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Edition 2.0 2023-05
REDLINE VERSION

INTERNATIONAL STANDARD

colour inside

Radio data system (RDS) – VHF/FM sound broadcasting in the frequency range from 64,0 MHz to 108,0 MHz –
Part 6: Compilation of technical specifications for Open Data Applications in the public domain

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IEC Secretariat
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

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RADIO DATA SYSTEM (RDS) – VHF/FM SOUND BROADCASTING IN THE FREQUENCY RANGE FROM 64,0 MHz TO 108,0 MHz –

Part 6: Compilation of technical specifications for Open Data Applications in the public domain

FOREWORD

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This redline version of the official IEC Standard allows the user to identify the changes made to the previous edition IEC 62106-6:2018. A vertical bar appears in the margin wherever a change has been made. Additions are in green text, deletions are in strikethrough red text.

IEC 62106-6 has been prepared by technical area 1: Terminals for audio, video and data services and contents, of IEC technical committee 100: Audio, video and multimedia systems and equipment. It is an International Standard.

This second edition cancels and replaces the first edition published in 2018. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) Annex E: coding of station logo
b) Annex F: coding of slideshow
c) Annex G: coding of internet connection.
d) Annex H: ODA tool – RDS data stream NFM

The text of this International Standard is based on the following documents:

Draft	Report on voting
100/3807/CDV	100/3871/RVC

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

A list of all parts in the IEC 62106 series, published under the general title *Radio data system (RDS) – VHF/FM sound broadcasting in the frequency range from 64,0 MHz to 108,0 MHz*, can be found on the IEC website.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

Since the mid-1980s a fascinating development has taken place. Most of the multimedia applications and standards have been created or redefined significantly. Hardware has become extremely powerful with dedicated software and middleware. In the mid-1980s, Internet as well as its protocols did not exist. Navigation systems became affordable in the late 1990s, and a full range of attractive smartphones now exist. The computing power of all these new products is comparable with that of the mainframe installations in that era.

Listener expectations have grown faster than the technology. Visual experience is now very important, like the Internet look and feel. Scrolling text or delivering just audio is nowadays perceived as insufficient for FM radio, specifically for smartphone users. New types of radio receivers with added value features are therefore required. RDS has so far proven to be very successful.

FM radio with RDS is an analogue-digital hybrid system, which is still a valid data transmission technology and only the applications need adaptation. Now the time has come to solve the only disadvantage, the lack of sufficient data capacity. With RDS2, the need to increase the data capacity can be fulfilled.

RDS was introduced in the early 1980s. During the introductory phase in Europe, the car industry became very involved and that was the start of an extremely successful roll-out. Shortly afterwards, RDS (RBDS) was launched in the USA.

The RDS Forum has investigated a solution to the issue of limited data capacity. For RDS2, both sidebands around the RDS 57 kHz subcarrier can be repeated a few times, up to three, centred on additional subcarriers higher up in the FM multiplex while still remaining compatible with the ITU Recommendations.

The core elements of RDS2 are the additional subcarriers, which will enable a significant increase of RDS data capacity to be achieved, and then only new additional data applications will have to be created, using the RDS-ODA feature, which has been part of the RDS standard IEC 62106 for many years.

In order to update IEC 62106:2015 to the specifications of RDS2, IEC 62106 has been restructured as follows:

Part 1: Modulation characteristics and baseband coding

Part 2: RDS message format, coding and definition of RDS features

Part 3: Usage and registration of Open Data Applications ODAs

Part 4: Registered code tables

Part 5: Marking of RDS and RDS2 devices

Part 6: Compilation of technical specifications for Open Data Applications in the public domain

~~The following future parts are planned:~~

Part ~~7~~9: RBDS – RDS variant used in North America

Part ~~8~~10: Universal Encoder Communication Protocol UECP

NOTE 1 The Part numbers 7 and 8 will not be used.

The original specifications of the RDS system have been maintained and the extra functionalities of RDS2 have been added.

~~Obsolete or unused functions from the original RDS standard IEC 62106:2015 have been deleted.~~

RADIO DATA SYSTEM (RDS) – VHF/FM SOUND BROADCASTING IN THE FREQUENCY RANGE FROM 64,0 MHz TO 108,0 MHz –

Part 6: Compilation of technical specifications for Open Data Applications in the public domain

1 Scope

This part of IEC 62106 contains the technical specifications for Open Data Applications in the public domain. This document is maintained by the RDS Forum Office. The RDS Forum Office applies an easy procedure for registering new Open Data Applications, to ensure that they can be used without the need to change the RDS standard. The ODA feature permits defining new applications that can be decoded on a receiver. The receiver needs to the adequate software handler for the specific AID, which identifies the application. Receivers that have not implemented the software handler needed for decoding are not affected by ODA data received for any of the applications already defined and specified.

