

RECOMMENDATION ITU-R BS.1350-1

**SYSTEMS REQUIREMENTS FOR MULTIPLEXING (FM) SOUND
BROADCASTING WITH A SUB-CARRIER DATA CHANNEL
HAVING A RELATIVELY LARGE TRANSMISSION
CAPACITY FOR STATIONARY AND
MOBILE RECEPTION**

(Question ITU-R 71/10)

(1998)

The ITU Radiocommunication Assembly,

considering

- a) there is an increasing requirement worldwide for a suitable means of multiplexing FM sound broadcasting with a sub-carrier data channel having a relatively large transmission capacity for stationary and mobile reception;
- b) that FM sound broadcasting will support higher capacity data transmissions;
- c) that the capacity of current data systems in common use in FM sound broadcasting is limited;
- d) that technical developments in large capacity data systems for multiplexing with FM sound broadcasting have demonstrated the technical feasibility of larger capacity data systems;
- e) that field trials and demonstrations have confirmed the feasibility of large capacity data systems for use in FM sound broadcasting;
- f) that compatibility has been achieved between the FM stereophonic services including the Radio Data System (RDS) services according to Recommendation ITU-R BS.643 and any new additional sub-carrier system has been demonstrated;
- g) that a much larger data capacity may be needed for some applications;
- h) that sub-carrier data radio channel systems can provide relatively large transmission capacity compared to RDS and are capable of meeting compliance requirements of Recommendation ITU-R BS.412;
- j) that several relatively large transmission capacity data systems according to Recommendation ITU-R BS.1194 have already been put into operation,

recommends

- 1** that systems for multiplexing FM sound broadcasting with a sub-carrier data channel having a relatively large transmission capacity for stationary and mobile reception:
- 1) must comply with current ITU policy on intellectual property rights;

- 2) must not interfere with:
 - the main broadcast on the same carrier or on adjacent carriers as stated in Recommendation ITU-R BS.412;
 - RDS and/or other sub-carrier services on the same or adjacent carriers as stated in Recommendations ITU-R BS.412 and BS.643;
 - aeronautical radio navigation services as stated in ITU-R IS.1009;
- 3) should be evaluated for selection taking into consideration the following characteristics and features relative to the needs of the particular application:
 - a) system performance characteristics such as:
 - data reliability in Gaussian noise;
 - data reliability in multipath reception conditions;
 - data reliability with adjacent channel signals;
 - shortest end-to-end delay;
 - message error rate for various message lengths in multipath conditions;
 - synchronization acquisition time;
 - b) additional features of the system such as:
 - minimum duty cycle for power savings;
 - receiver addressability;
 - conditional access;
 - support for various data types;
 - ability to operate in a network of data services;
 - possibility for additional sub-carrier services;
 - ability to operate independently of the radio network;
 - multiple station access;
 - capability for rebroadcasting;
 - c) system compliance with Recommendation ITU-R BS.450;
 - d) the ability of the system to minimize possible degradation to the audio main channel and/or RDS in multipath reception conditions;
 - e) results of field tests of the system;
- 4) should be selected and specified with at least the following general features being identified:
 - sub-carrier frequency;
 - bandwidth;
 - channel data rate;
 - information data rate;
 - modulation method;
 - packet structure and framing (data structure);
 - forward error correction and interleaving approach;
 - error detection capability;
 - injection level;
- 5) should be selected depending on the application.

NOTE 1 – These requirements, considerations and applications are discussed further in Annex 1.



ANNEX 1

Systems requirements for multiplexing FM sound broadcasting with a sub-carrier data channel having a relatively large transmission capacity for stationary and mobile reception

1 Introduction

1.1 Purpose

The purpose of this document is to assist in the selection of a specific system for providing relatively large data transmission capacity using sub-carriers multiplexed with FM sound broadcasts. This document presents a set of system characteristics that should be considered when selecting a system for the above purpose. These characteristics are divided into four aspects as follows:

- **General Features** is an overview of the basic parameters of the data systems (Section 3).
- **Additional Features** describes specifics of each data system that will tend to make it more or less suitable for special features of each system (Section 4).
- **Compatibility characteristics** which relate to the quantitative impact of the data system on existing services, both on the broadcast channel using the same carrier as well as on adjacent channels (Section 5).
- **System performance characteristics** which relate, in various terms, to the performance of the data system itself (Section 6).

It is recognized that compatibility characteristics of a system are important regardless of the application. The system performance characteristics are dependent on the specific requirements of the intended application. This document identifies the important system performance characteristics for a number of different applications.

1.2 Special requirements

As for all systems recommended by the ITU, the system chosen should comply with the current ITU policy on intellectual property rights (see Annex 1 to Resolution ITU-R 1). In addition, proposed systems should be field tested prior to selection.

2 System applications

System applications are based on receiver characteristics, data types and transmission characteristics. These are discussed in Sections 2.1, 2.2 and 2.3 respectively. A particular system application involves the transmission of one or more data types from transmitters having various characteristics, to receivers with one or more characteristics. Because of the particular data types, transmitter characteristics and expected receiver characteristics which distinguish any given application, certain system performance characteristics will be more important than others.

2.1 Receiver characteristics

Receiver applications are distinguished in terms of the following characteristics. Some receivers may be good enough to meet low data rates or reliability requirements, but will not be adequate where high data rates and reliability are required.

2.1.1 Physical characteristics of the receiver application

- availability of prime power to the receiver (battery size and capacity);
- receiver antenna performance;
- receiver mobility and speed of motion;
- receiver noise figure;
- ambient electrical noise.