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European Standard (Telecommunications series)

Digital Audio Broadcasting (DAB); VHF/FM Broadcasting: cross-referencing to simulcast DAB services by RDS-ODA 147

European Broadcasting Union   Union Européenne de Radio-Télévision

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DAB
Digital Audio Broadcasting

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Foreword

This European Standard (Telecommunications series) has been produced by Joint Technical Committee (JTC) Broadcast of the European Broadcasting Union (EBU), Comité Européen de Normalisation ELECtrotechnique (CENELEC) and the European Telecommunications Standards Institute (ETSI).

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NOTE 1: The EBU/ETSI JTC Broadcast was established in 1990 to co-ordinate the drafting of standards in the specific field of broadcasting and related fields. Since 1995 the JTC Broadcast became a tripartite body by including in the Memorandum of Understanding also CENELEC, which is responsible for the standardization of radio and television receivers. The EBU is a professional association of broadcasting organizations whose work includes the co-ordination of its members' activities in the technical, legal, programme-making and programme-exchange domains. The EBU has active members in about 60 countries in the European broadcasting area; its headquarters is in Geneva.

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EUREKA Project 147

EUREKA Project 147 was established in 1987, with funding from the EC, to develop a system for the broadcasting of audio and data to fixed, portable or mobile receivers. Their work resulted in the publication of a European Standard, EN 300 401 [1], for DAB (note 2) which now has world-wide acceptance. The members of the Eureka 147 Project are drawn from broadcasting organizations and telecommunication providers together with companies from the professional and consumer electronics industry.

NOTE 2: DAB is a registered trademark owned by one of the EUREKA 147 partners.

1 Scope

The present document establishes a standard method for signalling DAB service information to a receiver tuned to an FM-RDS service. The RDS Open Data Application (RDS-ODA) system is used EN 50067 [2].

The present document is applicable to FM radio broadcasts that carry RDS signalling. It describes the characteristics of an RDS-ODA for providing frequency information for DAB ensembles EN 300 401 [1]. Additionally the ODA can signal various service information attributes of DAB services. This is analogous to the EON function EN 50067 [2] for other services carried on FM.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies.

- A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] ETSI EN 300 401: "Radio Broadcasting Systems; Digital Audio Broadcasting (DAB) to mobile, portable and fixed receivers".

[2] EN 50067: "Specification of the radio data system (RDS) for VHF/FM sound broadcasting in the frequency range from 87,5 MHz to 108,0 MHz".

3 Definitions, abbreviations and terminology

3.1 Definitions

For the purposes of the present document, the terms and definitions given in EN 300 401 [1] and EN 50067 [2] and the following apply:

ensemble: DAB transmitted signal containing programme and data services

Ensemble Identifier (EId): unique 16-bit code, allocated to an ensemble and intended to allow unambiguous world-wide identification of that ensemble

ensemble table: application data that provides information about DAB ensembles

group type code: 4-bit code that specifies the application of an RDS group

Programme Identification (PI): 16-bit code used to identify an RDS programme (service)

service: user selectable output of the receiver

Service Identifier (SId): 16- or 32- bit code used to identify a particular DAB service. For the purposes of the present document all SIds are 16-bit codes

service table: application data that provides information about DAB services

transmission mode: specific set of transmission parameters (e.g. number of carriers, OFDM symbol duration). Four transmission modes (i.e. I, II, III and IV) are defined to allow the DAB system to be used in different network configuration and a range of operating frequencies

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in EN 300 401 [1] and the following apply:

AID	Application IDentification
DAB	Digital Audio Broadcasting
E/S	Ensemble/Service
EId	Ensemble Identifier
EON	Enhanced Other Networks
EWS	Emergency Warning System
FIG	Fast Information Group
FM	Frequency Modulation
IH	In House
ILS	International Linkage Set indicator
LA	Linkage Actuator
LSN	Linkage Set Number
ODA	Open Data Application
PI	Programme Identification
PTY	Programme TYpe
RDS	Radio Data System
RP	Radio Paging
S/H	Soft/Hard
SId	Service Identifier
TDC	Transparent Data Channel
TMC	Traffic Message Channel
TP	Traffic Programme

3.3 Reserved bits

In some fields, unused bits may be found. These are designated as:

Rfa: Reserved for future addition. The future use of Rfa bits shall not modify the usage of other bits in the same field as the Rfa bits.