The procedure for registering a new ODA is described in IEC 62106-3.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

~~IEC 62106 (all parts), *Radio data system (RDS) – VHF/FM sound broadcasting in the frequency range from 64,0 MHz to 108,0 MHz*~~

IEC 62106-1, *Radio data system (RDS) – VHF/FM sound broadcasting in the frequency range from 64,0 MHz to 108,0 MHz – Part 1: Modulation characteristics and baseband coding*

IEC 62106-2:2021, *Radio data system (RDS) – VHF/FM sound broadcasting in the frequency range from 64,0 MHz to 108,0 MHz – Part 2: Message format: coding and definition of RDS features*

IEC 62106-3, *Radio data system (RDS) – VHF/FM sound broadcasting in the frequency range from 64,0 MHz to 108,0 MHz – Part 3: Usage and registration of Open Data Applications (ODAs)*

IEC 62106-4, *Radio data system (RDS) – VHF/FM sound broadcasting in the frequency range from 64,0 MHz to 108,0 MHz – Part 4: Registered code tables*

ISO/IEC 10646, *Information technology – Universal Coded Character Set (UCS)*

ISO 14819 (all parts), *Intelligent transport systems – Traffic and travel information messages via traffic message coding*

3 Terms, definitions, abbreviated terms and conventions

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62106-1 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.2 Abbreviated terms

For the purposes of this document, the abbreviated terms given in IEC 62106-1 and IEC 62106-2 apply.

3.3 Notation and conventions

The notation and conventions given in IEC 62106-1 apply.

4 ODAs in the public domain

4.1 ODAs in the ~~37 bit ODA application~~ group type A structure

4.1.1 Traffic Message Channel (TMC)

This ODA has been standardized in ISO 14819 (all parts).

4.1.2 Other public ODAs

There exist four other public ODAs:

- Annex A: Coding of RadioText Plus (RT+) tagging information for RadioText in group type 2A/B.
- Annex B: Coding of RadioText Plus (RT+) tagging information for enhanced RadioText (eRT).
- Annex C: Coding of enhanced RadioText (eRT) using UTF-8 coding as standardized in ISO/IEC 10646.
- Annex D: Coding of AF lists in the frequency range 64,1 MHz to 107,9 MHz.

4.2 ODAs in the group type C structure for the upper data-streams 1, 2 and 3

~~Such applications are still under development.~~

Three public ODAs exist in this category:

- Annex E: Coding of Station logo
- Annex F: Coding of Slideshow
- Annex G: Coding of Internet connection.

5 Protocol to stream RDS on bearers different from FM (NFM)

The NFM protocol is specified in Annex H. It is an ODA development tool.

Annex A
(normative)

Coding of RadioText Plus (RT+) tagging information for RadioText in group type 2A/B

A.1 General

RT+ is designed to let the listener (or user) take additional benefit from the RadioText (RT) service by enabling receivers to offer direct access to specific elements of RadioText messages (e.g. to the title of the broadcast song transmitted at the same time, to news, to telephone numbers such as those used for voting, to web addresses for browsing web content offered by the radio programme provider, etc.).

These RT+ messages carried in the RadioText messages are identified by their location within the message and by the class code of their RT content type (see Table A.2). Thus, a receiver is able to store the different RT+ messages, and the listener may then select and request a specific content type from the storage at any instant in time that fits the user's needs. The advantage of this method is that a user is no longer forced to watch a lot of information passing by. The listener rather gets the opportunity to select specifically any favourite information to be shown on a static display.

Moreover, RT+ gives the possibility to present selected RT message elements to car drivers on a quasi−static display without any major risk of distracting the attention of the driver. Furthermore, RT+ is well suited for mobile phones with built-in RDS FM receivers: telephone numbers may be routed directly from the RadioText to the dialer.

RT+ is based on RT messages and is completely backwards compatible. All additional information necessary for implementing the RT+ service is carried as an Open Data Application in group type 3A and in an associated ODA application group (see Table A.1).

