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TECHNICAL SPECIFICATION

**Digital Audio Broadcasting (DAB);
Dynamic Label Plus (DL Plus);
Application specification**

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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 [1], for DAB (see note 2) which now has worldwide acceptance.

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

The DAB family of standards is supported by World DAB, an organization with members drawn from broadcasting organizations and telecommunication providers together with companies from the professional and consumer electronics industry.

Modal verbs terminology

In the present document "**shall**", "**shall not**", "**should**", "**should not**", "**may**", "**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.

1 Scope

The present document defines a backward compatible extension of the Dynamic Label feature used in Digital Audio Broadcasting (DAB) (ETSI EN 300 401 [1]).

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 referenced document (including any amendments) applies.

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

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 necessary for the application of the present document.

[1] ETSI EN 300 401 (V2.1.1): "Radio Broadcasting Systems; Digital Audio Broadcasting (DAB) to mobile, portable and fixed receivers".

[2] IEC 62106: "Radio data system (RDS) - VHF/FM sound broadcasting in the frequency range from 64,0 MHz to 108,0 MHz".

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 referenced 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.

Not applicable.

3 Definition of terms, symbols and abbreviations

3.1 Terms

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

category: group of content types

content type: classification of the content of a DL Plus object

Dynamic Label (DL): feature of DAB for providing a programme with text messages; it also provides commands, e.g. for presentation on the receiver terminal

Dynamic Label (DL) message: text messages that are associated with a programme service and are transmitted in the PAD part of that programme

NOTE: One single DL message should be sufficient for complete comprehension by a (human) listener.

Dynamic Label Plus (DL Plus): extension of the Dynamic label feature; it allows storing and filtering parts of the text (sent as DL messages) in the receiver terminal as DL Plus objects, which then can be selected and accessed by the listener independently from the currently transmitted DL messages

DL plus command: mechanism for carrying the DL tags necessary for identifying DL Plus objects

DL plus object: text string created in a receiver with a defined content type to allow selection by the listener

DL plus tag: contains the location and the content type of a DL Plus object carried in a corresponding Dynamic Label Message

programme item: time-slice of a programme, for example, a piece of music or a documentary report

3.2   Symbols

Void.

3.3   Abbreviations

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

CD	Compact Disc
CRC	Cyclic Redundancy Check
DAB	Digital Audio Broadcasting
DL Plus	Dynamic Label Plus
DL	Dynamic Label
EPG	Electronic Programme Guide
FIG	Fast Information Group
FM	Frequency Modulation
IR	Item Running
IT	Item Toggle
MMS	Multimedia Message Service
NT	Number of Tags
ODA	Open Data Application
PAD	Programme Associated Data
PC	Personal Computer
PDA	Personal Digital Assistant
PMP	Personal Media Player
RDS	Radio Data System
RT	RadioText
RT+	RadioText Plus
SMS	Short Message Service
UECP	Universal Encoder Communication Protocol
URL	Universal Resource Location
USB	Universal Serial Bus

4　　Introduction

Digital Audio Broadcasting DAB [1] provides the text feature Dynamic Label (DL) which allows the service provider to send text messages with information such as track playing, now/next, news headlines, weather, sport results, etc. To serve all the different interests of listeners, the service provider has to send DL messages frequently and with different content, one after the other, each message replacing the one before. The more information he wants to provide, the more frequently he has to update the messages, and the less time is left for presentation of a message on the display and for reading by a listener. So it will happen that a listener has to wait until specific information he is interested in shows up and - even worse - has to observe the display continuously in order not to miss the instant when the desired information is displayed.

DL Plus solves this dilemma by allowing the listener to select the kind of information he is interested in. For that purpose DL messages are complemented by tags which identify specific content of the DL message by its content type. Users can select the content types of information to be presented; they do not need to read, or even be aware of, the complete stream of DL messages.

DL Plus is a backwards compatible extension of the DL feature: the transmitted tags are not visible in the DL message so that listeners with receivers without a DL Plus decoder still view the DL messages as before. For the broadcaster, the additional data rate (for tag transmission) is significantly less than the data rate necessary for text.

A receiver can use the content classification and tagging in two different ways: by improving the presentation of the text messages and/or by providing the information to other applications and devices.

DL messages may contain any kind of text: some will be quite general - news headlines, for example - whilst others relate directly to the audio - artist and title information, for example. In this latter case, special consideration is given to allow correct grouping of all the different item-related information and an unambiguous reference to the audio of the respective programme item. This timing information may also be used to ensure that the text and audio make sense for time-shifted programmes.

DL Plus, by identifying text by content type, can automatically provide information to other devices like mobile phones, PDAs, PCs and personal audio players. This means listeners can interact with the radio station more easily because the transfer of telephone and SMS numbers, web addresses and event information may be done with a single click. DL Plus is designed to stimulate the integration of radio with other devices in order to strengthen the competitiveness of radio with respect to other media and to gain new and greater audiences.

Figure 1 illustrates the way that a DL Plus decoder in a receiver processes the received DL message and DL Plus tags to create DL Plus objects that are then displayed or stored. In this example, the DL message contains the title and artist of a music item that is currently on air. These two pieces of text are tagged so that the receiver may identify them and create the DL Plus objects.

DL message

| You are listening to "A very famous song" by Big Celebrity |

Title   Artist

DL Plus tag

Content Type: **Title**

Start marker: **22**

Length marker: **17**

DL Plus tag

Content Type: **Artist**

Start marker: **45**

Length marker: **12**

DL Plus object

Content Type: **Title**

Text: **A very famous song**

DL Plus object

Content Type: **Artist**

Text: **Big Celebrity**
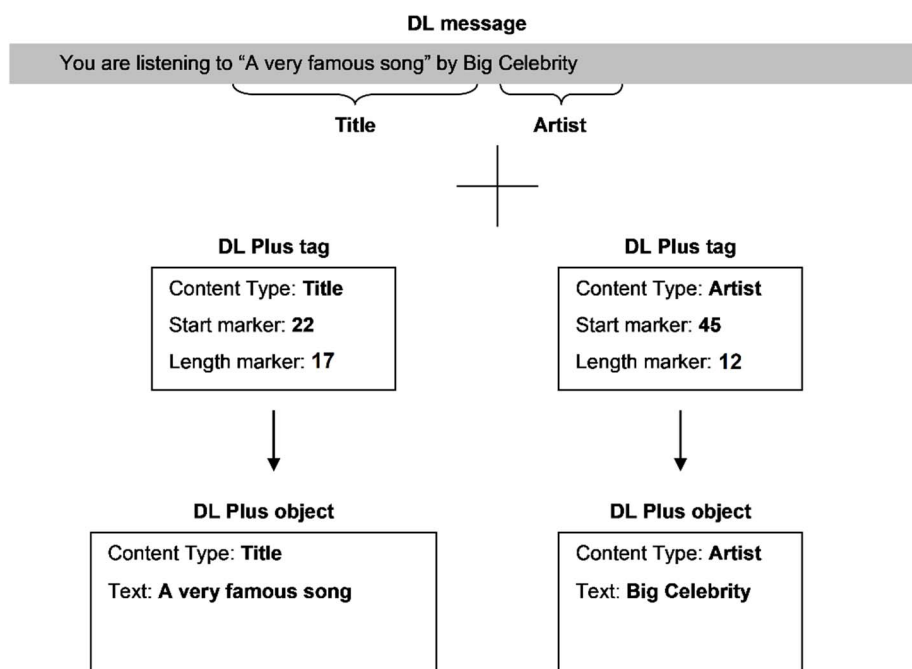
**Figure 1: Example of a simplified schematic of DL Plus object creation
from DL message and DL Plus tags**

The DL Plus tags are carried in the PAD using the same mechanism as the DL message but utilizing the command feature of the DL application. Up to four DL Plus tags may correspond to a single DL message. DL Plus tags contain a content type, a start marker and a length marker to identify the piece of text to be assigned to a DL Plus object. The DL Plus objects may contain additional data fields, if so required by the receiver functionality. It is recommended to store a time stamp indicating the time when the corresponding DL message was received (see clause 8.2). This allows history oriented handling of the DL Plus objects, e.g. by assembling a play list with the last received programme items.

