

RECOMMENDATION ITU-R BS.1348

**SERVICE REQUIREMENTS FOR DIGITAL SOUND BROADCASTING
TO VEHICULAR, PORTABLE AND FIXED RECEIVERS
USING TERRESTRIAL TRANSMITTERS
IN THE LF, MF AND HF BANDS**

(Question ITU-R 217/10)

(1998)

The ITU Radiocommunication Assembly,

considering

- a) that there is an increasing requirement worldwide for suitable means of broadcasting high-quality monophonic or stereophonic sound to vehicular, portable and fixed receivers;
- b) the limitations of the existing LF, MF and HF sound-broadcasting services abilities to fulfil such requirements;
- c) that the present congestion in some countries on the utilization of the LF, MF and HF bands causes a generally increasing level of interference and limits the number of programmes which can be transmitted;
- d) that technical developments in source and channel coding, modulation and advanced digital signal processing, have demonstrated the technical feasibility and maturity of digital sound-broadcasting systems in other bands;
- e) that a large series of demonstrations and field trials in various parts of the world have confirmed the technical feasibility and economic viability from a system design point of view of digital sound-broadcasting systems in other bands;
- f) that an advanced digital sound-broadcasting system can provide better coverage and better spectrum and power efficiency as well as better performance in multipath environments than conventional analogue systems;
- g) that a digital broadcasting system can be employed in both terrestrial and satellite applications using closely related emission signal parameters, thus allowing common receiver design;
- h) that sound broadcasting has always used similar modulation techniques throughout the world, such as AM or FM and similar, if not identical, frequency bands, leading to a receiver that could be used worldwide, for the benefit of the listener;
- j) that extensive sound-broadcasting services, both public and private, which provide sound programmes to listeners, exist throughout the world,

recommends

1 that, when digital sound-broadcasting services from terrestrial transmitters, intended for vehicular, portable and fixed reception, are introduced into the LF, MF and HF bands, digital sound-broadcasting systems employed should have the following technical and operational characteristics and capabilities:

- be capable of providing high-quality monophonic or stereophonic sound to vehicular, portable and fixed receivers;
- provide better spectrum and power efficiency than conventional analogue LF, MF and HF systems;
- provide significantly improved performance in a multipath environment;
- allow for a trade-off between extent of coverage and service quality for a given emission power;
- be capable of allowing, with a common receiver, the use of **all** means of programme delivery;

- be capable of providing facilities for programme-related data;
- be capable of providing additional data services;
- allow the manufacturing of low-cost receivers through mass production.

NOTE 1 – An initial report giving more details of HF service requirements is given at Annex 1.

ANNEX 1

Broadcasting service requirements for any HF digital system

Consideration has been given to the possibilities that might be offered by an HF digital system which could be used in the HF bands. These bands are used both for national and international broadcasting and are distinguished by having a particularly difficult propagation medium.

1 Introduction

In many areas, digital broadcasting systems are being introduced to replace the more traditional analogue systems. The general advantages of digital systems are well known:

- higher quality;
- higher reliability;
- better performance/cost ratio.

Digital broadcasting transmission systems, that is the part of the programme chain from the transmitter site to the listener or viewer, are also included in the process of transformation to digital technology. This process is already underway as far as satellite television is concerned and plans are well advanced for the introduction of terrestrial digital television broadcasting.

Sound broadcasting, at least as far as a replacement for VHF/FM, is also embracing the use of digital technology, with the introduction of DSB in several parts of the world.

However, so far there has been no formal proposal to introduce digital techniques into LF, MF and HF broadcasting.

In view of the significant benefits which have been shown to be obtained from the use of digital techniques in sound and television broadcasting, it is highly desirable to see if similar benefits could be obtained in the fields of LF, MF and HF broadcasting. Indeed, one advantage of the use of digital techniques which was not mentioned above, that is:

- spectrum economy;

is of particular importance in the MF and HF bands because of the severe congestion of the spectrum caused by the demand for services exceeding the capacity of the existing spectrum.