The Application Identification (AID) assigned to RT+ for RT in group type 2A/B is 0x4BD7.

Table A.1 – RT+ information elements for RT

RT+ information elements		
RT message	**RT+ identification**	**RT+ tags**
Group type 2A/B (see IEC 62106-2)	AID in group type 3A	ODA application group type A

A.2 Terms used

Category: The 'RT content types' listed in Table A.2 are grouped into categories: Item (information on programme element), Info (general information services), Programme (information on the programme), Interactivity (related information), Descriptors (places and addresses, date, time, etc.) and Private classes (to be defined by individual broadcasters) and reserved codes for future amendments.

Descriptor: a category of 'RT content types' used for describing places and addresses, date and time, specific identifiers, etc.

Length marker: part of the RT+ information element which describes the additional length of the tagged RadioText message. Counted are characters (64 maximum), not bytes. The addresses of the RadioText characters range from 0 to 63.

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

RT+: an extension of the RT RadioText feature, which allows storing and filtering of parts of the RadioText messages in the receiver terminal as RT+ objects that then can be displayed, selected and accessed by the listener, also independently from the transmitted RadioText messages sent at the same time.

'RT content type': the content of an RT+ message is characterized by an RT+ class code, listed in Table A.2. Sixty-four different codes exist in this table.

RT+ information elements: these are all RT+ elements for any given RT+ message, i.e. the RT+ element defined for group 3A, the RT+ ODA application group elements and the corresponding tagged RadioText elements (RT).

RT+ message: the basic information entity that is sent by the broadcaster to the listener. The listener can select the RT+ messages by their content type.

RT+ content: the RT+ content consists of one or two tagged RadioText elements (RT in group type 2A/B).

RadioText: feature of RDS for providing a programme with text messages.

RadioText message: text messages that are associated with a programme. One single RT message is not likely to be sufficient for complete comprehension by the user.

Start marker: part of the RT+ information element which describes the start position (number found by counting the text character positions within a text string) of the respective tagged RadioText message element (RT).

A.3 RT+ tag

When a RadioText message like "You are listening to 'House of the rising sun' by Eric Burdon" is sent out, the RT+ information elements 'Title' and 'Artist' are marked by two RT+ tags.

An RT+ tag consists of three elements:

a) RT content type;
b) start marker pointing to the position (inside the RT) of the first character of that RT+ message;
c) length marker indicating the additional length (in addition to the character at the start position) of that RT+ message.

The 'RT content type' is taken from a list with 64 entries (see Table A.2).

For the example given below, the two tags are as follows:

RT content type	ITEM.TITLE
Start marker	22
Length marker	22

RT content type	ITEM.ARTIST
Start marker	50
Length marker	10

Start marker and length marker can be derived from the following scheme below:

```
You are listening to 'House of the rising sun' by Eric Burdon
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---
```

The addresses of the RadioText characters range from 0 to 63, so the start marker can take the same values.

The length marker is ranging from 0 to 63 and from 0 to 31 respectively (see A.5.3).

If two RT+ messages are contained in the RadioText, they shall not overlap.

The tag information sent out should not change during the lifetime of the associated RadioText.

A.4 RT+ information elements and data model

A.4.1 General

The content of RT+ messages is carried in the RadioText (RT) messages. Their content is described by RT content type code (see Table A.2) in each RT+ tag.

A.4.2 List of RT content types

The list of defined RT content type codes, grouped in categories, is given in Table A.2. There are 64 RT+ classes of content type available, which a programme service provider can offer and the listener can select from, each with a specific RT+ class. The classes can be grouped into the following categories.

a) Item

The programme is made up of a sequence of programme items (see NOTE), corresponding to an entry in a programme schedule. A programme item may consist again of several programme elements. For all programme elements which can be designated by RT+ classes of the category "Item" in Table A.2, this document uses the term "Item". In popular music programmes, an item is a song; in a programme with classical music, it ~~may~~ can be a complete symphony. A speech-based programme item may also be assembled from different items (see the NOTE below). Programme elements like News and Talk as shown in Figure A.2 and Figure A.3 are not "Items", as there do not exist any appropriate RT+ classes of the category "Item" in Table A.2. A programme item can be described by one, several or even all classes of this category, but for the duration of the "Item", the associated RT+ message of each class can only have a single value, for example the RT+ message classified as "Item". "Title" will remain fixed to "House of the rising sun" until the start of the next song.

