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Digital Radio Mondiale (DRM); Data applications directory

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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: 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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Introduction

The frequency bands used for broadcasting below 30 MHz are:

- Low Frequency (LF) band - from 148,5 kHz to 283,5 kHz, in ITU Region 1 [1] only;
- Medium Frequency (MF) band - from 526,5 kHz to 1 606,5 kHz, in ITU Regions 1 [1] and 3 [1] and from 525 kHz to 1 705 kHz in ITU Region 2 [1];
- High Frequency (HF) bands - a set of individual broadcasting bands in the frequency range 2,3 MHz to 27 MHz, generally available on a Worldwide basis.

These bands offer unique propagation capabilities that permit the achievement of:

- large coverage areas, whose size and location may be dependent upon the time of day, season of the year or period in the (approximately) 11 year sunspot cycle;
- portable and mobile reception with relatively little impairment caused by the environment surrounding the receiver.

There is thus a desire to continue broadcasting in these bands, perhaps especially in the case of international broadcasting where the HF bands offer the only reception possibilities which do not also involve the use of local repeater stations.

However, broadcasting services in these bands:

- use analogue techniques;
- are subject to limited quality;
- are subject to considerable interference as a result of the long-distance propagation mechanisms which prevail in this part of the frequency spectrum and the large number of users.

As a direct result of the above considerations, there is a desire to effect a transfer to digital transmission and reception techniques in order to provide the increase in quality which is needed to retain listeners who, increasingly, have a wide variety of other programme reception media possibilities, usually already offering higher quality and reliability.

In order to meet the need for a digital transmission system suitable for use in all of the bands below 30 MHz, the Digital Radio Mondiale (DRM) consortium was formed in early 1998. The DRM consortium is a non-profit making body which seeks to develop and promote the use of the DRM system worldwide. Its members include broadcasters, network providers, receiver and transmitter manufacturers and research institutes. More information is available from their website (<http://www.drm.org/>).

1 Scope

The present document gives the data application identifiers needed for Digital Radio Mondiale (DRM) system data applications and provides the references to the associated specifications. It provides details on data application transport and the mappings required to carry application specified for Digital Audio Broadcasting (DAB) in the DRM multiplex.

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 ES 201 980: "Digital Radio Mondiale (DRM); System specification".
- [2] ETSI EN 301 234: "Digital Audio Broadcasting (DAB); Multimedia Object Transfer (MOT) protocol".
- [3] ETSI TS 101 759: "Digital Audio Broadcasting (DAB); Data Broadcasting - Transparent Data Channel".
- [4] ETSI ES 201 735: "Digital Audio Broadcasting (DAB); Internet Protocol (IP) datagram tunnelling".
- [5] ETSI TS 101 756: "Digital Audio Broadcasting (DAB); Registered Tables".

3 Definitions and abbreviations

3.1 Definitions

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

Fast Access Channel (FAC): channel of the multiplex data stream which contains the information that is necessary to find services and begin to decode the multiplex

Main Service Channel (MSC): channel of the multiplex data stream which occupies the major part of the transmission frame and which carries all the digital audio services, together with possible supporting and additional data services

reserved for future addition (rfa): bits with this designation shall be set to zero

NOTE: Receivers shall ignore these bits.

reserved for future use (rfu): bits with this designation shall be set to zero

NOTE: Receivers shall check that these bits are zero in order to determine the valid status of the other fields in the same scope.

Service Description Channel (SDC): channel of the multiplex data stream which gives information to decode the services included in the multiplex

NOTE: The SDC also provides additional information to enable a receiver to find alternative sources of the same data.

3.2 Abbreviations

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

CRC	Cyclic Redundancy Check
DAB	Digital Audio Broadcasting
DRM	Digital Radio Mondiale
FAC	Fast Access Channel
HF	High Frequency
LF	Low Frequency
MF	Medium Frequency
MOT	Multimedia Object Transfer
MSC	Main Service Channel
rfa	reserved for future addition
rfu	reserved for future use
SDC	Service Description Channel
TDC	Transparent Data Channel

4 General

DRM has been designed to provide transport mechanisms for data applications which are complimentary to the audio service(s) carried or which stand alone. For stand alone data services, the FAC contains an application identifier field which allows receivers to scan the frequency bands to find a particular data service. For all data applications, the SDC data entity type 5 - application information - shall be coded according to ES 201 980 [1] and the descriptions provided in the present document.

The DRM multiplex may contain up to four streams in the MSC, each carrying audio or data service information.

