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Radiocommunication Study Group 5

DRAFT REVISION OF 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

Summary of the revision

The revision includes deletion of old text or information duplicating relevant provisions of the Radio Regulations and editorial updating of the text to reflect the recent studies conducted by ITU-R.

DRAFT REVISION OF RECOMMENDATION ITU-R M.1652*

Dynamic frequency selection (DFS)¹ in wireless access systems including radio local area networks for the purpose of protecting the radiodetermination service in the 5 GHz band

(Questions ITU-R 212/58 and ITU-R 142/9)

(2003)

Scope

This Recommendation provides requirements of dynamic frequency selection (DFS) as a mitigation technique to be implemented in wireless access systems (WAS) including radio local area networks (RLANs) for the purpose of facilitating sharing with the radiodetermination service in the 5 GHz band. Annex 1 specifies the detection, operational and response requirements. Other Annexes address the methodologies and provide information which can be used by administrations when conducting sharing studies between radars and WAS including RLANs.

The ITU Radiocommunication Assembly,

considering

- a) that harmonized frequencies in the bands 5 150-5 350 MHz and 5 470-5 725 MHz for the mobile service would facilitate the introduction of wireless access systems (WAS) including radio local area networks (RLANs);
- b) that there is a need to protect the radars in the radiodetermination service operating in the bands 5 250-5 350 and 5 470-5 725 MHz;
- c) that in many administrations, the ground-based meteorological radars are extensively deployed and support critical weather services;
- d) that procedures and methodologies to analyse compatibility between radars and systems in other services are provided in Recommendation ITU-R M.1461;
- e) that representative technical and operational characteristics of radiolocation, radionavigation and meteorological radars are provided in Recommendation ITU-R M.1638, including maritime radionavigation radars in, *inter alia*, the band 5 470-5 650 MHz;
- ~~f) that Recommendation ITU-R M.1313 provides typical technical characteristics of maritime radionavigation radars in, *inter alia*, the band 5 470-5 650 MHz;~~
- g) that WAS including RLANs as described in Recommendation ITU-R M.1450 are capable of operating both indoor and outdoor;
- h) Report ITU-R M.2034 which addresses the impact of certain detection requirements of the DFS on the performance of WAS,

* ~~This Recommendation was jointly developed by Radiocommunication Study Groups 8 and 9, and future revisions should be undertaken jointly.~~

¹ ~~DFS~~ Dynamic frequency selection is a general term used in this Recommendation to describe mitigation techniques that allow, amongst others, detection and avoidance of co-channel interference with respect to radar systems.

recognizing

- a) that the band 5 250-5 350 MHz is allocated to the radiolocation service on a primary basis; that the band 5 250-5 350 MHz is also allocated to the Earth exploration-satellite service (EESS) (active) on a primary basis;
- b) that the band 5 470-5 650 MHz is allocated to the maritime radionavigation service on a primary basis;
- c) that the band 5 350-5 650 MHz is allocated to the radiolocation service on a secondary basis;
- d) that ground-based radars used for meteorological purposes are authorized to operate in the band 5 600-5 650 MHz on a basis of equality with stations in the maritime radionavigation service ~~(see No. 5.452 of the Radio Regulations (RR))~~;
- e) that the band 5 650-5 725 MHz is allocated to the radiolocation service on a primary basis;
- f) that administrations may take account of detailed information on actual radar deployment when developing guidance for the use of DFS in WAS in consultation with potentially affected administrations,

noting

- a) that the high RF power level and the receiver sensitivity of radars in the radiodetermination service in conjunction with the expected high density of WAS including RLANs would, in general, not enable compatible operation of WAS including RLANs and radars on a co-channel basis in the absence of mitigation techniques;
- b) that WAS including RLANs could be deployed in these bands as licence-exempt devices, consequently making control of their deployment density more difficult;
- c) that there are various standards for RLAN specifications;
- d) that administrations may consider procedures to confirm the ability of interference avoidance mechanisms to function correctly in the presence of the radar systems deployed in this band,

recommends

- 1** that, in order to facilitate sharing with radars, mitigation techniques as described in Annex 1 be implemented by WAS, including RLANs in the bands used by radars at 5 GHz;
- 2** that the mitigation techniques comply with the detection, operational and response requirements as given in § 2 of Annex 1;
- 3** that the methodologies given in Annexes 4, 5, 6 and 7 can be used by administrations when conducting sharing studies between radars and WAS including RLANs.

