ETSI TS 102 427 V1.1.1 (2005-07)

Technical Specification

Digital Audio Broadcasting (DAB); Data Broadcasting - MPEG-2 TS streaming

European Broadcasting Union Union Européenne de Radio-Télévision

EBU·UER

Reference

DTS/JTC-DAB-40

Keywords

audio, broadcasting, DAB, digital, MPEG

ETSI

650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
Sous-Préfecture de Grasse (06) N° 7803/88

Contents

Intellectual Property Rights

IPRs essential or potentially essential to the present document may have been declared to ETSI. The information pertaining to these essential IPRs, if any, is publicly available for **ETSI members and non-members**, and can be found in ETSI SR 000 314: *"Intellectual Property Rights (IPRs); Essential, or potentially Essential, IPRs notified to ETSI in respect of ETSI standards"*, which is available from the ETSI Secretariat. Latest updates are available on the ETSI Web server (http://webapp.etsi.org/IPR/home.asp).

Pursuant to the ETSI IPR Policy, no investigation, including IPR searches, has been carried out by ETSI. No guarantee can be given as to the existence of other IPRs not referenced in ETSI SR 000 314 (or the updates on the ETSI Web server) which are, or may be, or may become, essential to the present document.

Foreword

This Technical Specification (TS) 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).

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, program-making and program-exchange domains. The EBU has active members in about 60 countries in the European broadcasting area; its headquarters is in Geneva.

European Broadcasting Union
CH-1218 GRAND SACONNEX (Geneva)
Switzerland
Tel: +41 22 717 21 11
Fax: +41 22 717 24 81

The Eureka Project 147 was established in 1987, with funding from the European Commission, to develop a system for the broadcasting of audio and data to fixed, portable or mobile receivers. Their work resulted in the publication of European Standard, EN 300 401 [1], for DAB (see note) which now has worldwide acceptance. The members of the Eureka Project 147 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 Project 147 partners.

1 Scope

The present document specifies how MPEG-2 Transport Stream can be encapsulated within a DAB MSC stream data sub-channel including additional error protection. The error protection mechanism is composed of a Reed-Solomon coder and an interleaver.

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 and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at http://docbox.etsi.org/Reference.

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

[2] ETSI EN 300 744: "Digital Video Broadcasting (DVB); Framing structure, channel coding and modulation for digital terrestrial television".

[3] ISO/IEC 13818 (Parts 1 to 3): "Information technology - Generic coding of moving pictures and associated audio information".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following definition applies:

Transport stream (TS) multiplexer: device that combines multiple elementary streams into a Transport Stream (TS) for delivery through a single transmission path (see ISO/IEC 13818 [3])

3.2 Abbreviations

For the purposes of the present document, the following abbreviation applies:

DAB Digital Audio Broadcasting

4 Introduction

The DAB system EN 300 401 [1] defines the way that audio (programme) and data services may be carried. However, in MSC stream mode, the error protection scheme is optimised for audio services. Data services carried in stream mode (for example video services) require additional error protection and this can be achieved by applying an outer coding to the data packets before insertion into a DAB MSC stream mode sub-channel. In order to provide as much commonality in transmission and reception equipment as possible, the outer coding is taken directly from DVB-T EN 300 744 [2], which also needs to provide appropriate error protection.

The system is defined as a functional block that performs the addition of outer coding (Reed-Solomon code) and outer interleaving (convolutional interleaving). This functional block sits between the output of the MPEG-2 transport multiplexer and the input to a stream sub-channel of a DAB multiplexer, see figure 1.

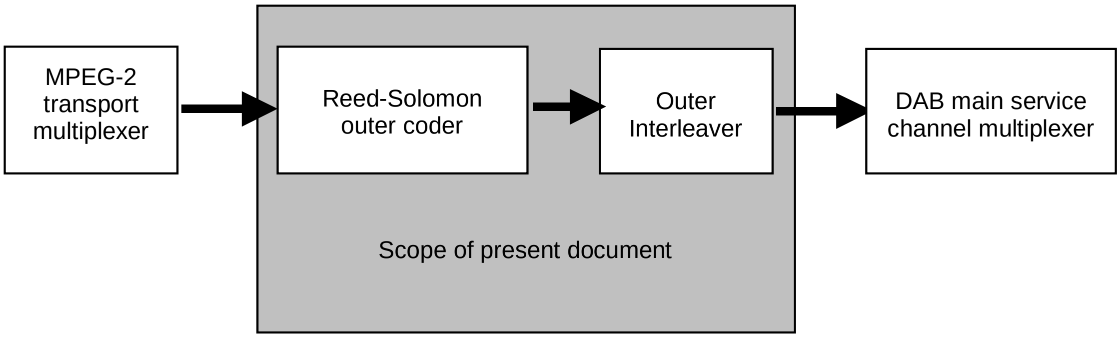

Figure 1: Conceptual diagram of the outer coder and interleaver

The process is identical to that specified in EN 300 744 [2] clause 4.3.2.

NOTE: No energy dispersal scrambling is performed because this is provided by the DAB system; therefore no inverted SYNC bytes are required.

5 Error Protection for DAB MSC stream data sub-channels and transport packets of 188 bytes

5.1 General considerations

Each input transport packet is 188 bytes long and starts with a synchronizing byte of value 0x47. The transport packet may contain any data. See ISO/IEC 13818 [3] for more details of the format of transport packets.

5.2 Outer Coding

The outer coding and interleaving shall be performed on the input transport packet (see figure 2).