Using the SDC data entities type 9 and/or 5, each DRM service can reference:

- one audio stream,
- one data stream (or one data sub-stream if the stream is in packet mode), or
- one audio stream and one data stream (or one data sub-stream) as programme associated data.

4.1 New data applications

As new data applications are defined and standardized, the present document will be revised to reflect those changes. The content of the present document is maintained by the DRM Consortium. Applications for the inclusion of a new data application should be made to the address below:

Digital Radio Mondiale
 DRM Project Office
 Postal Box 360
 CH - 1218 Grand-Saconnex
 Geneva - Switzerland
 Tel: +41 22 717 2718
 Fax: +41 22 747 4718
 E-mail: applications@drm.org

Applications for the inclusion of a new data application shall clearly state the purpose along with all necessary definitions of required fields. Support from other organizations for the request should be cited. The proposal shall be circulated to all members of the DRM consortium for a 30 day comment period. If there are no adverse comments, then the application, as amended by any helpful editorial suggestions will be accepted and published within a further 30 days on the DRM website. If there are adverse comments, then the application will be considered by the DRM Technical Committee at its next plenary meeting following the comment period. The applicant will be given an opportunity to describe their proposal and reasons for it. The decision of the DRM Technical Committee will be final and if the application is accepted, as amended by any helpful editorial suggestions, it will be published within 30 days on the DRM website. The present document will be amended as required via the normal ETSI process.

4.2 FAC Application identifiers

The FAC service information contains a field to indicate the data application identifier. This is to allow a scanning receiver to quickly decide if the application is useful or whether to continue to scan.

The application identifier is only available to stand alone data services, not data applications carried with audio services.

Table 1 provides the interpretation of the application identifier field.

Table 1: Application identifiers

Decimal number	Application identifier
0	application is only signalled in the SDC
1 to 30	reserved for future definition
31	skip indicator
NOTE 1: The value 0 shall be used for proprietary applications.	
NOTE 2: The skip indicator is to allow for engineering test transmissions to be ignored by standard receivers.	

4.3 SDC application information data entity - type 5

The SDC data entities are defined in ES 201 980 [1]. The application information data entity - type 5 - contains various fields for which the interpretations are defined in the present document.

All data services (or data applications for audio services) are described by data entity type 5. Many applications may require additional data to describe them that is specific to that application.

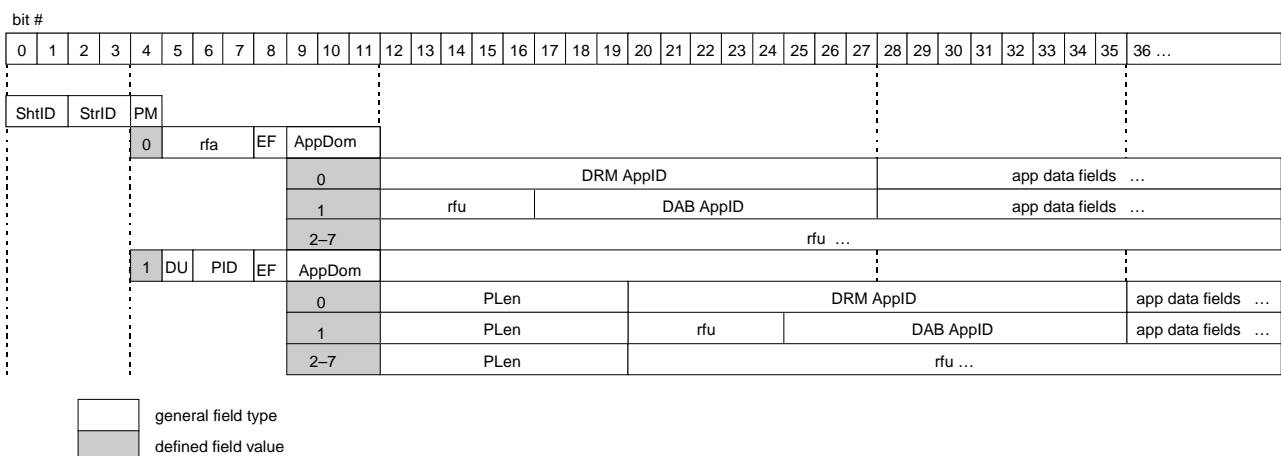


Figure 1: SDC data entity type 5 bit scheme

Figure 1 shows the various combinations for the data entity type 5 fields. The abbreviations used are defined as follows:

ShtID: Short ID
 StrID: Stream ID
 PM: Packet Mode indicator

EF:	Enhancement Flag
DU:	Data Unit indicator
PID:	Packet ID
PLen:	Packet Length
AppDom:	Application Domain
DRM AppID:	user application identifier for DRM specified data Applications
DAB AppID:	user application type for DAB specified data Applications
app data fields:	data fields as required by individual application specification (length depends on application)
rfa/rfu:	fields shall be set to 0

4.3.1 Application domain

The application domain field is a 3-bit field. Table 2 provides the interpretation of the application domain field.

