



Recommendation ITU-R BS.643-4
(12/2022)

**Radio data system for automatic tuning and
other applications in FM radio receivers for
use with the pilot-tone system**

BS Series
Broadcasting service (sound)



Foreword

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Series	Title
BO	Satellite delivery
BR	Recording for production, archival and play-out; film for television
BS	Broadcasting service (sound)
BT	Broadcasting service (television)
F	Fixed service
M	Mobile, radiodetermination, amateur and related satellite services
P	Radiowave propagation
RA	Radio astronomy
RS	Remote sensing systems
S	Fixed-satellite service
SA	Space applications and meteorology
SF	Frequency sharing and coordination between fixed-satellite and fixed service systems
SM	Spectrum management
SNG	Satellite news gathering
TF	Time signals and frequency standards emissions
V	Vocabulary and related subjects

Note: This ITU-R Recommendation was approved in English under the procedure detailed in Resolution ITU-R 1.

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RECOMMENDATION ITU-R BS.643-4*

Radio data system for automatic tuning and other applications in FM radio receivers for use with the pilot-tone system

(1986-1990-1995-2011-2022)

Scope

This Recommendation specifies the main parameters and operational requirements for the use of the radio data system (RDS) for VHF/FM broadcasting.

Keywords

FM broadcasting, Radio Data System

The ITU Radiocommunication Assembly,

considering

- a) that, in VHF/FM broadcasting, the density of transmissions in many parts of the world is increasing to the extent that tuning to a given programme service is becoming more and more difficult, particularly for listeners using FM portable or car radios;
- b) that, on the other hand, technologies offer the possibility of adding auxiliary data signals to the sound-programme signals which offer a wide variety of methods for identifying the transmissions, thereby facilitating the implementation of assisted and automatic tuning in radio receivers;
- c) that such radio-data signals can be added to existing VHF/FM broadcasts in such a way that they are inaudible, thus achieving good compatibility with reception of the normal stereophonic or monophonic sound-programme signals;
- d) that inexpensive receiver technology optimized in miniaturization processes is available to implement assisted or automatic tuning using radio-data signals;
- e) that such a system offers the flexibility to implement a wide range of optional applications to suit the particular needs of individual broadcasting organizations;
- f) that many countries have implemented this system on their broadcasts,

recommends

- 1 that broadcasters wishing to introduce the transmission of supplementary information for station and programme identification in FM broadcasting and other applications, should use the radio-data system (RDS), as specified in Annex 1;
- 2 the following notes should be considered as part of the Recommendation.

NOTE 1 – Information regarding the operational characteristics of RDS is given in Annex 2.

NOTE 2 – The most recent version of the international RDS standard is IEC 62106 (2018 and later, all parts). In North America although the structure and coding is identical, there are minor differences in implementation of certain features. RDS in North America is called RBDS, specified in IEC 62106-9.

* This Recommendation should be brought to the attention of the International Electrotechnical Commission (IEC).

NOTE 3 – Since RDS was first specified by the European Broadcasting Union (EBU) in 1984. Billions of RDS receivers were and are still produced worldwide with retail prices held very low due to RDS decoder silicon embedded in FM receiver chips and software defined radio technology costing very little in large quantities.

Annex 1

Specifications of the radio data system*

1 Modulation of the data channel

1.1 Basic sub-carrier frequency (mandatory): 57 kHz, locked in phase or in quadrature to the third harmonic of the pilot tone 19 kHz (± 2 Hz) in the case of stereophony. (Frequency tolerance: ± 6 Hz.)

1.2 Three additional sub-carriers (optional): 66.5 kHz, 71.25 kHz and 76.0 kHz, phase locked to the basic sub-carrier 57 kHz.¹

1.3 Sub-carrier level: the recommended nominal deviation of the main FM carrier due to each modulated sub-carrier is ± 2 kHz. However, in practice for the basic sub-carrier it can be as low as ± 1.2 kHz; many EBU broadcasters with wide dynamic range (e.g. classical music) services prefer this lower value to ensure best signal-to-noise performance. The decoder should, however, be designed to work with sub-carrier levels corresponding to between ± 1 kHz and ± 7.5 kHz deviation.

The peak frequency deviations of the additional data streams on the upper sub-carriers need to be optimised. Since the amplitude of the RDS2 data stream increases with the peak frequency deviation, a larger deviation would imply better BER performance. However, larger deviations would increase the multiplex signal bandwidth (and consequently the FM signal bandwidth), which is constrained by Recommendation ITU-R BS.450. Therefore, a trade-off is necessary to optimise the peak frequency deviations of the RDS2 data streams subject to the bandwidth constraint.

1.4 Method of modulation: the sub-carriers are amplitude-modulated by the shaped and biphase-coded data signal. The sub-carrier is suppressed (see Figs 1a to 1c for the basic sub-carrier).

1.5 Clock frequency and data rate: the basic clock frequency is obtained by dividing the transmitted sub-carrier frequency by 48. Consequently, the basic data rate is 1 187.5 bit/s ± 0.125 bit/s.

1.6 Differential coding: when the input data-level from the coder at the transmitter is 0, the output remains unchanged from the previous output bit, and when an input 1 occurs, the new output bit is the complement of the previous output bit.

* The characteristics published here are only a summary drawn from a more detailed text which is published separately as the IEC 62106 standard.

¹ The phase lock requirements are detailed in IEC 62106-1. They are needed to facilitate the demodulation using DSP technology. The symbol shifting used reduces the peak deviation of the RDS2 data signal by an amount of 25%.