DL Plus offers similar functionality to the FM-RDS RT+ feature (see annex C).

5   DL Plus objects

5.0   Introduction

DL Plus objects are created in receivers from DL messages and associated DL Plus tags. Therefore the DL Plus objects inherit some basic properties from the DL messages they are based on:

- The text of DL Plus objects shall be contained within a single DL message, and so has a maximum text length determined by the limit of 128 bytes.

- The throughput of DL Plus objects is limited by the throughput of DL messages; the need for non-DL Plus equipped receivers to be able to display all DL messages limits the throughput.

- These limitations restrict the overall amount of data that can be made available for the DL Plus application decoder.

5.1   Content types

Each DL Plus object is assigned a content type chosen by the service provider from those available. 64 content types are currently defined, see table A.1. These content types correspond exactly to those defined for the FM-RDS RT+ feature. A further 64 content types are reserved for future addition.

The user can select which content types should be presentable to him and therefore which should be filtered and chosen from the stream of received DL Plus objects.

The content types are grouped in the following categories:

- **Item**
  Content types within this category are related closely to the current audio programme item. A programme item could be a music track from a popular music programme, or a feature in a magazine programme. In some cases there may be a single programme item in a programme, in other cases there may be many programme items. All content types in the Item category conform to the use of ID3 tags.

- **Info**
  Content types within this category carry information that is more or less unrelated to the audio, but offers important additional information to the listener, including news, headlines, alarms, advertisements and events.

- **Programme**
  Content types within this category describe the programme and the programme service (i.e. the "radio station").

- **Interactivity**
  Content types within this category include telephone numbers, SMS numbers, e-mail addresses or web addresses (URLs) to support the implementation of interactivity by integration of radio and mobile phones, PCs and PDAs.

- **Private**
  Content types within this category are defined by the service provider and have no pre-determined use. The interpretation is dependent on the programme service and may be used in closed user groups with special receivers.

- **Descriptor**
  Content types within this category are used to provide further detail to another DL Plus object (see clause 5.2.3).

Up to four DL Plus objects can be created from each DL message and the DL Plus objects may contain different text, the same text, or a portion of the same text which corresponds to the assigned content type.

EXAMPLE: The DL message "Coming soon: Performance featuring the SSSSSS in Concert, on Saturday 11.8.2017 at the RRRRR AAAAAA HHHH."
DL Plus tags are transmitted to produce the following DL Plus objects:
INFO.EVENT: "Performance featuring the SSSSSS in Concert, on Saturday 11.8.2017 at the RRRRR AAAAAA HHHH"
DESCRIPTOR.APPOINTMENT: "11.8.2017"
DESCRIPTOR.PLACE: "RRRRR AAAAAA HHHH"
The text for both descriptor objects are completely contained in that of the INFO.EVENT object. So the service provider ensures that a receiver can filter, store and present all details but also allows for a more advanced receiver to identify the descriptor objects APPOINTMENT and PLACE and provide them to calendar managing software on a PDA or PC.

5.2   Linking of DL Plus objects

5.2.0   Introduction

In general, DL Plus objects carry information that is meaningful in itself, without knowledge of information provided by other DL Plus objects (except for DL Plus objects in category Descriptor).

DL Plus provides mechanisms to combine the information of two or more DL Plus objects. There are three structuring methods:

- Aggregating all DL Plus objects with content types belonging to the Item category related to the same programme item.

- Compiling several DL Plus objects of the same content type to a table (applicable to the categories Info, Programme and Interactivity).

- Linking a DL Plus object with content types belonging to the Descriptor category to another DL Plus object.

5.2.1   Aggregating DL Plus objects (category Item)

Whilst a programme item is in progress, several DL messages may be sent and some of them will signal the creation of various DL Plus objects with content types in the Item category (with information about title, artist, composer, etc.) and all referring to the same programme item. These may be aggregated to give a fuller description of the programme item. To ensure that DL Plus objects are associated correctly to the appropriate programme item, two flag bits are defined: the **item toggle bit** and the **item running bit**.

These flag bits are set according to the audio and are transmitted with the DL Plus tags (see clause 6). The timing precision of the signalling is dependant on the transmission of the DL Plus tags.

The value of the item toggle bit is changed at the start of each programme item.

The value of the item running bit is normally set to 1, but it is reset to 0 when the programme is interrupted, for example by a news bulletin or by an announcer, for the duration of the interruption. When the item running bit is 0, a receiver should not display DL Plus objects in the Item category and may interrupt recording of the programme.

The item toggle bit and the item running bit are used by receivers for the association of DL Plus objects in the Item category with programme items and to control the recording of a programme.

If the broadcaster does not wish to signal the boundaries between programme items, then the item toggle bit and the item running bit should be set to zero. However, it is recommended that these bits be correctly signalled to assist time-shifting of programmes (both audio and messages) and the operation of "rewind-radio" devices.

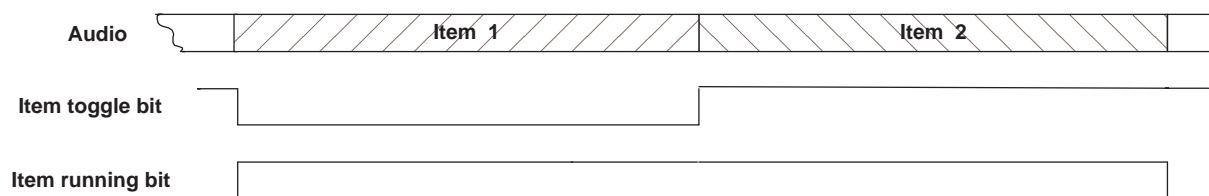Some examples of the use of these bits are shown below.

EXAMPLE 1:

Figure 2: Setting of item toggle bit and item running bit when one programme item follows another

In example 1, each programme item follows the previous one. The item toggle bit changes at the start of each programme item; the item running bit remains set for the whole programme.
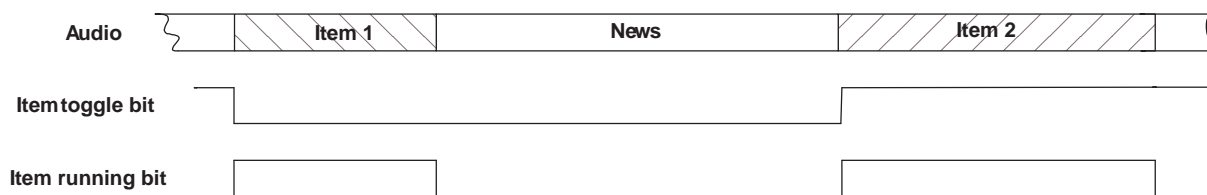
EXAMPLE 2:

Figure 3: Setting of item toggle bit and item running bit when news interrupts a programme

In example 2, a news item is transmitted between programme items in the middle of a programme. The item toggle bit changes at the start of each programme item; the item running bit is set for each programme item, but reset for the duration of the news.

EXAMPLE 3:
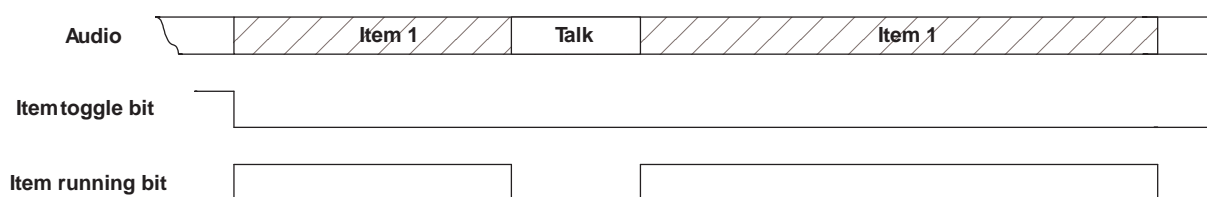
Figure 4: Setting of item toggle bit and item running bit when an announcer interrupts a programme item

In example 3, an announcer interrupts a programme item. The item toggle bit changes at the start of the programme item; the item running bit is set for the programme item, but reset for the duration of the announcer's interruption.