Rfu: Reserved for future use. The future use of Rfu bits can modify the usage of other bits in the same field as the Rfu bits.

Unless otherwise specified, the values of bits designated as either Rfa or Rfu shall be set to zero.

4 Overview of the service referencing ODA definition

4.1 Introduction

DAB services are being broadcast in many countries and some of these services are simulcasts of existing FM services, usually with RDS. However it is likely to be a number of years before DAB coverage equals that of FM. DAB provides superior quality reception over FM, and consequently should be the preferred choice for listening where available. Receivers able to receive both DAB and FM services should therefore present the listener with the DAB service where present, but can fall back to the FM service outside the DAB coverage area. DAB provides the signalling, through the service following information in the Fast Information Channel, to enable a receiver to find the equivalent service on FM. The present document describes the way that DAB service information can be provided from FM-RDS by using an Open Data Application (ODA) thus allowing a receiver to find an equivalent DAB service.

For FM (and AM) broadcasts, services are carried on one or a number of frequencies. The RDS system EN 50067 [2] allows a service provider to send all the frequencies the service is available on to receivers. A receiver can build up a list of alternate frequencies which allow it, when mobile, to find the best frequency for that service. The RDS system also allows other service information to be provided, and, through the Enhanced Other Networks (EON) feature, this can be extended to other services.

For DAB broadcasts, the situation is slightly different in that services are carried within ensembles. A given service may be carried in one or a number of ensembles and each ensemble may be carried on one or a number of frequencies.

The ODA defined in the present document allows a service provider to signal frequency and transmission mode information about DAB ensembles and linkage information and ensemble information about DAB services. This information can be used by a receiver to perform service following from FM-RDS to DAB. The minimum information required is provided by the ensemble table. Additional information can be signalled using the service table.

4.2   ODA description

The ODA is specified such that each received RDS group contains a complete information entity. The data contained is usable directly without reference to any other group. The ODA uses a type A group and therefore there are 37 bits available for coding. One bit is used to differentiate between data for the ensemble table and data for the service table.

4.2.1   Ensemble table

The ensemble table contains the basic information required for service following. It signals the Ensemble Identifier (EId), the DAB transmission mode, and the frequency of the ensemble. The service provider shall signal every transmission mode and frequency for an ensemble before sending the modes and frequencies for the next ensemble.

Reception of the ensemble table does not mean that the tuned RDS service is carried on that ensemble. The purpose of the ensemble table is to allow the receiver to build up information about DAB ensembles. To locate an equivalent DAB service for service following requires that the receiver tune to each ensemble and inspect the service linking information (either signalled or implicit). This task can be simplified by using the service table also.

4.2.2   Service table

The service table provides additional information about services available on DAB. 16 variants are available, of which two are presently defined. These are used to provide the list of ensembles that a DAB service is available on, and to provide linkage information for a DAB service. The service provider shall signal every ensemble that a service is carried in before signalling the other attributes for that service. Once all the information is signalled for one service, the information for the next service may be signalled, and so on.

5   Definition of the ODA

5.1   Introduction

The presence of an ODA channel and its application identifier (AID) are signalled using RDS group type 3A EN 50067 [2]. The actual group that is used to convey the application data is also signalled by this group, since a number of ODA channels may be present in the RDS stream for a given service. The groups allowed to convey ODAs are given in EN 50067 [2].

The present document specifies an ODA which operates in mode 1.1 EN 50067 [2] (i.e. it uses type A groups only). It has the AID 147 (decimal), 0093 (hexadecimal).

The definition of the field values for the type 3A group is given in subclause 5.2. The definition of the ODA group is given in subclause 5.3.

Further information on the use of ODAs is described in the RDS specification EN 50067 [2].