However, it has to be accepted that the ionosphere as a propagation medium (for MF by night and for HF at all times of the day) leaves much to be desired and could be regarded as fairly hostile in terms of the provision of broadcasting services. While it is to be expected that the use of digital techniques can lead to improved reception even in this relatively hostile propagation environment, it will be necessary to ensure that any digital broadcasting system selected for HF use, in particular, meets the requirements of the broadcasters who will need to use it. It is also necessary that the system requirements can be met in realistic broadcasting conditions, that is to say:

- at frequencies which are not necessarily optimum for a particular propagation path and time of day;
- in congested bands.

The system requirements outlined below represent a first attempt to specify what an HF digital broadcasting system would be required to achieve. Practical tests will be needed to establish whether these requirements can be met in operational practice. Feedback from such tests will be used to refine the system requirements themselves.

The introduction of a digital broadcasting system into the HF bands would need to be considered in two phases. Some of the potential benefits would be available in the short term, when the new digital services would have to coexist with analogue services and mutual interference could be the factor which limits the amount of improvement possible. The full benefits would only be available in the longer term when it becomes possible to effect a substantial transfer of the analogue (AM) services to digital ones.

2 Technical performance characteristics

2.1 The target would be to have a single worldwide standard for HF digital broadcasting.

2.2 Audio performance characteristics at the receiver

a) Quality requirements in the short term:

- monophonic;
- frequency response - 4.5 kHz minimum;
- referring to the ITU-R subjective listening scale, audio quality greater than 3.5 in the absence of interference, for a representative selection of HF broadcasting audio material, both voice and music.

b) Medium to longer term development objectives:

- stereophonic;
- frequency response - 9.0 kHz minimum;
- referring to the ITU-R subjective listening scale, audio quality greater than 4.0 in the absence of interference for a representative selection of HF broadcasting audio material, both voice and music;
- backward compatibility with a) above.

2.3 Co-channel and adjacent channel protection requirements

- a) Channel bandwidth requirements - 99% of the power of the transmission of a HF digital transmission system should be contained within a 10 kHz channel.
- b) A digital transmission replacing an analogue transmission should have an interference potential not greater than the analogue transmission which it is replacing.
- c) A digital transmission replacing an analogue transmission should have an interference susceptibility not greater than that of the analogue transmission which it is replacing.
- d) It will be necessary to have values of protection ratios for the cases of:
- digital signals interfering with digital signals;
 - digital signals interfering with analogue signals;
 - analogue signals interfering with digital signals.

2.4 Reception reliability

A digital HF broadcasting system should permit reception at the designed audio quality at all locations within a coverage area with a very high total reliability. Estimates of reliability which will be realistically achievable in the short term and in the long term can only be made on the basis of detailed system proposals and the results of studies concerning the implementation of digital services in the HF broadcasting bands.

2.5 Equipment and equipment compatibility requirements

a) Transmitter requirements

It should be possible to use existing modern HF transmitters for HF digital transmissions, with minimum conversion costs.

It is required that the converted transmitters be able to be used for both analogue and digital transmissions.

Ideally the use of a digital HF transmission system should lead to power savings.

b) Receiver requirements

Low-cost receiver with low-power consumption which will receive both analogue and digital HF transmissions must be available.

It is desirable to be able to adapt existing receivers to receive digital HF transmissions with an add-on "black box".

2.6 Receiver operational characteristics

a) Receiver controls

Receivers should be simple to operate.

b) Receiver power requirements

Receivers which operate under battery power should have quite moderate power requirements.

c) Programme-seeking capability of HF digital receivers

Receivers should have the capability of automatically tuning to the same programme being transmitted on other frequencies, so that when the programme on its primary frequency fades, it can tune to another channel with only minimal interruption.

2.7 Data and other transmission requirements

The system should ideally be capable of delivering text, slow-scan video and supplementary information as well as audio, although the latter remains the primary objective.

2.8 Digital HF system operational requirements

The system should be capable of single frequency network operation. This would permit improved reception in the coverage area without the use of additional channels for the same programme in the same area.