5.2.2   Compiling DL Plus objects into tables

DL Plus objects can be compiled to a table, provided:

- they all have the same content type from categories Info, Programme or Interactivity; and

- the text of the objects contains redundant spaces.

The term "redundant spaces" is defined as two or more space/blank characters together within the text of the DL message.

The table is identified by a content type belonging to the Info, Programme or Interactivity category - all DL Plus objects with the same content type contribute DL Plus objects to the same table.

The text of DL Plus objects destined for tables shall consist of a *keyword* followed by one or more *elements* each separated by redundant spaces. The keyword is used to identify each row of the table and the elements populate the columns of the table. The combination of the content type and the keyword uniquely identify an entry in a table. The entries in the table may be ordered by reception time or alphabetically by the keyword. The broadcaster may assist receivers to display the information in columns by varying the number of space/blank characters within each redundant spaces separator. Receivers may arrange the information on the display as desired to provide the best presentation.

Some examples are given below. The notation "␣␣" is used to indicate redundant spaces:

- INFO.STOCKMARKET
  "Company␣␣Value (€)␣␣Change␣␣High␣␣Low␣␣Volume"
  "NNNNNN␣␣12.27␣␣0.41␣␣12.31␣␣12.15␣␣23,332,238"

- INFO.SPORT
  "Bayern München:AC Milano␣␣5:5"

- INFO.WEATHER
  "London␣␣16 C"
  "Munich␣␣23 C"

- INTERACTIVITY.PHONE.OTHER
  "Deutsches Museum␣␣089323990"

NOTE: For the example INFO.STOCKMARKET, the first line could appear as a middle row in the table if the receiver sorts alphabetically and the stock information for BBBBBB is provided.

The service provider may omit elements from the right if necessary.

5.2.3   Linking a Descriptor object to another DL Plus object

A Descriptor object is meaningful only in combination with another DL Plus object and it provides further detail of the other object.

A DL Plus object (parent object) and its Descriptor objects shall be transmitted in the same DL message; therefore a DL message may carry one parent object with three linked Descriptor objects, or two parent objects each with a linked Descriptor object, or any other combination, provided the limit of four DL Plus objects per DL message is observed. The Descriptor objects are intended to be passed to intelligent terminals that can automatically use the information. The Descriptor objects may also be provided to the user.

PLACE and APPOINTMENT are intended to provide data for schedule planning software on PDAs and PCs (Calendar function). They provide address information and time and date information for events foreseen in the future and for appointments.

PLACE can be combined with: EVENT, SCENE, CINEMA, TV and ADVERTISMENT of category INFO.

APPOINTMENT can be combined with: EVENT, SCENE, CINEMA, TV and ADVERTISMENT (all of category INFO) and PROGRAMME.NEXT.

IDENTIFIER is intended to be used as input for a template to be completed for ordering an item.

IDENTIFIER can be combined with: ITEM.TITLE and ITEM.ALBUM.

PURCHASE and GET_DATA are intended as Hyperlink to Websites, they are directed to internet browsers and other software. In context with SMS numbers, these can be forwarded directly to the phone or to the contact management software on PDAs and PCs.

PURCHASE can be combined with: ITEM.TITLE, ITEM.TRACK; also with EVENT, SCENE, CINEMA, and ADVERTISMENT of category INFO. It allows the ordering of music items, tickets for events, products announced in the commercial or advertisement. It also includes acquiring goods that are provided free of charge.

GET_DATA can be combined with almost all content types (of category Item, Info (also for single table entries), Programme, Interactivity and Private). It allows via link to an SMS or Web source to retrieve additional data referring to the object with which it is combined, by applying the indicated SMS number or URL address.

5.3   Life time, updating and deletion

5.3.0   Introduction

DL Plus allows a receiver to store at least as many up-to-date DL Plus objects as there are content types defined. If the receiver supports the compilation of objects into tables, it will store multiple objects with the same content type. The receiver shall respect the life time of the multiple objects. The object starts its life (within a receiver), when it is received for the first time. The object's life time ends, when:

- an object is updated: it then is replaced by a new object;

- a "delete" object is received;

- if the object belongs to the Item category, the item toggle bit changes its value or the running bit is set to "0";

- the user switches to another programme or switches off the receiver.

When an object's lifetime is over, it is no longer current, but it may be archived to form a history of objects (see clause 8). In this case, the receiver shall store the times when the object starts and ends its life.

5.3.1   Updating objects

Objects are updated by transmitting a new object with the same content type as an existing object. When a new DL Plus object is received, it replaces the object stored under the same content type. In the case of tables, the keyword qualifies which object is to be replaced.

5.3.2   Deleting objects

Objects are deleted by transmitting a "delete" object (see clause 6.2) with the same content type as an existing object. When a "delete" object is received, it removes the object stored under the same content type. In the case of tables, the complete table is removed. It is not possible to delete individual table entries.

6   DL Plus tags

6.0   Introduction

The receiver constructs the DL Plus objects from the received DL message and DL Plus tags (see figure 1).

The first character of the DL message is character 0. DL messages may contain up to 128 characters, depending on the indicated character set (see ETSI EN 300 401 [1], clause 7.4.5.2).

The coding of a DL Plus tag is as follows.
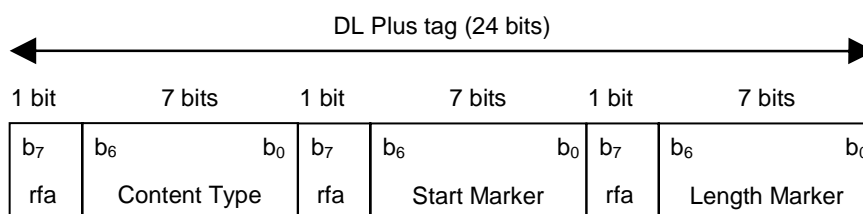
Figure 5: Structure of the DL Plus tag

The following definitions shall apply:

- **rfa:** these 1-bit fields are reserved for future amendments, and shall be set to 0 until defined.

- **Content Type:** this 7-bit field shall specify the Content Type of a DL Plus object as defined in annex A. Content Types 0 to 63 are identical to RT+; Content Types 64 to 127 are reserved for future additions in DL Plus.

- **Start Marker:** this 7-bit field shall specify the position of the first character of the DL message that forms the DL Plus object in the range 0 to 127.

- **Length Marker:** this 7-bit field shall specify the number of characters following the first character of the DL message that forms the complete DL Plus object in the range 0 to 127.

6.1   Creating a dummy object

DL Plus tags may be used to create dummy objects, either to improve the timing accuracy of the item toggle bit and item running bit (see clause 5.2.1), to inform receivers that DL Plus is still active when there are no DL Plus objects associated with the current DL message, or for compatibility with RT+.

To create a dummy object, the content type is set to "DUMMY" and the start and length markers are set to 0.

If a DL message carries text for only one DL Plus object, and therefore requires only one DL Plus tag, but the service is simulcast using FM-RDS with RT+, then a second tag with the Content Type set to "DUMMY" may be sent (see annex C).

6.2   Creating a delete object

To create a delete object, the content type is set to the required value, the start marker specifies a blank character and the length marker is set to 0. Any blank character may be specified.

    EXAMPLE:

```
Hotline: 0123456677
0----0----1----1----2----2----3----3----4----4----5----5----6---
0----5----0----5----0----5----0----5----0----5----0----5----0---
```

Content Type	PHONE.HOTLINE
Start Marker	9
Length Marker	9

Content Type	INFO.NEWS
Start Marker	8
Length Marker	0

The first DL Plus tag creates a DL Plus object of content type "PHONE.HOTLINE", text string "0123456677". The second DL Plus tag creates a delete object for content type "INFO.NEWS", and demonstrates that a separate DL message is not required for deleting objects.