NOTE A programme item can consist of only one element (e.g. radio drama) and can also be designated by RT+ classes of the category "Item" in Table A.2.

b) Info

RT+ messages of this category carry textual service information that is more or less unrelated to the audio service, but is offering important additional information to the listener, including info about alarms, advertisements and events.

c) Programme

RT content types of this category describe the programme service.

d) Interactivity

Telephone numbers, short message text SMS used for mobile phone services addressed with SMS numbers, e-mail addresses or web addresses (URLs) are given. The listener ~~may~~ can send contributions for chat conversations to a chat centre. These contributions ~~may~~ can

be broadcast by the radio station. Questions for voting may be sent as RT+ content. The listener ~~may~~ can send a response back to the voting centre.

e) Private classes

While all other RT+ classes describe precisely the RT content type, also to permit their interpretation by automatic routines within the receiver terminal or by a human user, the Private classes can be freely defined just as required for a specific programme service provider. The interpretation is then dependent on the programme service and does require a template on the receiver terminal. Alternatively, a program provider may supply his customers with special receivers, where the facilities to interpret own Private classes are already built in. In this particular case, no template is required.

f) Descriptors

An RT+ message belonging to one of the categories above can be complemented by an information element of the category Descriptor. Both shall always be transmitted in the same RadioText just as the corresponding tags in the same application group. As an example: the Descriptor GET_DATA contains the URL-address or the SMS number for retrieving more data describing the RT+ message the Descriptor is referring to. The listener can then get access to more information for the music item, special news, events, etc.

A.4.3 Structures of RT+ messages

For some classes, RT+ messages may be structured by the programme service provider following a general pattern, for example results of football matches may be given as RT content type INFO.SPORT with two parts, one indicating the match and the other the result.

"Bayern München:AC Milano 5:5"

This specification generalizes the scheme given above as follows:

The two different parts are separated by two or more consecutive space characters (see NOTE below), that are redundant spaces. The redundant spaces serve as a delimiter between these two parts. The first part is called the key word and will be used primarily for explanation of the text which follows.

NOTE In the examples given in this text, a space character is represented by the symbol "␣".

The key word carries an explanation for the user, whereas the second part may also carry a phone number, the SMS- or MMS-telephone number or the email address to be contacted.

This scheme permits an advanced receiver to accumulate all information (carried in the sequence of RT+ messages of the same RT content type) and then to build one table for presentation to the user.

This scheme may be used for the categories 'Info', 'Programme', and 'Interactivity', and shall not be used for the categories 'Item' and 'Descriptor' for the specific RT+ classes, identified in Table A.2 with footnote d.

For explanation, the following examples are given for different classes, first lines indicating the structure, and then a line giving a specific example:

- INFO.STOCKMARKET

  [Name␣␣Latest value in €] or more extended:

  [Name␣␣Latest value in €␣␣Change␣␣High␣␣Low␣␣Volume] e.g.

  'Nokia␣␣12,27␣␣0,41␣␣12,31␣␣12,15␣␣23 332 238'

- INFO.SPORT

  [Match␣␣Result] or more extended:

  [Kind of sport␣␣Match␣␣Result] e.g.

'Football␣␣Bayern München:AC Milano␣␣5:5'

- INFO.WEATHER
  [Description␣␣Temperature] e.g.
  'Raining␣␣16 degrees C' or
  'Munich␣␣23 degrees C'
- Interactivity
- PHONE.OTHER
  [Description␣␣Phone Number] e.g.
  'Deutsches Museum␣␣089323990'

If it makes sense, elements may be omitted from the right in a given structure

(e.g. INFO.STOCKMARKET: 'Nokia␣␣12,27␣␣0,41␣␣12,31␣␣12,15')

Alternatively, the description of the classes PHONE.OTHER, SMS.OTHER, EMAIL.OTHER and MMS.OTHER may be put into tag 1 and the second part, i.e. the phone number or the address, will be put into tag 2. This then gives the text editor more freedom to introduce some additional glue words in the RadioText message.

EXAMPLE 'The match Bayern München:AC Milano ended 5:5'

RadioText messages may contain several space characters for optimizing the layout in static displays. However, if the RT messages are used in context with an RT+ service, redundant spaces in parts marked by RT+, are only allowed for the purpose of delimiting two or more parts of the RT+ content.

