ETSI TS 102 371 V3.1.1 (2015-01)

Digital Audio Broadcasting (DAB); Digital Radio Mondiale (DRM); Transportation and Binary Encoding Specification for Service and Programme Information (SPI)

European Broadcasting Union
Union Européenne de Radio-Télévision
EBU·UER
DAB Digital Audio Broadcasting

Reference

RTS/JTC-DAB-74

Keywords

audio, broadcasting, DAB, DRM, digital, EPG

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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, 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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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, ETSI EN 300 401 [3], for DAB (see note 2) 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.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**may not**", "**need**", "**need not**", "**will**", "**will not**", "**can**" and "**cannot**" are to be interpreted as described in clause 3.2 of the ETSI Drafting Rules (Verbal forms for the expression of provisions).

"**must**" and "**must not**" are **NOT** allowed in ETSI deliverables except when used in direct citation.

Introduction

The present document defines how the SPI data will be transported, compressed and profiled such that a good user experience can be achieved using limited broadcast capacity. Using a combination of SPI profiles it is possible that a range of features could be supported in devices, including:

- Navigation and selection of services and programmes.
- The display of schedules at varying levels of detail for programmes from a range of services.
- The display of schedules, with programmes and events ordered into particular groups.
- Searching through current, future and past programme listings, including on-demand content (Filecast).
- Timed recording of individual programmes, or of groups of programmes and themed or similar programming.

The present document is compatible with the hybrid digital radio SPI, ETSI TS 102 818 (V3.1.1 or later) [1].

1 Scope

The present document defines how the XML schema data model for Service and Programme Information (SPI) (ETSI TS 102 818 [1]) should be compressed, profiled and broadcast. Within the present document the term "DAB" is used to refer to the Digital Audio Broadcasting standard (ETSI EN 300 401 [3]) and "DRM" is used to refer to the Digital Radio Mondiale standard (ETSI ES 201 980 [6]).

In respect to previous versions of the present document, hybrid radio provisions have been added to allow a seamless experience for users when consuming radio services delivered by digital radio broadcasting systems (DAB, DRM) or IP or a combination of both. The use of the present document allows content to be created once by the service provider for delivery by both mechanisms and allows manufacturers to implement devices with many common elements.

2 References

2.1 Normative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

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

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The following referenced documents are necessary for the application of the present document.

[1] ETSI TS 102 818 (V3.1.1 or later): "Hybrid Digital Radio (DAB, DRM, RadioDNS); XML Specification for Service and Programme Information (SPI)".

[2] ETSI EN 301 234: "Digital Audio Broadcasting (DAB); Multimedia Object Transfer (MOT) Protocol".

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

[4] ISO/IEC 10646: "Information technology - Universal Multiple-Octet Coded Character Set (UCS)".

[5] ETSI TS 101 756: "Digital Audio Broadcasting (DAB); Registered Tables".

[6] ETSI ES 201 980: "Digital Radio Mondiale (DRM); System specification".

[7] ETSI TS 101 968: "Digital Radio Mondiale (DRM); Data applications directory".

2.2 Informative references

References are either specific (identified by date of publication and/or edition number or version number) or non-specific. For specific references, only the cited version applies. For non-specific references, the latest version of the reference document (including any amendments) applies.

NOTE: While any hyperlinks included in this clause were valid at the time of publication, ETSI cannot guarantee their long term validity.

The following referenced documents are not necessary for the application of the present document but they assist the user with regard to a particular subject area.

[i.1] ETSI TS 102 371 (V1.3.1): "Digital Audio Broadcasting (DAB); Digital Radio Mondiale (DRM); Transportation and Binary Encoding Specification for Electronic Programme Guide (EPG)".

[i.2] ETSI TS 102 818 (V1.5.1): "Digital Audio Broadcasting (DAB); Digital Radio Mondiale (DRM); XML Specification for Electronic Programme Guide (EPG)".

[i.3] ETSI TS 103 177: "Digital Audio Broadcasting (DAB); Filecasting; User application specification".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

delivery system: broadcast system, either DAB or DRM, used to deliver the SPI service

Ensemble Identifier (EId): unique 16-bit code, allocated to a DAB ensemble and intended to allow unambiguous worldwide identification of that ensemble

entity reference: group of characters used in text strings as a substitute for a single specific character, e.g. &amp

Filecast Channel: data service component containing media files according to [i.3]

Programme Associated Data (PAD): information that is related to the audio data in terms of contents and synchronization

service: "radio station" such as BBC Radio 4 or Heart

Service Identifier (SId): 16-bit, 24-bit or 32-bit code used to identify a particular service

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

CA	Conditional Access
CDATA	Character DATA
CRID	Content Reference ID
CS	Classification Scheme
DAB	Digital Audio Broadcasting
DRM	Digital Radio Mondiale
ECC	Extended Country Code
EId	Ensemble Identifier
EPG	Electronic Programme Guide
FAC	Fast Access Channel
FIG	Fast Information Group
GCC	Global Country Code
GI	Group Information
GZIP	GnuZIP
IP	Internet Protocol
ISO	International Organization for Standardization
LTO	Local Time Offset
MIME	Multipurpose Internet Mail Extensions
MJD	Modified Julian Date
MOT	Multimedia Object Transfer
PAD	Programme Associated Data
PI	Programme Information
Rfa	Reserved for future addition
Rfu	Reserved for future use
SCIdS	Service Component Identifier within the Service
SDC	Service Description Channel
SI	Service Information
SId	Service Identifier

SPI	Service and Programme Information
UA	User Application
UTC	Co-ordinated Universal Time
UTF	Unicode Transformation Format
XML	eXtensible Markup Language
X-PAD	eXtended - Programme Associated Data

4 Encoding

4.0 Introduction

The present document provides a method to encode raw SPI XML data, generated as per the hybrid radio SPI XML specification ETSI TS 102 818 [1], into a compact binary format to be broadcast using the MOT protocol [2] using the DAB [3] or DRM [4] systems.