7   Command structure

7.1   Transport of DL Plus commands

DL commands are transported using the same mechanism as that for DL messages, see ETSI EN 300 401 [1], clause 7.4.5.2. When the **Command** field = **0 0 1 0** (DL Plus command), Field 2, Field 3 and the DL Command field shall be used as follows:

<div align="center">

4 bits

b$_7$	b$_4$
	Field 2

First = 1

1 bit   3 bits

b$_7$	b$_6$	b$_4$
L		Rfa

First = 0

1 bit   3 bits

b$_7$	b$_6$	b$_4$
L		Seg Num

</div>
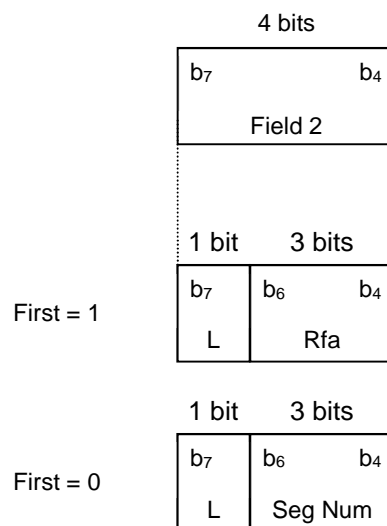
Figure 6: Structure of Field 2 for DL Plus

The following definitions apply:

- **Field 2:** the interpretation of this 4-bit field shall depend on the value of the First flag (b14) as follows:

    - **First flag = "1":**

        - **L (Link bit):** in commands that are linked to a DL message, this bit shall carry the same value as the toggle bit of the DL message segments; otherwise it shall be set to zero.

        - **Rfa:** 3-bit field shall be reserved for future additions. These bits shall be set to zero until they are defined.

    - **First flag = "0":**

        - **L (Link bit):** in commands that are linked to a DL message, this bit shall carry the same value as the toggle bit of the DL message segments; otherwise it shall be set to zero.

        - **SegNum (Segment Number):** this 3-bit field, expressed as an unsigned binary number, shall specify the sequence number of the current segment minus 1. (The second segment of a command corresponds to SegNum=1, the third segment to SegNum=2, etc.) The value 0 is reserved for future use.

- **Field 3:** this 4-bit field, expressed as an unsigned binary number, shall specify the number of bytes in the DL Command field minus 1.

- **DL Command field:** this field shall carry the payload of the DL Plus command segment.

7.2   DL Plus commands: general structure

The presence of DL Plus is signalled implicitly by the occurrence of DL Plus commands in the same X-PAD data stream as the DL messages (application types 2 and 3) i.e. the presence of DL commands where the Command field contains the value "0 0 1 0". Figure 7 shows the general structure of the DL Plus command.

DL Plus command

4 bits	4 bits	n × 8 bits
b7 b4	b3 b0	
CId	CB	Command body
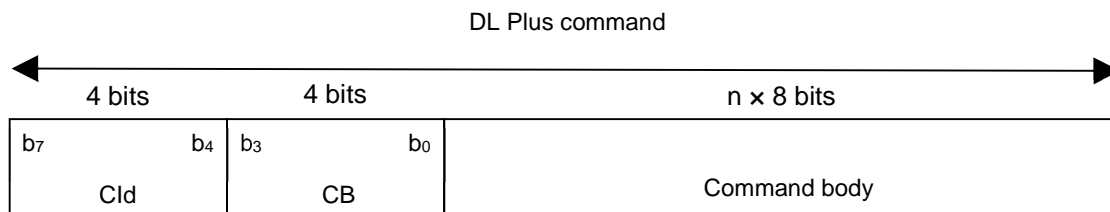
Figure 7: General structure of the DL Plus command

The following definitions apply:

CId: this 4-bit field bit shall identify the specific command as follows:

"0 0 0 0": DL Plus tags command;

other values are reserved for future use.

CB: this 4-bit field shall be defined by each specific command.

Command body: this field shall be defined by each specific command.

DL Plus commands shall be transported using the X-PAD data group for dynamic label segment in the DL Command field (see clause 7.1).

7.3   The DL Plus tags command

DL tags are conveyed in the DL Plus tags command. It may be segmented in several DL Plus command fields. A DL Plus tags command can transport up to 4 DL Plus tags that refer to the same DL message. Figure 8 shows the structure of the DL Plus tags command.

DL Plus tags command

4 bits	4 bits	n × 8 bits		
b7 b4	b3 b0			
CId	CB	Command body		
4 bits	1 bit	1 bit	2 bits	24 bits		24 bits
b7 b4	b3	b2	b1 b0	b23 b0		b23 b0
0 0 0 0	IT	IR	NT	DL Plus tag 1	. . .	DL Plus tag j

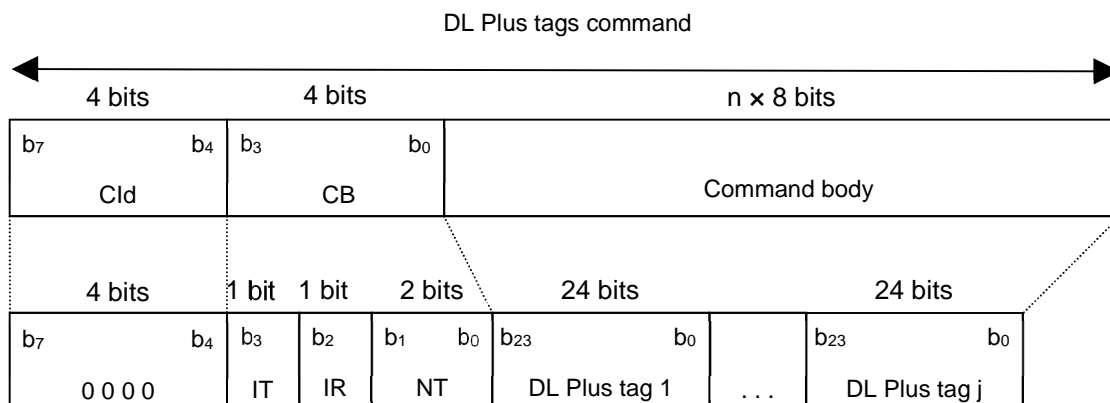**Figure 8: Structure of the DL Plus tags command**

The following definitions apply:

CId: this 4-bit field bit shall take the value "0 0 0 0" to indicate the DL Plus tags command.

CB: this 4-bit field is defined for the DL Plus tags command as follows:

- **IT (Item Toggle bit):** this bit shall be set according to clause 5.2.1.

- **IR (Item Running bit):** this bit shall be set according to clause 5.2.1.

- **NT (Number of Tags):** this 2-bit field, expressed as unsigned binary number, shall specify the number of DL tag fields present in the command body field minus 1.

Command body: the Command body contains between one and four DL tags.

- **DL Plus tag:** see clause 6.

The NT field shall be evaluated by receivers to determine the correct number of DL tags.

NOTE: The DL Plus tag(s) may in future be followed by other data which is reserved for future amendments.

In general, the order of the DL Plus tags is arbitrary. However, in the case of Descriptor tags (see clause 5.2.3), these shall follow the DL Plus tag carrying the parent content type.

7.4   Transmission sequence

The complete DL message shall be transmitted before the related DL Plus command(s) are transmitted. The L (Link) bit of the DL Plus tags command shall be set to the same value as the T (Toggle) bit of the related DL message. The DL message and DL Plus command(s) may be repeated to guard against transmission errors, but the sequence of DL message followed by DL Plus command(s) shall be observed. The transmission of the DL Plus commands shall be completed before another dynamic label command (if any) is transmitted.

When the transmission of a different DL message is started, the value of the T (Toggle) bit for the DL message is changed and the L (Link) bit for the DL Plus tags command is changed to match.

If there are no DL Plus tags associated with a DL message then a DL Plus tag with content type "DUMMY" shall be sent to inform the receiver that it should continue to present DL messages using DL Plus. This also allows the broadcaster to continue to send the item toggle bit and item running bit to associate text to programme items (see clause 5.2.1). The timing precision can be further improved by reducing the delay before these bits will be transmitted in the next DL Plus tags command. This may be achieved by stopping the transmission of the current DL message and then transmitting a DL message consisting of a single space character and a DL Plus tag indicating "DUMMY" (however this may cause the display of non-DL Plus receivers to blank).

8   Receiver behaviour

8.0   Introduction

DL Plus provides an enhanced way to view DL messages. This allows a great variety of receiver terminals with different concepts, depending on the user expectations and requirements, the terminal hardware and software resources. Some DL Plus use cases are given in annex B.

8.1   Basic requirements

Receivers shall be capable of processing both the DL messages and the DL Plus tags that are carried in the DL Plus commands.