Table 2: Application domains

Decimal number	Application domain
0	DRM
1	DAB
2 to 7	reserved for future definition

4.3.2 Application data

The application data field is a variable length field defined by the application domain and the data application specification.

4.3.2.1 Application domain DRM

When the application domain carries the value 0 (DRM), the application data field shall be made up as follows:

- user application identifier 16 bits
- application data *m* bytes

user application identifier: this field shall indicate the user application identifier as follows:

- The values 0x0000 to 0x7FFF are reserved for openly specified applications.
- The values 0x8000 to 0xFFFF are reserved for proprietary applications.

application data: as required by the corresponding DRM application specification.

4.3.2.2 Application domain DAB

When the application domain carries the value 1 (DAB), the application data field shall be made up as follows:

- rfu 5 bits
- user application type 11 bits
- application data *m* bytes

rfu: these 5 bits shall be reserved for future use by the application data field and shall be set to zero until they are defined.

user application type: the value specified in TS 101 756 [5].

application data: as required by the corresponding DAB application specification.

4.3.2.3 Undefined application domains

When the application domain carries a value other than 0 or 1, the application data field is reserved for future definition.

4.4 Transport protocol signalling

Every data application shall clearly state which of the transport mechanisms shall be used:

- DRM domain applications shall use the mechanisms detailed in clause 5.
- DAB domain applications shall use the mappings provided in clause 6 to the mechanisms detailed in clause 5.

5 DRM data transport

Data essentially comes in two types - streams and objects (files). DRM provides the basic mechanisms to transport these two types of data.

5.1 Streams

Data stream transport has three varieties in DRM:

- synchronous stream mode;
- asynchronous stream mode;
- asynchronous data unit mode.

The **synchronous stream mode** occupies a full DRM data stream. Therefore the bitrate is fixed until a multiplex reconfiguration occurs.

The two **asynchronous modes** allow the transport of streaming data without a fixed bitrate. Whenever new data is available at the transmitting side it will be forwarded to the receiving DRM application decoder.

5.1.1 Synchronous stream mode

In this mode a data stream of fixed bitrate is broadcast. When there is no data to send, the multiplex encoder shall transmit 0 bits.

This mode is signalled by setting the following parameters in SDC data entity type 5 (see ES 201 980 [1]):

- The packet mode indicator is set to 0 to indicate synchronous stream mode.

5.1.2 Asynchronous stream mode

In this mode a data stream of variable bit rate is broadcast.

The benefits of this low level implementation are:

- low overhead;
- low latency;
- simple processing requirements.

This mode is signalled by setting the following parameters in SDC data entity type 5 (see ES 201 980 [1]):

- the Packet mode indicator bit is set to 1 to indicate packet mode;
- the Data unit indicator bit is set to 0 to indicate single packets.

5.1.3 Asynchronous data unit mode

In this mode a data stream of variable bit rate is broadcast.

The benefits of this scheme in comparison to asynchronous stream mode are:

- error control by using data unit repetition;
- the ability to guarantee that "chunks" of data from the stream are delivered to the receiver (or lost) as a coherent set of data.

This mode is signalled by setting the following parameters in SDC data entity type 5 (see ES 201 980 [1]):

- the Packet mode indicator bit is set to 1 to indicate packet mode;
- the Data unit indicator bit is set to 1 to indicate data units.

5.2 Objects (files)

For the standardized transport of objects, DRM uses the DAB MOT protocol EN 301 234 [2]. There is a simple adaptation that is applied which is described below.

5.2.1 MOT - Introduction

The MOT protocol allows finite objects to be carried from the broadcaster to the receiver. It provides reliable and consistent transfer of objects, each up to 256 MBytes in size.

In addition to the payload (e.g. a file), management data can be broadcast: file name, file size, content type, etc.

Figure 2 shows how a MOT data group is built from a given payload, e.g. a file.