Figure 2: Input transport packet

Reed-Solomon RS (204,188, t = 8) shortened code (see note), derived from the original systematic RS (255,239, t = 8) code, shall be applied to each transport packet (188 bytes) to generate an error protected packet (see figure 3). Reed-Solomon coding shall also be applied to the packet synchronizing byte (i.e. 0x47).

NOTE: The Reed-Solomon code has length 204 bytes, dimension 188 bytes and allows the correction of up to 8 random erroneous bytes in a received word of 204 bytes.

Code Generator Polynomial: $g(x) = (x+\lambda^0)(x+\lambda^1)(x+\lambda^2)...(x+\lambda^{15})$, where $\lambda = 2$.

Field Generator Polynomial: $p(x) = x^8 + x^4 + x^3 + x^2 + 1$.

The shortened Reed-Solomon code may be implemented by adding 51 bytes, all set to zero, before the information bytes at the input of an RS (255,239, t = 8) encoder. After the RS coding procedure these null bytes shall be discarded, leading to a RS code word of N = 204 bytes.

204 bytes

Sync byte 0x47	MPEG-2 transport stream data (187 bytes)	parity word (16 bytes)

Figure 3: Error protected packet

5.3 Outer Interleaver

The convolutional byte-wise interleaver shall be based on the Forney approach with the interleaving depth I = 12 bytes as shown in figure 4.

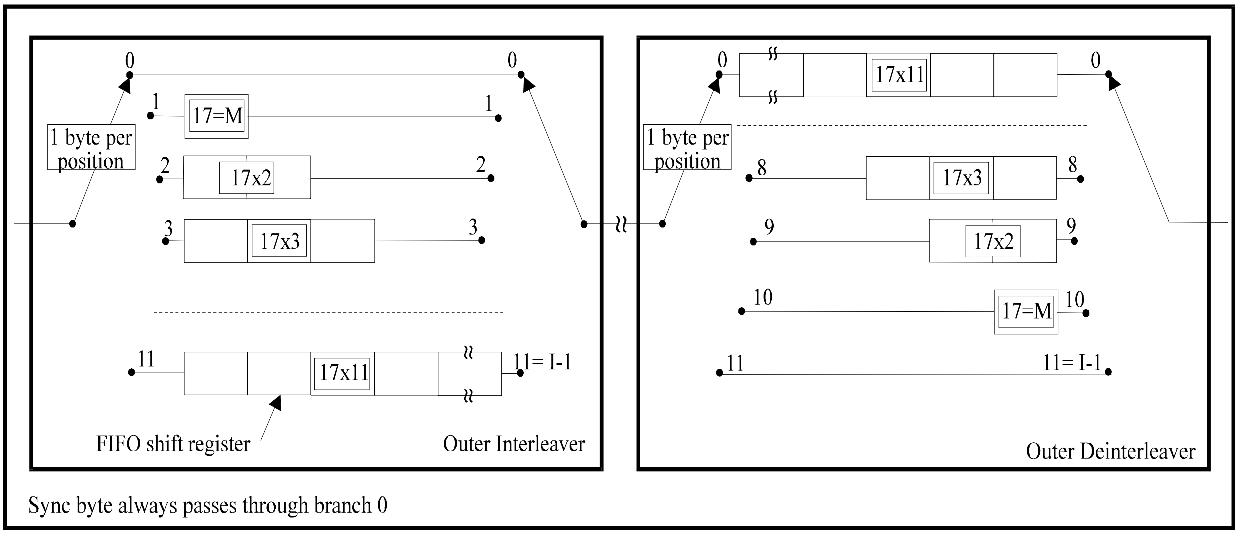

Figure 4: Conceptual diagram of the outer interleaver and deinterleaver

Following the conceptual scheme of figure 4, convolutional byte-wise interleaving with depth I = 12 shall be applied to the error protected packets. This results in the interleaved data structure (see figure 5).

The convolutional interleaving process shall be based on the Forney approach, which is compatible with the Ramsey type III approach, with I = 12.

The interleaver may be composed of I = 12 branches, cyclically connected to the input byte-stream by the input switch. Each branch j shall be a First-In, First-Out (FIFO) shift register, with depth $j \cdot M$ cells where $M = 17 = N/I$, $N = 204$. The cells of the FIFO shall contain 1 byte and the input and output switches shall be synchronized.

For synchronization purposes, the SYNC bytes shall always be routed in the branch "0" of the interleaver (corresponding to a null delay).

NOTE: The deinterleaver is similar in principle to the interleaver, but the branch indices are reversed (i.e. j = 0 corresponds to the largest delay). The deinterleaver synchronization can be carried out by routing the first recognized sync byte in the "0".

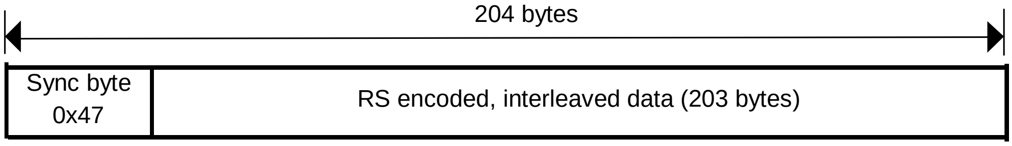

Figure 5: Interleaved packet

5.4 Transmission

The interleaved packets are inserted into the MSC stream mode data sub-channel. The use of the outer coding and interleaving scheme is specified by the user application. No additional signalling is required.

History

Document history		
V1.1.1	July 2005	Publication