When a receiver is tuned to a service, it shall start by processing the DL messages only. As soon as a DL Plus command is received it shall start processing DL messages and DL Plus commands to create the DL Plus objects. It shall remain in the DL Plus mode, as long as DL Plus tags are received with DL messages.

NOTE: Broadcasters send DL Plus tags with content type "DUMMY" whenever a DL message is sent which does not contain DL Plus objects.

When a receiver is re-tuned to a different service, all DL Plus objects shall be deleted (see clause 5.3).

The synchronization of DL messages and DL Plus commands in the receiver is achieved by observing that the T (Toggle) bit in the prefix of the DL message and the L (Link) bit in the associated DL Plus command have the same value.

If the receiver detects a change to the T (Toggle) bit of the received DL message or the L (Link) bit of the received DL Plus tags command does not match the T (Toggle) bit of the DL message, then this indicates that a new DL message and associated DL Plus tags command are being transmitted and processing of the previous message shall end, even if reception errors (indicated by a failure of the segment CRC) have not permitted the DL Plus objects to be created.

DL Plus receivers shall be able to filter the DL Plus objects according to their content types. Very simple receivers may have filters based on a small number of content types preconfigured by the manufacturer according to the main interests of the users (e.g. title and artist). Other receivers will allow the user himself to configure the filter and select those content types that are of interest. Selection of single Descriptor objects is meaningless, they may be enabled for display or storage if the object they refer to is selected. Objects from the Private category should also be selectable for storage and display. Not all programmes will provide every user with the DL Plus objects requested. Therefore, it shall be possible for the user to disable DL Plus and the receiver shall revert to displaying the DL messages. If the display size is sufficiently large, it should allow a simultaneous presentation of the DL Plus objects requested and the current DL message.

Very simple receivers will forward the text carried by a DL Plus object of requested content type to the display as soon as it becomes available. The receiver will be more attractive for a user if it stores the DL Plus objects, so that he can browse through the stored information at any time he wishes to. (See also annex B: use cases B1, B2). DL Plus allows storing as many up-to-date DL Plus objects as there are content types defined (see annex A). If the receiver is able to compile tables from DL Plus objects with the same content type, it can store as many DL Plus objects as there are different received keywords. The broadcaster will ensure that all the DL Plus objects stored in the receiver are kept up-to-date: normally by replacing an obsolete DL Plus object by sending the information for a new DL Plus object of the same content type (and with the same keyword). The broadcaster can also delete obsolete DL Plus objects by creating a delete object (see clause 5.3).

The lifetime of DL Plus objects from the Item category are generally controlled by the item toggle bit and the item running bit, although a delete object may also be used. Whenever the lifetime of a DL Plus object from the Item category is completed, all DL Plus objects of the category Item shall also be deleted and removed from the display.

8.2 History

A simple receiver will only handle the current DL Plus objects, e.g. it displays the current news headline. A more advanced receiver may provide a history function, so that it can offer the information carried in objects previously received, so a user could recall the last headlines received. A receiver with such a history function shall display the object with the start and end times of the object's life to ensure that users are aware that the information is taken from the history and that the current DL Plus object of the requested content type may carry different information.

In case of a programme item, the start time and the stop time are derived from the item toggle bit and the item running bit (see clause 5.2.1). This information allows a receiver to provide the user with a playlist of e.g. the last ten music items. A receiver with such history functionality could keep the stored playlist information even when the user changes the programme. However, the receiver shall keep the DL Plus objects for each service separate.

When a receiver implements a time-shifting function, the PAD is stored with the audio and therefore the DL Plus objects may be recovered on playback. Special attention should be paid to the history function in this case since the playback time will not be the same as the original transmission time and the start and end times of the objects' lives will relate to the time the DL Plus objects are decoded.

Annex A (normative): List of DL Plus content types

The list of DL Plus Content Types are defined in table A.1. Content Types 0 to 63 are identical with the list of Content Types defined with RT+; Content Types 64 to 127 are reserved for future additions in DL Plus.

Table A.1: List of DL Plus content types

Category	Code	DL Plus content type	MP3 id3v2		Description
Dummy	0	DUMMY			To permit item timing and RT+ compatibility (see clauses 6.1 and 7.3)
Item	1	ITEM.TITLE	TIT2	TITLE	Title of the current item on air; e.g. title of track that belongs to an album
	2	ITEM.ALBUM	TALB	ALBUM	The collection name to which this item belongs
	3	ITEM.TRACKNUMBER	TRCK	TRACKNUM	The track number of the item on the album on which it was originally released
	4	ITEM.ARTIST	TPE1	ARTIST	A person or band/collective generally considered responsible for the work
	5	ITEM.COMPOSITION	TIT1	COMPOSITION	A complete composition (classical music broadcasters should use this item to identify the composition)
	6	ITEM.MOVEMENT	TIT3	MOVEMENT	A movement is a large division of a composition or musical form (classical music broadcasters should use this item to identify the movement)
	7	ITEM.CONDUCTOR	TPE3	CONDUCTOR	The artist(s) who performed the work. In classical music this would be the conductor
	8	ITEM.COMPOSER	TCOM	COMPOSER	Name of the original composer/author
	9	ITEM.BAND	TPE2	BAND	Band/orchestra/accompaniment/musician
	10	ITEM.COMMENT	COMM	COMMENT	Any comment related to the content
	11	ITEM.GENRE	TCON	CONTENTTYPE	The main genre of the audio, e.g. "classical", "hip-hop", "jazz", "oldies", "drama", etc.
Info	12	INFO.NEWS			News headline (see note 4)
	13	INFO.NEWS.LOCAL			Local news (see note 4)
	14	INFO.STOCKMARKET			Quote information; may be built from several distinct parts, e.g. "name ␣␣latest value ␣␣change ␣␣high ␣␣low ␣␣volume" (see notes 1 and 4)
	15	INFO.SPORT			Result of a game; may be built from several distinct parts, e.g. "match ␣␣result" (see note 4)
	16	INFO.LOTTERY			Raffle / lottery (see note 4)
	17	INFO.HOROSCOPE			Horoscope; key word for a table, e.g. "sign of the zodiac" (see note 4)
	18	INFO.DAILY_DIVERSION			Daily tip / diversion / joke / etc. (see note 4)
	19	INFO.HEALTH			Information about health (see note 4)
	20	INFO.EVENT			Info about an event (see note 4)
	21	INFO.SCENE			Information for the target audience of the programme service; for a youth programme info for the community and about its scene (hot locations to be) (see note 4)
	22	INFO.CINEMA			Information about movies in cinema (see note 4)
	23	INFO.TV			Information about TV-movies (see note 4)
	24	INFO.DATE_TIME			Not used in DL Plus (date and time given by FIG (0/10)) (see note 6)
	25	INFO.WEATHER			Information about weather (see note 4)
	26	INFO.TRAFFIC			Information about traffic. This shall alert users in case of exceptional traffic news (see note 4)
	27	INFO.ALARM			Alarm information and other urgent information; if implemented by a receiver, it should be presented immediately to the user. The receiver configuration should allow de-selection of this feature