5.2   ODA channel definition

Figure 1 gives the format and field value definition for the type 3A group to indicate the presence of the service referencing ODA.
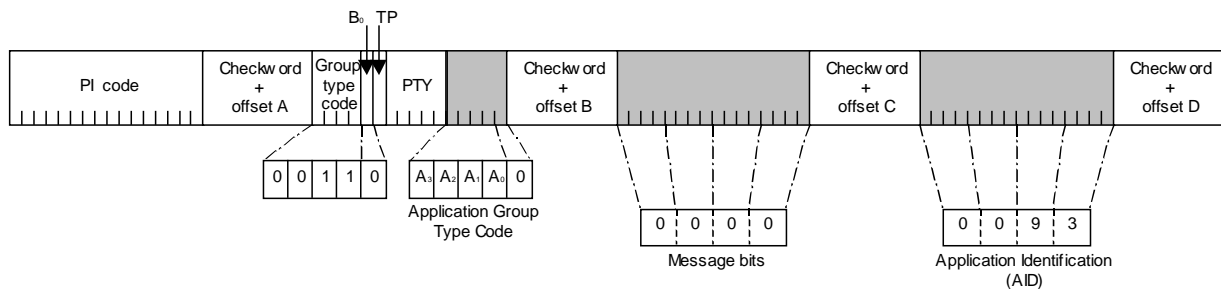

Figure 1: Structure of type 3A group for AID = 147 (0093 hexadecimal)

5.2.1   Application Group Type Code field

This 5-bit field shall indicate the group used, in a **particular** transmission, to carry the application data. The ODA uses a type A group. Table 1 specifies the permitted group types.

Table 1: ODA group availability

Group type	Application group type code field	Availability for this ODA
5A	01010	Available when not used for TDC
6A	01100	Available when not used for IH
7A	01110	Available when not used for RP
8A	10000	Available when not used for TMC
9A	10010	Available when not used for EWS
11A	10110	Available unconditionally
12A	11000	Available unconditionally
13A	11010	Available when not used for RP

5.2.2   Message bits field

This 16-bit field shall be reserved for future addition and shall be set to the value 0000 (hexadecimal) until they are defined.

5.2.3   Application Identification (AID) field

This 16-bit field shall indicate the application. It shall be set to the value 0093 (hexadecimal).

5.3   ODA group definition

Figure 2 shows the format of the ODA group for AID = 147 (0093 hexadecimal).
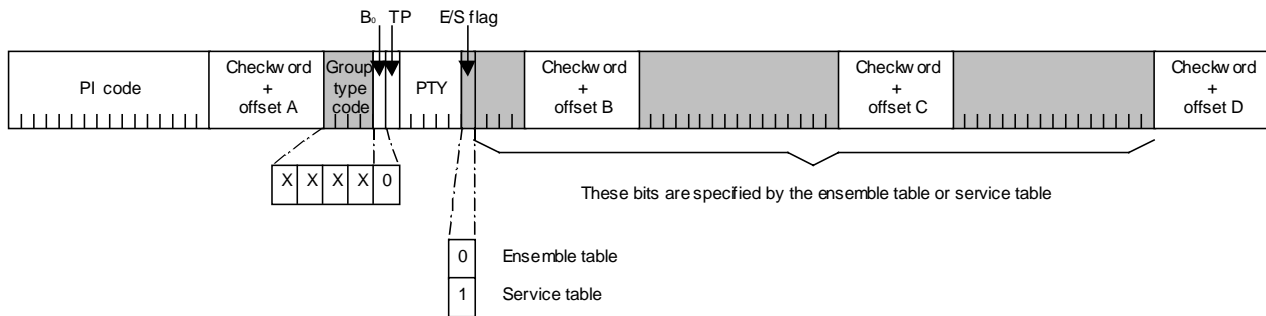
Figure 2: ODA group format for AID = 147 (0093 hexadecimal)

5.3.1   Group type code field

This 5-bit field shall contain the group type code indicated in the type 3A group application group type code field.

5.3.2   E/S flag

This 1-bit field shall indicate whether the remaining information bits provide data for the ensemble table or service table as follows:

 0:     data is for the ensemble table. The format is given in subclause 5.3.3.
 1:     data is for the service table. The format is given in subclause 5.3.4.

5.3.3   Ensemble table definition

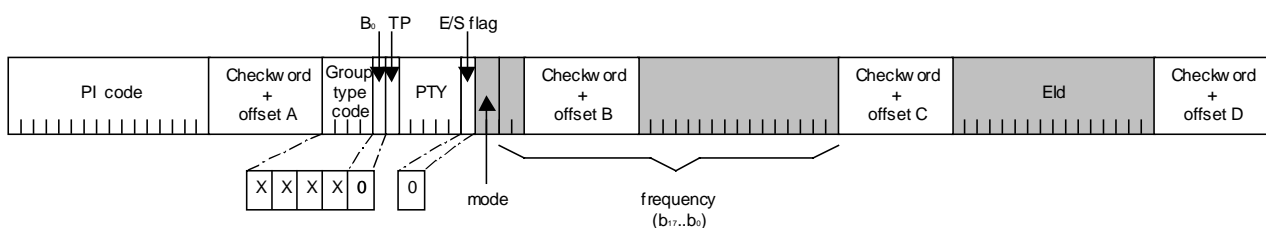Figure 3 gives the format of the ensemble table version.