A.4.4 Receiver data model

The RT+ feature is designed to allow a broad range of receiver models with different display capabilities and memory complexity to be used. The broadcaster may provide special radio skins (templates) for presenting RT+ information on the receiver display. Each programme provider may deposit various templates for different programme types on a web server (to be defined). This web server can be addressed by the receiver for downloading a particular template (see also A.5.2). This requires the receiver to be able to download actively external data (pull information by unicast, for example to download templates using a telephone connection).

A simple receiver will store a small selection of RT+ classes only. The storage will contain only the current content of the 'RT+ classes'. The storage of a given class will be overwritten by a new version of that same class. The receiver may offer a choice to the listener to enable a selection of any particular 'RT+ class' to be presented on the display. For example, a listener ~~may~~ might want to see one or several 'RT+ classes' of the category 'Item' simultaneously, i.e. 'Title' and 'Artist' of the 'Item' received at that moment.

More complex receivers will store not only the current content of several classes, but will use a memory to keep the information collected during the past. For reviewing the list of earlier received 'Items', it is essential for the receiver that it can combine the different RT+ information elements (received at different times) correctly, so that elements of different 'Items' are not mixed. For that purpose, an 'Item toggle bit' changes every time a new 'Item' starts and the 'Item running bit' indicates whether the 'Item' is still running. Both bits are sent continuously together with every pair of the RT+ tags.

The examples in Figure A.1, Figure A.2 and Figure A.3 show the setting of the 'Item toggle bit' and the 'Item running bit' for different audio sequences.

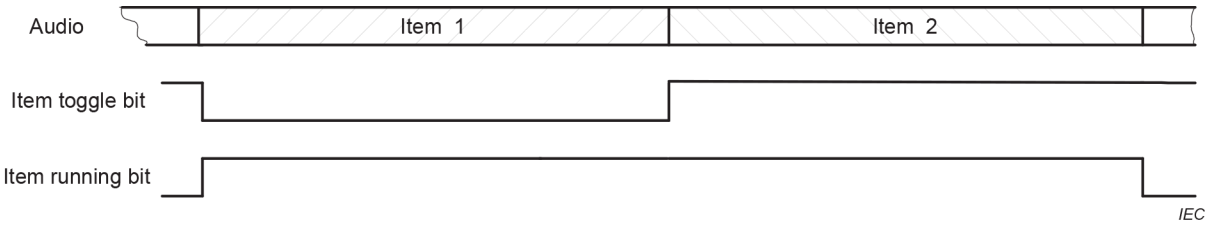

Figure A.1 – Example 1: RT+ information of the category 'Item' (see Table A.2) will be attached to the programme elements Item 1 and Item 2

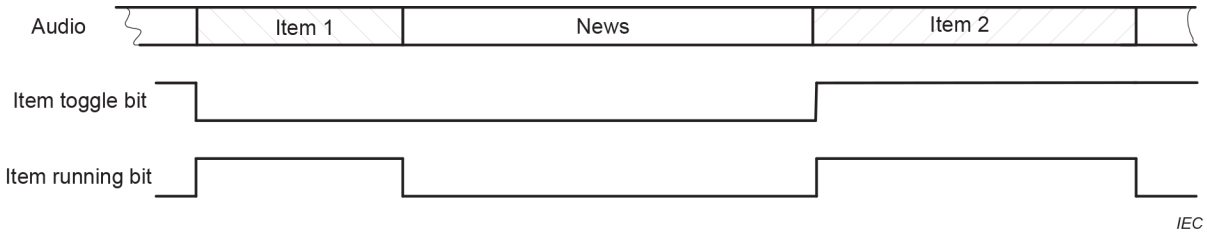

Figure A.2 – Example 2: RT+ information of the category 'Item' will be attached to the programme elements Item 1 and Item 2, but not to the programme element News

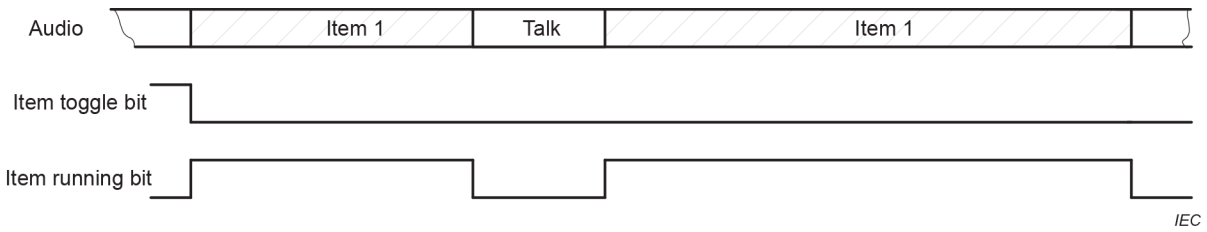

Figure A.3 – Example 3: RT+ information of the category 'Item' will be attached only to the programme element Item 1, but not to the programme element Talk