Category	Code	DL Plus content type	MP3 id3v2		Description
	28	INFO.ADVERTISEMENT			Advertisement (e.g. book review, commercial etc.), may be additional information to an advertisement currently sent out in the audio channel of that programme (see note 4)
	29	INFO.URL			URL link to interesting information sources; <Keyword>␣␣<URL> (see notes 4 and 5)
	30	INFO.OTHER			Other information, topic defined by service provider; different topics may be specified by keywords; <Keyword>␣␣<information> (see note 4)
Programme	31	STATIONNAME.SHORT			Name describing the radio station (in USA: call letters as station identifiers)
	32	STATIONNAME.LONG			Name describing the radio station (and its motto)
	33	PROGRAMME.NOW			Info about the current programme (EPG present); useful if DAB EPG service is not available or terminal has no DAB EPG decoder
	34	PROGRAMME.NEXT			Info about the next programme (EPG following) or upcoming highlights of the programme; useful if DAB EPG service is not available or terminal has no DAB EPG decoder
	35	PROGRAMME.PART			Part of the current programme (PROGRAMME.NOW); if a programme is consisting of several parts, this info explains the content of the current part on air; if transmitted, this info should be presented in context with the PROGRAMME.NOW info (see note 4)
	36	PROGRAMME.HOST			Name of the host of the radio show (see note 4)
	37	PROGRAMME. EDITORIAL_STAFF			Name of the editorial staff; e.g. name of editorial journalist (see note 4)
	38	PROGRAMME. FREQUENCY			Not used in DL Plus (see note 6)
	39	PROGRAMME. HOMEPAGE	WORS	WWW RADIOPAGE	Link to radio station homepage
	40	PROGRAMME. SUBCHANNEL			Not used in DL Plus (see note 6)
Interactivity	41	PHONE.HOTLINE			The telephone number of the radio station's hotline
	42	PHONE.STUDIO			The telephone number of the radio station's studio
	43	PHONE.OTHER			Name and telephone number: "<key word>␣␣<number>" (see notes 4 and 5)
	44	SMS.STUDIO			The SMS number of the radio station's studio
	45	SMS.OTHER			Name and SMS number: "<key word>␣␣<SMS number>"(see notes 4 and 5)
	46	EMAIL.HOTLINE			The email address of the radio stations hotline
	47	EMAIL.STUDIO			The email address of the radio stations studio
	48	EMAIL.OTHER			Name and email address; <Keyword>␣␣<email address> (see notes 4 and 5)
	49	MMS.OTHER			Name and mms number; <Keyword>␣␣<mms number> (see notes 4 and 5)
	50	CHAT			Chat content is broadcast by the radio station as part of a DL message, may be a chat contribution from a listener
	51	CHAT.CENTER			Address (may be URL or SMS), where a listener should send his replies as chat contribution to
	52	VOTE.QUESTION			A question sent as DL Plus object and concerning a vote; could be binary, i.e. with two valid answers ("yes" or "no" or "1" or "2"), could

Category	Code	DL Plus content type	MP3 id3v2		Description
					also be a multiple choice question; could also be used with riddles, 10€-Questions etc.
	53	VOTE.CENTRE			URL or SMS number to send the answer to: the range of values for an expected answer will be indicated by VOTE.QESTIONS (preferred characters are decimal numbers, alphabet characters not excluded)
rfu	54				Reserved for future use
	55				Reserved for future use
Private classes	56				(see note 2)
	57				(see note 2)
	58				(see note 2)
Descriptor	59	DESCRIPTOR.PLACE			Adds info about a location, address etc.; important use case: in conjunction with INFO.EVENT (see note 3)
	60	DESCRIPTOR. APPOINTMENT			Adds in general info about date and time for something in future; important use case: appointment in conjunction with INFO.EVENT (see note 3)
	61	DESCRIPTOR. IDENTIFIER	TSRC	ISRC	For music it is the International Standard Recording Code (http://www.ifpi.org/isrc/) (see note 3)
	62	DESCRIPTOR. PURCHASE	WPAY	WWW PAYMENT	Address (URL or SMS number) where item can be ordered or purchased; includes items free of charge (see note 3)
	63	DESCRIPTOR. GET_DATA			SMS number or URL as source to retrieve more data about that is linked to the corresponding DL Plus object (see note 3)

NOTE 1: ␣ = space/blank character; two or more consecutive blanks act as a separator between several parts of the DL Plus object.
NOTE 2: Private classes may be defined by the service provider.
NOTE 3: A Descriptor will always provide more information about another DL Plus object that it is referring to (see clauses 5.2.3).
NOTE 4: Multiple DL Plus objects of this class can be compiled to a table (see clause 5.2.2): such an object is built from several distinct parts, which are separated by two or more consecutive space or blank characters.
NOTE 5: Multiple Phone numbers, SMS numbers, MMS numbers, URLs and e-mail addresses: the name shall serve as keyword; the keyword and each second part of the object text (i.e. the number, the e-mail address, or the URL) are separated by redundant spaces: "␣␣":<Keyword>␣␣<Column 2>, here column 2 with numbers or address respectively. Multiple Objects of each class can be compiled to a table; (clause 5.2.2).
NOTE 6: Intended for RT+ receivers; DL Plus equipped receivers ignore this content type.

Annex B (informative):
Use cases and Examples

B.1 Use cases

DL Plus is basically a simple extension of the DL feature. It requires some additional software only, because most DAB receivers today already have the necessary hardware: a (text) display and keys for selecting DL messages to be output on the display.

Table B.1 lists informally a range of use cases, that differ in respect to the users expectations, the broadcasters target audience, the receiver requirements in hardware and software (for implementing the proper functionality).

The table lists the type of receiver terminal: Stereo/HiFi (sitting room), Portable (kitchen or bathroom), Pocket Radio (also with file storage: PMP=Personal Media Player, or combined with Pocket TV), Mobile Phone with DAB, Radio in PDA, Radio on a USB-Stick or on a PC-Card.

Each type addresses a specific user context:

- where is the user listening: at home in the sitting room, in the bath, in the car, on a train or other public transport, at his desk with a computer;

- does he expect daily entertainment with no need for any interaction, or does he want to always have a choice, with interaction, also with other media.

The table further lists which receiver resources are needed. So use cases are given for better presentation (A1), better access to the text information by making a selection (A2, B1, B2), support of rewind radio and recording (C1, C2), media and device integration (radio with TV and colour display, mobile phone (D1, D2a, D3a, D5; phone, SMS, MMS, Internet), PDA, PCs (D2b, D3b, D4, D5; Internet: Websites, e-Mail, etc.).

Table B.1: Use cases

Case	Receiver Terminal	Resources needed (including DL Display)	Function	User: Expectations and actions
A1	Stereo HiFi, Car Radio, Portable	Toggle Key for switching between DL and DL Plus	See figure B.2: **Display of Title, Artist, Composer**; static template; a display with higher resolution allows presentation of additional DL Plus information (ITEM.COMMMENT); user can **switch between DL and DL Plus mode**. Display could also be integrated on the remote control (e.g. of the HiFi-stereo receiver)	User gets **most important information about current programme item**; strong user requirement for this information, he can expect this with every MP3 player, many satellite radios, etc.; now this information is also available in DAB! **User observes display from time to time** or in case of unknown items; **no interaction with the receiver**; main focus is on music or on other activities (like car driving, etc. with radio as background entertainment)
A2	Stereo HiFi, Car Radio, Portable (Pocket Radio)	1 dimensional navigation (rotary control + selection key; or equivalent tool)	User can **configure his DL Plus terminal**: selects content types of his interest (bookmarks/favourites); default content types: category item; **terminal displays the information that has been preselected** (and so is most interesting for the user)	**User interacts with the receiver only during its configuration**; then, in normal use situations, user observes display from time to time or in case of unknown items; but no further interaction with the receiver needed, same as in case A1
B1	Pocket Radio; or Radio combined with mobile phone, PC or PDA	menu driven (soft keys)	See figure B.1 (including explanations):Terminal offers **(inter-) active navigating through Info** (and other current DL Plus objects of other content types; these should be organized in a **2-level hierarchy**: navigation through **categories first**, **then** through **content types** of selected category; object aggregation in tables would allow **3rd level of hierarchy**: browsing through a table with keyword for selections: menu presentation always in a fixed order, e.g. like in table A.1 in annex A; **menu items only presented if DL Plus objects** of that content type **have been received**; book-marking in addition would allow a user-defined order and selection of favourites	User wants to **browse through the latest news, so he requests information interactively**; audio may have less focus, may be used for background entertainment. Later on, after news reading, user will resume his earlier activities (radio listening, etc.). All categories of content type are adapted to users' interest, category Info is best suited
B2	Pocket Radio, Stereo HiFi, etc.	1 dimensional navigation (rotary control+ selection key; or soft keys)	Terminal produces a **playlist**, e.g. of the last 10 music items; items are provided with time stamps and **ISRC-Identifier**; user can initiate the persistent storage of the identifier, for later retrieval	**User focus is on the programme items**, user is ready to actively pursue his specific music interests; **can be used e.g. in a music shop to find the product; he then can easily buy the item**
C1	Pocket Radio, Portable, car radio, mobile phone radio	2 or 4 keys for step or (re-) wind (backwards & forwards); audio storage for 20 minutes or so	Based on the principle of **Rewind Radio**: item running and toggle bits allow the receiver to find the cue marks of the audio. This allows the user to **step from item to item** (this is far more convenient than continuously browsing through the audio). The title information and other item related DL Plus objects **allow selection of (audio) items by title**	**User needs time shift**: Urgent home activities prevents him from linear listening; or he has an incoming telephone call, or is distracted by driving a car etc.; in such a use case he can resume listening later on; another scenario is: the user listens to a CD during the news programme, later on he can **step (inter-) actively through the stored news, advance directly to the most interesting news** (and skip the others)