Figure 3: Ensemble table format

5.3.3.1   Mode field

This 2 bit field shall specify the DAB transmission mode as follows:

 00:     mode is unspecified
 01:     mode I
 10:     mode II or mode III
 11:     mode IV

5.3.3.2   Frequency field

This 18-bit field, coded as an unsigned binary number, shall specify the DAB ensemble centre carrier frequency. It is defined in the same way as for the frequency information in FIG 0/21 in DAB (see EN 300 401 [1], subclause 8.1.8) but since only 18 bits are available the frequency range possible is from 16 kHz to 4 194 288 kHz.

5.3.3.3   EId field

This 16-bit field shall specify the Ensemble Identifier to which the transmission mode and frequency apply.

5.3.4 Service table definition

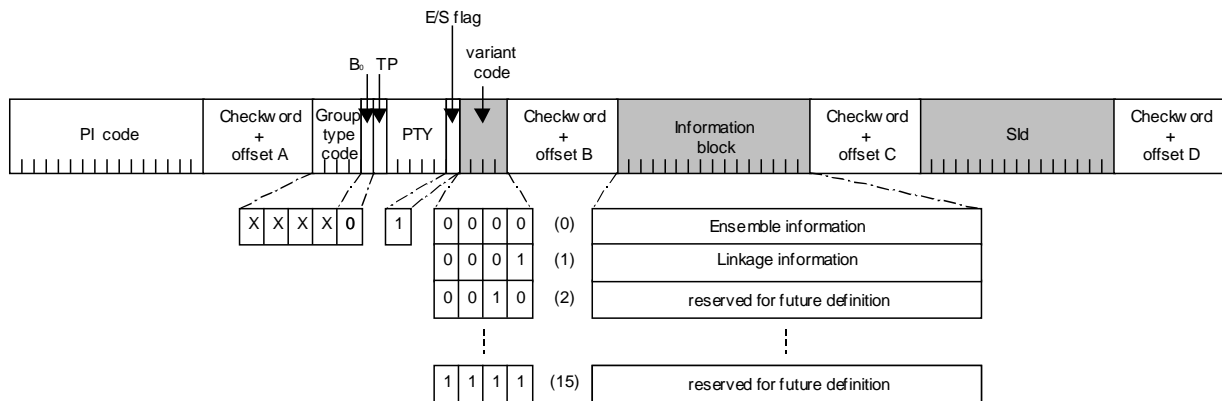Figure 4 gives the format of the service table version.

Figure 4: Service table format

5.3.4.1 Variant code field

This 4-bit field, coded as an unsigned binary number, shall specify the service table variant. At present only two variants are defined; variant 0 is used for ensemble information and variant 1 is used for linkage information. The other variants are reserved for future definition.

5.3.4.2 Information block

This 16 bit field shall contain information related to the DAB service. The interpretation of the field is dependant upon the value of the variant code field.

5.3.4.2.1 Variant 0: Ensemble information

The information block shall contain the Ensemble Identifier (EId) code.

5.3.4.2.2 Variant 1: Linkage information

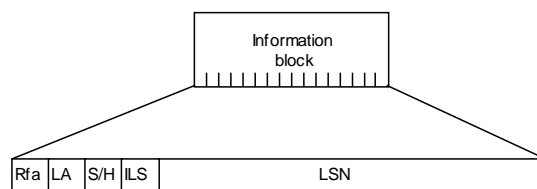The information block contains five fields, as shown in figure 5.

Figure 5: Variant 1: Linkage information definition

The following definitions apply:

Rfa: this 1 bit field shall be reserved for future addition. It shall be set to zero until it is defined.