NOTE 1 – Further information on the results of studies on tThe requirements stated in *recommends 2 is given in Report ITU-R M.2115, which provides information on the procedures in place in various administrations and/or regional groups to test compliance with DFS requirements~~should be subject to further study on an urgent basis, based on practical experience.~~*

ANNEX 1

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~~ In relation to studies on the feasibility of sharing between the mobile service for WAS² 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 Annex~~ describes the interference mitigation technique(s) DFS³ 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.

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;

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

³ 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.

- 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 W⁴ averaged over 1 μ 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).

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.

⁴ 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.

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.

TABLE 1

Parameter	Value
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 μ s
Channel availability check time	60 s
Non-occupancy period	30 min
Channel move time	\leq 10 s

ANNEX 2

Radar detection and example of associated DFS procedures

(No change).

ANNEX 3

Use of characteristics of radiolocation, maritime radionavigation and meteorological radars

The technical characteristics of some meteorological, radiolocation and maritime radionavigation radars operating in the bands between 5 250-5 350 MHz and 5 470-5 725 MHz can be found in Recommendation ITU-R M.1638. This information is used for the determination of the technical requirements of the DFS mechanism to be implemented in the WAS, which is identified as necessary to enable the introduction of WAS in the mobile service ~~(to be considered in accordance with Resolution 736 (WRC-2000))~~ in these frequency bands used by radars. Specifically radars A through -S provided in Recommendation ITU-R M.1638 are considered in development of DFS characteristics.

Table 2 of Recommendation ITU-R M.1638 shows the allocations within the 5 GHz range to the radiodetermination service. Table 2 gives the allocations of sub-bands of the 5 GHz range to the radiodetermination service:

TABLE 2

Band (MHz)	Allocation
5 250 5 255	— RADIOLOCATION
5 255 5 350	— RADIOLOCATION
5 350 5 460	— AERONAUTICAL RADIONAVIGATION— (Note 2) — Radiolocation (Note 3)
5 460 5 470	— radionavigation — radiolocation (Note 3)
5 470 5 650	— MARITIME radionavigation (Note 1) — radiolocation (Note 3)
5 650 5 725	— radiolocation
5 725 5 850	— radiolocation

NOTE 1— In accordance with RR No. 5.452, between 5 600 and 5 650 MHz, ground-based radars for meteorological purposes are authorized to operate on a basis of equality with stations in the maritime radionavigation service.

NOTE 2— This Recommendation does not consider the aeronautical radionavigation radar since the 5 GHz band allocated to the aeronautical radionavigation service (ARNS) is the frequency band 5 350 5 460 MHz which is not envisaged for the introduction of WAS in the mobile service.

NOTE 3— WRC 03 agenda item 1.5 addresses a possible upgrade of the status of the radiolocation service in the frequency range 5 350 5 650 MHz in accordance with Resolution 736 (WRC 2000).

ANNEX 4

Parameters and methodology to calculate the probability of detection of radiodetermination systems by WAS including RLAN devices using DFS in the 5 GHz band during in-service monitoring

(No change except for the renumbering of Tables 3-5 to Tables 2-4).

ANNEX 5

Interference assessment using link budget calculations involving a single WAS device and radiodetermination systems in the 5 GHz band

(No change).

ANNEX 6

Parameters and methodology for conducting aggregate interference studies involving WAS including RLANs and radiodetermination systems in the 5 GHz band

(No change except for the renumbering of Tables 6-12 to Tables 5-11).

ANNEX 7

Interference assessment results analysis and recommendation on DFS threshold values

(No change except for the renumbering of Tables 13-14 to Tables 12-13).