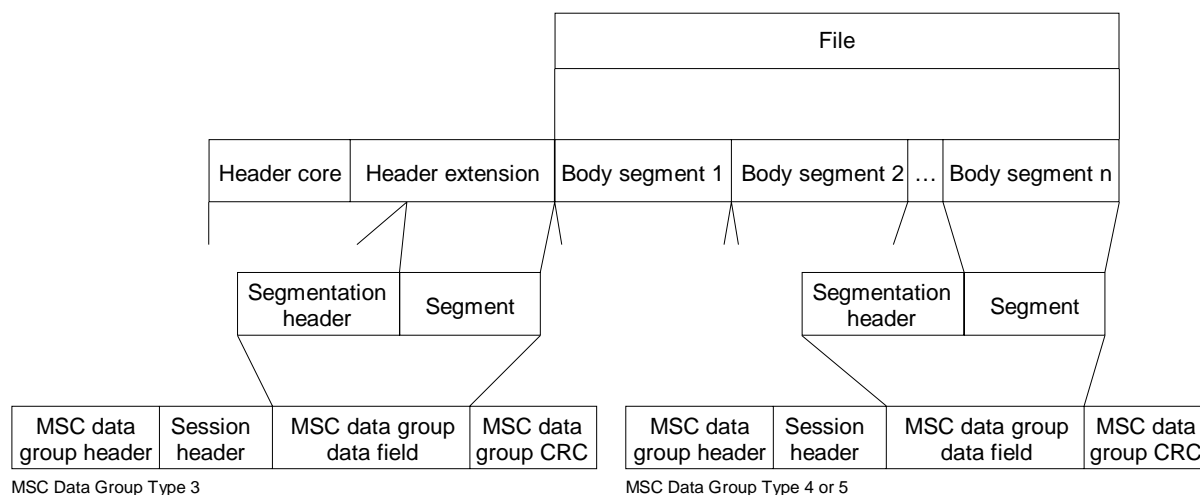


Figure 2: MOT segments and data groups

In the first step, a MOT header is created to describe the MOT body (in this example a file). The MOT header contains the MOT object's management data. Afterwards, the MOT header as well as the MOT body are split into equally sized segments (only the last segment of each item may be smaller).

Note that the headers of several files may be combined and sent as a separate MOT Directory using MSC Data Groups Type 6. This is called "MOT Directory mode" and allows proper management of several concurrent objects. When only a single object is required, the directory is not needed and "MOT Header mode" may be used.

Segmentation is especially useful if only one series of packets can be transported at a time in combination with low bit rates, as it is the case for DRM packet mode. If each file had to be sent as one piece, large files would occupy the DRM channel for a very long time. By using segmentation, only one segment of the file has to be sent in one piece. Segments of other MOT objects may be sent interleaved. This allows the transport of MOT objects with higher priority at a virtually higher bit rate. Segments of larger, less important objects can therefore be sent at a virtually lower bit rate.

The segments are each mapped into one DAB MSC data group. The DAB MSC data group is the lowest level of the MOT protocol. For transporting files using the MOT protocol in DRM, the mapping from the DAB MSC data groups to DRM is given in the following clause.

5.2.2 MOT over DRM

For DRM, each DAB MSC data group is mapped directly to a DRM data unit. The DRM data unit is split into packets of any suitable size and transported using the DRM Packet Mode protocol (as specified in ES 201 980 [1]). Figure 3 shows this procedure. "FF" and "LF" represent the state of the "first flag" and "last flag" bits for each packet.

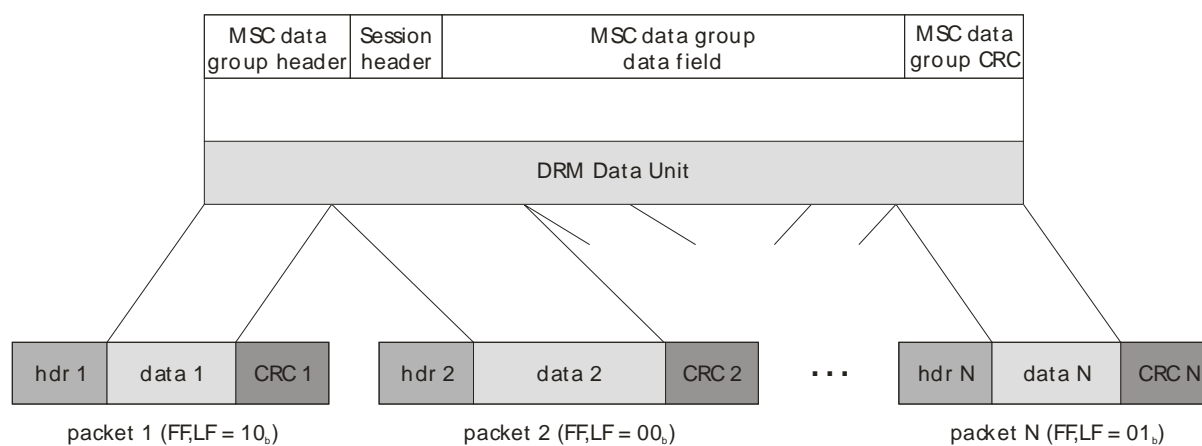


Figure 3: MSC data group transport in DRM

This is almost equal to the DAB procedure. All levels of en- and decoding, starting with the MSC data group and above, remain exactly as they were specified for MOT.