Case	Receiver Terminal	Resources needed (including DL Display)	Function	User: Expectations and actions
C2	Pocket Radio	same as in C1, integration with a PMP (Personal Media Player)	Function in addition to C1: if user decides so during listening, he can initiate recording by pressing recording key, **programme items are persistently recorded**, together **with all item related information**, in ID3 format; recorded material has same visual appearance on the display as any MP3 material. (Rewind functionality would allow that persistent storage could be initiated later, even when in the meantime other items are already on air) This feature could also be used for a complete programme to be recorded	User can take more benefit from radio programmes by repeating the highlights of a programme, so this strengthens his link to the programme **The user is offered more freedom in selecting interactively the highlights; this interactivity prevents him to replace radio by other, e.g. interactive, media**
D1	Mobile Phone radio	Backchannel via Mobile Phone	DL Plus objects (category Interactivity) carry SMS and telephone numbers, web addresses; after selecting a telephone number from the list (i.e. after navigating through DL Plus objects of category "Interactivity") **one key stroke ("red button") activates the telephone call**	**User participation in the activities of a live programme** (phone in, SMS chat, voting), so listeners are becoming members of the radio community
D2a	Mobile Phone radio	Backchannel via Mobile Phone and easy text input	Receiving **chat messages** as DL objects CHAT via DAB, writing **replies via SMS** to a chat centre of the radio show, the SMS-number of which is forwarded automatically as DL Plus object to the dial function of the mobile phone	SMS Chat, chat conference: the host of the radio show initiates SMS chat by sending text as DL. Listeners contribute to the chat by sending their replies by SMS to the chat centre. The **replies will be broadcast as DL to whole community** and will find broad attention. **Contributor of smart SMS messages could be called instantaneously and interviewed**
D2b	(Pocket) radio linked via USB to PC	Backchannel via internet	Like D2a, the only difference: The chat replies are sent using a PC-radio and an internet link	Like D2a
D3a	like D1	Backchannel via Mobile Phone and with easy numerical (or text) input	**Voting** requires similar functions like chat: A question concerning the vote is received as DL Plus object and displayed to the user. His answer is sent by SMS	Voting, like SMS Chat, **supports the live character of radio**. A simple question with possible answers yes/no or 1/2 is swiftly answered, the **votes are easy to collect and immediately published**. Could also be used with riddles, 10€-Questions, etc.
D3b	(Pocket) radio linked via USB to PC	Backchannel via internet	Like D3a, the only difference: Votes are send via PC and an internet link (instead of mobile phone)	Like D3a
D4	Mobile Phone, Radio in PDA or (Pocket) Radio linked via USB to PC	Mobile Phone channel or stationary internet link	If a stationary internet link is available (instead mobile phone), **user can respond by e-mail or via websites directly and without delay**. User can find **extra information to any issue** which is **identified by a web address and by a content type** (all categories and classes): simply one key stroke acts as hyper link for the browser	During live broadcasting, the user is directed to the website of the broadcaster with additional information. **The radio service** and the **internet presentation** of a programme provider **are aiming at an integrated media experience**
D5	Mobile Phone, Radio in PDA or (Pocket) Radio linked via USB to PC	Mobile Phone channel or stationary internet link	**Programme items** (especially music items), **tickets** for events, and **articles** announced during advertisements, **can be ordered and purchased**, either by visiting the appropriate website or by a SMS-number. Public broadcasters may also provide some of their music items etc. free of charge	**Convenience by easy and spontaneous ordering**

Category (A)	Content Type (B)		Display (D)	Descriptor	Web Browser

ITEM

DL Plus

Info

(0)

Interactivity

Playlist (1)

Title (2)

Artist (3)

Comment

News (4)

Event

SMS Studio

Hotline mail (5)

Chat (6)

ChatCentre(7)

Keyword (C)

Politics

Science

Culture

A very famous song

Big Celebrity

Politics:

Get It!

More Info?

Our offer: 1€!
Do you really want it?
So click…..

Big Celebrity was born
in Somewhere etc.

Descriptor

Web Browser

"I love your music, and
Christina too!"

Chat
Centre (7)

To: Broadcaster
Ref: Radio Show R1
Please play more hip...

Mail Client

D2: "Congratulations
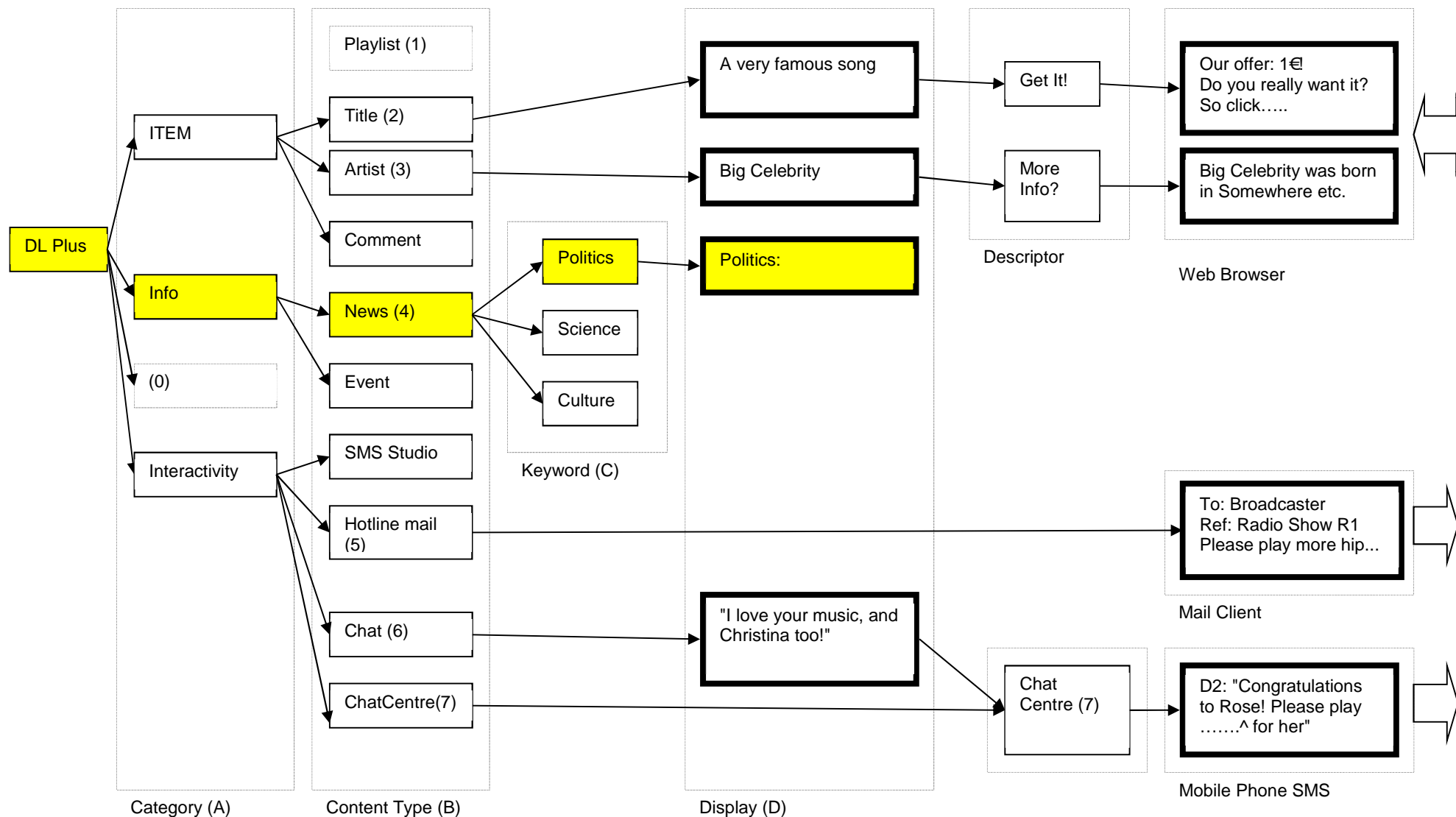to Rose! Please play
…….^ for her"

Mobile Phone SMS

**Figure B.1: Navigation through DL Plus objects stored in a receiver; Display of DL Plus objects; Display of linked applications:
Web Browser, Mail Client, SMS Client**

B.2   Examples for navigation and display use

Figure B.1 shows the browsing through DL Plus objects stored in the receiver. A 2-dimensional cursor key is assumed; left/right: hierarchy; up/down: select in the menu of that hierarchy; could be of 2-dimensional cursor or a 1-dimensional rotary control with selection key.