The hybrid SPI XML contains elements and attributes that are not relevant for broadcast use and consequently these are not binary encoded. Similarly, it also represents the data in a slightly modified form to the broadcast only version [i.2] and in order to generate backwards compatible binary that permits devices equipped with an EPG decoder based on the broadcast only version of this specification [i.1] to continue to decode correctly, some additional steps are required to generate the binary.

In the present document the term "delivery system" is used to indicate whether the SPI service is delivered over DAB or DRM. This parameter is used in the encoding of several elements and attributes, but is not itself encoded. Therefore, decoders need to know which system delivered the binary data in order to correctly decode it.

The binary encoding described here uses a tag-length-value encoding. Each element or attribute is encoded using a unique tag value, a length value (indicating the length of the data contained within this element or attribute) and the actual data value(s). This enables devices to easily skip elements that are not wanted or were undefined.

Figure 1: Tag-length-value encoding scheme

XML elements are all encoded in these binary structures as described in clause 4.2. Attributes are coded in a similar way (see clause 4.4). The hierarchical nature of the SPI XML is generally preserved in these binary structures, but the structure is not necessarily identical. Various common data types have been assigned efficient binary encodings as described in clause 4.7. For an example of a binary encoded XML object, see annex C.

Note that although the length of certain data types can be worked out from their encoding, there shall still be a length field in the attribute encoding (see clause 4.4).

4.1 Syntax specification

The specifications of syntax that appear in the present document are written using a form of pseudo-code that is similar to the procedural language "C"; this provides for easy specification of loops and conditional data structures. Within these specifications, the type of individual data fields is expressed using the mnemonics given in table 1.

Table 1: Data type mnemonics for syntax specification

Mnemonic	Description
Uimsbf	Unsigned integer, most significant bit first

4.2 Binary objects

The basic binary objects defined by the present document are defined in table 2. Each binary object carries a single top level element and shall be carried within a single MOT object.

Table 2: Structure of a binary object

Syntax	Size	Type

`binary_object() {`
`  top_level_element()`
`}`		

top_level_element: A top level element as defined in clause 4.3.1.

4.3 Elements

4.3.0 General

All elements use basically the same encoding, as defined here.

Table 3: Structure of an element

Syntax	Size	Type
`element() {`		
`  element_tag`	8 bits	uimsbf
`  element_length`	8 bits	uimsbf
`  if (element_length == 0xFE) {`		
`  extended_element_length`	16 bits	uimsbf
`  }`		
`  if (element_length == 0xFF) {`		
`  extended_element_length`	24 bits	uimsbf
`  }`		
`  for (i=0; i<element_length or extended_element_length; i++) {`		
`  element_data_byte`	8 bits	uimsbf
`  }`		
`}`		

element_tag: This byte identifies the element. The tag uniquely identifies the element - i.e. there is a one to one mapping between a tag and an element. If new elements are required in the future then they will use new tag values. The possible values are defined in annex D. Elements with tags that are not defined here are reserved for future use; the tags and their associated content shall not be processed by devices.

element_length: This field indicates the number of data bytes contained in this element, i.e. the number of bytes that follow the length byte up to the end of the element. The range of this is `0x00` to `0xFD` (i.e. 0 to 253). If this value is either `0xFE` or `0xFF` then the additional *extended_element_length* field defines the element length.

extended_element_length: When used, this field indicates the number of data bytes contained in this element, i.e. the number of bytes that follow the last extended length byte up to the end of the element.

element_data_byte: These bytes contain the element's attributes, CDATA (i.e. string data) and child elements. They shall be encoded in the following order:

1) Attributes.
2) Child elements.
3) CDATA content.

4.3.1 Top-level elements

There are two top-level elements defined in the present document; *epg* and *serviceInformation*. A top-level element shall be carried within a binary object (see clause 4.2) and it shall be the only element (apart from its nested children) in that object. The possible values of the *element_tag* for top-level elements are defined in table 4. Top-level elements with tags that are not defined here are reserved for future use; these tags and their associated content shall not be processed by devices.

Table 4: Top-level element tags

Element	Tag
epg	0x02
serviceInformation	0x03

As well as the appropriate elements defined by the SPI XML specification the top-level elements may also, optionally, contain a string token table (see clause 4.9), a default bearerURI (see clause 4.10) and a default language (see clause 4.11). If present, these elements shall be the first elements to occur in the top-level element after the attributes.

A top-level element is encoded in the same way as a normal element (see clause 4.3) with the exception that the *element_data_bytes* shall be encoded in the following order:

1) Attributes.
2) String token table (if present).
3) Default bearerURI (if present).
4) Default language (if present).
5) Child elements.
6) CDATA content.

4.4 Attributes

4.4.0 General

All attributes use basically the same encoding, as defined here.

Table 5: Structure of an attribute

Syntax	Size	Type
`attribute() {`		
`    attribute_tag`	8 bits	uimsbf
`    attribute_length`	8 bits	uimsbf
`    if (attribute_length == 0xFE) {`		
`        extended_attribute_length`	16 bits	uimsbf
`    }`		
`    if (attribute_length == 0xFF) {`		
`        extended_attribute_length`	24 bits	uimsbf
`    }`		
`    for (i=0; i<attribute_length or extended_attribute_length; i++) {`		
`        attribute_data_byte`	8 bits	uimsbf
`    }`		
`}`		

attribute_tag: This byte uniquely identifies the attribute **within the parent element**. The possible values are defined in annex E.

Attributes with tags that are not defined here are reserved for future use and should not be processed by devices.