LA (Linkage Actuator): this 1-bit flag shall indicate whether the link is active or inactive (potential), as follows:

    0:                  potential future link or de-activated link
    1:                  active link

S/H (Soft/Hard): this 1-bit flag shall indicate whether the link is soft or hard, as follows:

    0:                  Soft link (related services)
    1:                  Hard link (services carrying the same primary service component)

ILS (International Linkage Set indicator): this 1-bit flag shall indicate whether the link affects only one country (national) or several countries (international), as follows:

    0:                  national link
    1:                  international link

LSN (Linkage Set Number): this 12-bit field represents a number which shall be common to all services linked together as a set. The use of LSN = "0000 0000 0000" is reserved.

For an international link, the LSN shall be structured according to the RDS specification EN 50067 [2].

5.3.4.3   SId field

This 16-bit field shall specify the DAB Service Identifier (SId) to which the information block data applies.

6   Operational requirements

To provide information to receivers about services carried on DAB, a service provider shall open an ODA channel for Application Identifier 147 by transmitting two type 3A groups per minute. This action shall indicate to the receiver which application decoder is required and which group type is being used for carrying the application data.

All the application data shall be transmitted within two minutes. It is envisaged that up to two groups per second may be required to transmit all the application data if a service provider has many services carried on DAB in many ensembles that he wishes to inform receivers of.

Two separate data carousels are used to transmit the data - one for the ensemble table and one for the service table. Data from each carousel can be interleaved, but data shall be transmitted in sequence within each carousel. This means that the service provider may choose to send all the ensemble table information and then all the service table information, or he may choose to send part of the ensemble table information and then part of the service table information. Whichever order the data is transmitted in, it shall be complete within two minutes.

Application data from the ensemble table shall be transmitted such that all data for one ensemble shall be broadcast before data for the next ensemble is broadcast.

Application data from the service table shall be transmitted such that all data for one service shall be broadcast before data for the next service is broadcast. Furthermore, all ensemble information (carried in variant 0) relating to one service shall be broadcast before other data (carried in other variants) relating to that service is broadcast.

For service following, it is recommended that the receiver shall use the linkage information provided via RDS for the FM service and via DAB for the DAB service to link between equivalent services. This means only the ensemble table needs to be transmitted. However, single-front end receivers have to use the linkage information provided via RDS for both the FM and the DAB service, and therefore both the ensemble table and the service table information should be transmitted. The linkage information is either explicitly provided by RDS type 14A groups and DAB FIG 0/6 or implicitly when the RDS PI code and DAB SId are identical. Services are linked when the linkage actuator (LA) flag is set to one on both the currently tuned service and the possible alternate service (or when the PI code and SId are identical).

The service table information allows a receiver to get information via the RDS-ODA rather than having to examine each DAB ensemble for FIC information. Variant 0 allows the receiver to build up a list of ensemble identifiers that a service is available on, and variant 1 allows the linkage information for that (DAB) service to be stored.

The transmission of the service table information is recommended. When the service table is transmitted, both variant 0 and variant 1 information shall be broadcast.

Annex A (normative):
ODA Registration Document

RDS Open Data Application - Registration
reference:
CENELEC EN 50067:1998, Annex L

Original Issue Date: 7 December 1998

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Application Name:	**Cross referencing DAB within RDS**
Application Description:	This Application is intended to provide RDS cross referencing of FM services simulcast in DAB transmissions, to allow a dual standard receiver to continue delivering service. It is described in the specification references cited below.
Open Data mode:	1.1

Specification References:	"Cross-referencing DAB within RDS - Final Version" (also RDS Forum Namur Temp 002, 16.11.98)	Publication is permitted
Capacity requirements:	a) 2 (two) ODA groups per second b) 2 (two) type 3A group per minute	Publication is permitted

Application ID:	decimal 147 / hex 0093 / bin 0000 0000 1001 0011

Notes:

1. Transmissions carrying this AID *must* adhere fully to the specifications/provisions of the above references.

2. All transmissions must conform to CENELEC EN 50067:1998, dated April 1998, Specification of the radio data system (RDS).

3. *Users of this AID must satisfy themselves as to the validity of using it and the accuracy of all related information and must accept all due consequence. The RDS Registrations Office is not liable for any incidental, special or consequential damages arising out of the use or inability to use this AID, whether in transmission or reception equipment.*

An extract of this information will be published on the RDS Forum Web site, (URL: www.rds.org.uk), in due course.

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History

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