User selects navigating through a 2- or 3-level hierarchy tree (A: Category; B: Content Type; C: optional keyword). User will be informed about selected branches in his display, as notated in the following lines for some examples, leading number refers to selected Content Type in figure B.1:

- (0)   If no DL Plus object of category PROGRAMME is available, the receiver does not offer this menu item (not visible or shadowed).

- (1)   ITEM/Playlist: Display: xyz (Menu item Playlist is no DL Plus object, but may be inserted here in case of a receiver with history function).

- (2)   ITEM/Title/Display: xyz; / "GetIt!" With activating Descriptor PURCHASE, it will start web browser which will then be used for further navigation, including ordering, paying, etc.

- (3)   ITEM/Artist/Display: xyz; / "More Info?!" With activating Descriptor GET_DATA, it will start web browser which then will be used for further navigation on websites linked to the topic.

- (4)   Info/News/Politics/Display: xyz; (Example marked in yellow, here keyword used; because broadcasters uses those and provides them inside the DL Plus objects of class NEWS).

- (5)   INTERACTIVITY/HOTLINE.EMAIL: Mail client is started with the proper e-mail addresses (e.g. for destination).

- (6)   INTERACTIVITY/CHAT: DL Plus object of Class CHAT, with latest Chat text on mobile phone display; if listener likes to, he then can activate SMS software and send his SMS to the proper number.

- (7)   INTERACTIVITY/CHAT.CENTRE: A user might be motivated by the audio broadcasting to send an SMS to the Chat Centre; by selecting the appropriate menu item, mobile phone will start of SMS software to send SMS.

Figure B.2 shows the most simple, nevertheless one of the most import use cases (A1): Display of title and artist, together with the DL (may be scrolling in case of insufficient display size; no selection necessary).
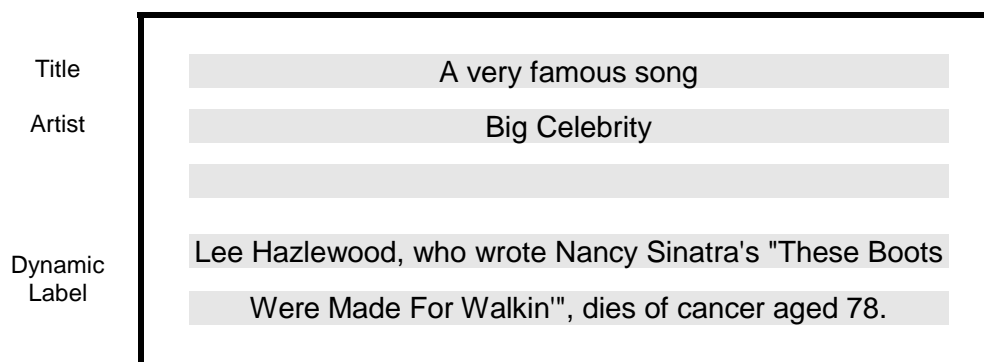
Title	A very famous song
Artist	Big Celebrity
Dynamic Label	Lee Hazlewood, who wrote Nancy Sinatra's "These Boots Were Made For Walkin'", dies of cancer aged 78.

**Figure B.2: Display with DL Plus and Dynamic Label and configured
to show title and artist information**

B.3   Prioritization

Broadcasters offer their programme content to listeners with a wide range of sometimes diverging interests. DL Plus helps to direct the DL information to the right and interested listener. So broadcasters will use DL Plus to provide as many as possible of them with a wide spectrum of information.

Information on programme item (DL Plus object of category ITEM) is felt as most important. This information is available in every studio and can be sent as DL Plus easily. DAB receivers with display should have no implementation problems. Receiver manufacturers should consider updating the software of the receivers they have already on the market.

Information contained in the DL Plus objects of Category INFO, PROGRAMME and PRIVATE can be displayed as easily as item related information.

Item based rewind radio with segment-wise stepping and item based recording seems very attractive, for broadcasters and listeners. Receiver manufacturers should consider upgrading their rewind radio concept balancing the additional complexity and the market potential.

Mobile phones with DAB, pocket Radios with a USB or wireless interface, PDA Radios and USB-Stick Radios allow to integrate the Radio medium with the (stationary, home based) Internet-Websites. Broadcasters have already now a lot of radio associated data in the web that could be used (by evaluating DL Plus objects of category INTERACTIVITY). These efforts will be reinforced when more receivers of this type are on the market and the listener will ask for it.

Annex C (informative):
DL Plus and the compatibility with RDS/RT+

DL Plus offers equivalent functionality as RT+ (together with the feature RDS RadioText (RT), see IEC 62106 [2]) that is defined and in use for analogue FM-broadcasting.

A broadcaster may broadcast the same programme on FM and DAB simultaneously. He then can offer the same service with RT+ and DL Plus using the same studio equipment with the same interfaces generating basically the same signal, provided he takes into account that the features of DL Plus cannot be used to the full extent, i.e. the RT+/DL Plus generator is restricted to the limits that are allowed for RT+ (see table C.1). RT+ is limited to 64 characters per RT message, to 64 content types and to 2 tags per RT message. In RT+ the tags cannot mark overlapping text, i.e. the corresponding DL Plus objects cannot overlap. Some RT messages will be marked with tags of one or even two dummy content types.

Table C.1: Comparison of RT+ and DL Plus features

Feature	RT+	DL Plus
Text length (in characters)	64	128
Object/Text overlapping	no	yes
Number of tags/objects per RT/DL message	2	1 to 4
Number of content types	64	128
Template number signalling	yes	no
Server Control bits	yes	no
CB flag (template is available)	yes	no
Extendable	yes	yes
DL Plus commands, ODA 3A/	3 bits	yes
RDS/RT+ Application Group	no	
UECP Message Element Code		
RT/DL	MEC0A	MECAA
ODA/DL Plus command	MEC46	MEC48

DL Plus with text length up to 128 characters allows for more complex messages. However, the text length should not mislead a broadcaster to combine different pieces of information to one message. While simulcasting with RT+ the message is restricted to 64 characters in any case. The data rate is, with both RT and DL, limited by the reading speed of the user, not by the message length. RDS has more limitations in respect to the data rate and the error robustness, so that normally the text speed is significantly lower than the reading speed.

The RT+ generator provides the RT+ information to the RDS-Coder applying the UECP protocol.

If the UECP protocol is used also for interfacing the DL Plus generator (information source) with a PAD-multiplexer for data insertion, then the message field of the UECP command (MEC 48) will be copied transparently to the parameter field of the DL Plus commands.

Receiver manufacturer can reuse the same functionality of RT+ and DL Plus for implementation of FM and DAB radios. This is of greatest importance because combined FM/DAB receivers are required in all countries. This is also of importance for the user, who expects to have this functionality with FM/RDS as well as with DAB radios.

Annex D (informative):
Bibliography

- RDS Forum R06/040_1: "RadioText Plus (RT+); Specification (Version 2.1)".

- RDS Forum SPB 420: "UECP RDS Universal Encoder Communication Protocol".

History

Document history		
V1.1.1	September 2008	Publication
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