

RECOMMENDATION ITU-R F.1778

Channel access requirements for HF adaptive systems in the fixed service

(Question ITU-R 205-1/9)

(2007)

Scope

This Recommendation describes channel access objectives and techniques for HF adaptive systems in the fixed service to minimize interference to and from other systems.

The ITU Radiocommunication Assembly,

considering

- a) that the advancement in technologies and use of the Internet are creating new opportunities for HF fixed service system applications using frequency-adaptive techniques;
- b) that the effectiveness of spectrum use will be improved by the use of HF frequency-adaptive systems in the fixed service, which is required to operate effectively in its allocated spectrum;
- c) that Recommendation ITU-R F.1110 specifies the general characteristics of adaptive HF systems, and specifically recognizes that adaptive HF systems make it possible to achieve a higher quality of service, reduce transmission times, increase spectrum effectiveness and minimize interference between users;
- d) that Recommendation ITU-R F.1611 describes the frequency planning and operation of adaptive HF systems;
- e) that the ITU-R Handbook – Frequency adaptive communication systems and networks in the MF/HF bands, gives guidance on HF frequency-adaptive systems,

noting

that administrations may consider procedures to confirm the ability of interference avoidance mechanisms to function correctly for HF adaptive systems,

recommends

- 1** that frequency-adaptive HF systems should use the minimum number of active (in use at any moment) frequency channels out of its available frequency pool in order to limit the potential for interference to other users;
- 2** that, to minimize interference to and from other systems, HF fixed service adaptive systems should use dynamic frequency selection (DFS) and procedures to evaluate the channel prior to and during operation as described in Annex 1.

Annex 1

Adaptive HF systems channel access requirements

1 Introduction

HF fixed service adaptive systems operating below 30 MHz have the potential to mutually interfere when operating at the same frequencies and within range of other HF systems. This Annex describes objectives and means to mitigate such interference.

1.1 Dynamic frequency selection (DFS)

Resolution 729 (WRC-97) calls for studies on the feasibility of adaptive use and sharing between HF systems in the MF/HF bands.

DFS has then been envisaged to:

- ensure a spread of the loading across the available spectrum;
- avoid co-channel operation with other systems.

Adaptive HF systems manage call set-up and call progress using digital data formats with embedded network and station addresses. They are able to mitigate interference to other systems by implementing these DFS procedures to avoid occupied channels. Non-adaptive receivers may develop intelligent squelch systems to mitigate interference received from other co-channel adaptive systems.

1.2 Objective of the use of DFS with respect to HF adaptive systems

The objective of using DFS in HF adaptive systems is to protect users of HF bands from mutual interference. This is achieved by avoiding the use of, or vacating, a channel identified as being occupied by other systems on detection of their signals.

The implementation of detection mechanisms and procedures used by adaptive systems are outside the scope of this document. The main reasons for this are that:

- adaptive system design affects implementation;
- practical experience may lead to innovative and more efficient means than can be formulated today;
- manufacturers may choose different implementation methods to achieve 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 a signal. Adaptive HF system channel access should meet the following detection and response requirements.

2.1 Detection requirements

The DFS mechanism should be able to detect signals for the purpose of in-service monitoring and channel availability checks above a minimum DFS detection threshold of 6 dB S/N ratio.

2.2 Operational requirements

The HF adaptive system should be able to perform a channel availability check during which time the system listens on a particular radio channel for 800 ms to identify whether there is another system operating on that radio channel.

The adaptive system should be able to perform in-service monitoring of the operating channel to check that a co-channel system has not started operation. During in-service monitoring the signal detection function continuously searches for other system signals in-between normal adaptive system transmissions. This requires the use of quiet spaces between successive transmissions.

If the adaptive HF system 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. The channel availability and in-service monitoring operations will utilize a minimum DFS detection threshold of 6 dB *S/N* ratio.

At this threshold, the probability of missed detection of single sideband voice should not exceed 50%, and the probability of missed detection of data modem waveforms should not exceed 30%, both with a false detection probability not exceeding 1%.

2.3 Response requirements

A channel that has been flagged as containing a radio transmitter, either by a channel availability check or in-service monitoring, is subject to a 2-min period (non-availability period) during which it should not be used by the adaptive HF system. The non-availability period should start at the time when the radio signal is detected. The non-availability period monitoring operation may be continuous or sampled in time.

Channel move time is defined as the period of less than or equal to 125 s needed by an adaptive HF system to cease transmissions on the operating channel upon detection of a signal above the DFS detection threshold. Transmissions during this period may consist of normal traffic for typically less than 125 s. Management and control signals can be sent during this time period to facilitate vacating the operating channel.

2.4 Summary of the DFS performance requirements

Table 1 provides a summary of the DFS performance requirements described above.

TABLE 1

Parameter	Value
DFS detection threshold	Minimum of 6 dB <i>S/N</i> ratio
Channel availability check time	800 ms
Non-availability period	2 min
Channel move time	≤ 125 s