>Value</b>
DFS detection threshold	-62 dBm for devices with a maximum e.i.r.p. of < 200 mW and -64 dBm for devices with a maximum e.i.r.p. of 200 mW to 1 W averaged over 1 $\mu$ s
Channel availability check time	60 s
Non-occupancy period	30 min
Channel move time	$\leq 10$ s