6 Data applications

Data applications are divided into various categories, depending upon the domain in which they were specified. The SDC data entity 5 carries information on which domain and the following clauses describe the applications that are specified for use in DRM. Some applications have an entry in the FAC application Id table and so can be selected from scanning through the frequencies. These applications are specified in clause 4.2.

6.1 DRM domain applications

6.1.1 Openly specified applications

There are currently no openly specified data applications registered.

Table 3: Application identifiers for openly specified applications

Application identifier	Name of application	Reference document
0x0000	Reserved	
...	Reserved	
0x7FFF	Reserved	

6.1.2 Proprietary applications

There are currently no proprietary data applications registered.

Table 4: Application identifiers for proprietary applications

Application identifier	Name of holder	Date of issue
0x8000	Reserved	
...	Reserved	
0xFFFF	Reserved	

6.2 DAB domain applications

6.2.1 General

All DAB data applications that use the TDC, the MOT, or IP tunnelling can be carried in a DRM multiplex. However, the signalling shall be carried solely in the SDC except for applications with an entry in the FAC table where both FAC and SDC carry the signalling information. For a complete list of DAB data applications see TS 101 756 [5].

6.2.2 Signalling

In DAB, applications are signalled using FIG 0/13. In DRM, the application specific signalling data is carried in SDC data entity type 5 as specified by ES 201 980 [1] and clause 4.3 of the present document.

6.2.3 Applications using the Transparent Data Channel (TDC)

DAB defines the TDC as general purpose transport protocol for use by data applications requiring simple streaming data to be delivered from service provider to receiver. It is standardized as TS 101 759 [3].

TS 101 759 [3] defines three methods for transporting data application streams. Two of these, namely TDC in a packet mode service component and TDC in stream mode service component, are applicable to the DRM Multiplex. The third method, TDC in an audio stream service component using X-PAD, is not applicable.

6.2.3.1 TDC in a packet mode service component

This method is used to transport asynchronous data streams, either with or without the use of DAB MSC data groups. DRM packet mode ES 201 980 [1] is used as the transport mechanism in DRM, either with or without the use of DRM data units.

6.2.3.1.1 TDC in a packet mode service component without data groups

This is carried as asynchronous stream mode, see clause 5.1.2. The application data is carried in packets.

The Packet mode indicator is set to 1 to indicate packet mode. The Data unit indicator is set to 0 to indicate DRM data unit transport is not used.

6.2.3.1.2 TDC in a packet mode service component with data groups

This is carried as asynchronous data unit mode, see clause 5.1.3. Each DAB MSC data group is mapped directly to a DRM data unit. The DRM data unit is split into packets of any suitable size and transported using the DRM Packet Mode protocol (see ES 201 980 [1]). Figure 2 shows this procedure.

The Packet mode indicator is set to 1 to indicate packet mode. The Data unit indicator is set to 1 to indicate DRM data unit transport is used.

In this mode, end user addressing is available.

6.2.3.2 TDC in a stream mode service component

This method is used to transport synchronous data streams (fixed bit rate).

This is carried in DRM as synchronous stream mode, see clause 5.1.1.

The Packet mode indicator is set to 0 to indicate stream mode.

6.2.4 Applications using the Multimedia Object Transfer protocol (MOT)

The MOT protocol (EN 301 234 [2]) is specified for use with DRM. The mapping from DAB data groups to DRM data units is specified in clause 5.2.

6.2.5 Applications using IP tunnelling

The IP Packets including their respective IP Headers are mapped into one DAB MSC Data Group each. This adds another protection mechanism by introducing a CRC checksum and allows the retransmission of IP Packets.

This mechanism is described in ES 201 735 [4].

For transmission over DRM, the DAB MSC Data Groups are mapped to DRM Data Units as described in clause 5.2.2. The DRM data units are transmitted in asynchronous data unit mode, see clause 5.1.3.

History

Document history		
V1.1.1	April 2003	Publication
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