Receivers can provide more convenience by assembling an ordered cumulative list of all RT+ content of a specific class. For example, the class INFO.SPORT may be displayed as a list of the football match results. This is easy to implement for those classes of the category 'Info' that use redundant space characters as a delimiter between several parts of the text. The first part, the keyword, can then be used to establish a table which is ordered according to the keywords. Updating is also possible, if the keyword is not changed.

NOTE 1 The broadcaster can set the 'Item toggle bit' and the 'Item running bit' as required.

NOTE 2 The default setting for both the 'Item toggle bit' and the 'Item running bit' is '0'.

A.5 RT+ coding for RT

A.5.1 General

To transmit the RT+ tags, the ODA feature is used and the necessary details are defined by A.5.2 to A.5.4.

The message bits of group type 3A in block 3 carry control data for the application AID 0x4BD7 in block 4. The tag information, to identify the RT+ messages within the RadioText, is carried by the RT+ ODA application group, signalled in block 2 of the 3A group. Only type A groups can be used for the application group.

A.5.2 RT+ identification (group type 3A)

The coding of the message bits in group type 3A and the Application Identification (AID) for the ODA RT+ is shown in Figure A.4.

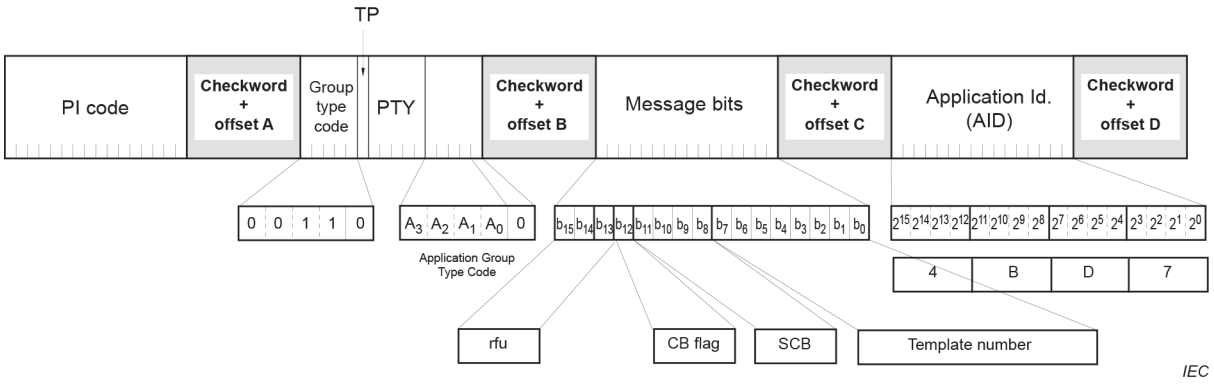

Figure A.4 – Bit allocation for group 3A (message bits and AID)

Application group type code:

- The group type for transmitting the RT+ application data can be chosen from IEC 62106-3.
- The group type code is signalled in block 2 of the 3A group.

The meaning of the message bits of group type 3A is as follows:

a) rfu

Reserved for future use, and not affecting any of the functions of the other bits. The rfu bits shall be set to zero until they are defined.

b) CB flag

The CB flag gives the information, if there is a template available for the ongoing programme. The template may already be present in the receiver (downloaded previously) or can be downloaded at that moment, if the user wants it. The identification of the desired template is accomplished by sending back from the receiver terminal to the web server the PI code and the Extended Country Code (ECC), the 'Server Control Bits' and the 'Template number'.

If the CB flag is set to '0', no special radio skin (template) is available and 'Server Control Bits' and 'Template number' bits are reserved for future use.

If the CB flag is set to '1', a special radio skin (template) is available for the ongoing transmission.

c) Server Control Bits (SCB)

It ~~may~~ can occur that the same PI code is used repeatedly within a national area (e.g. for local programme stations far away from each other). In these cases, the Server Control Bits are used to distinguish between programmes using the same PI code.

NOTE The Server Control Bits are allocated by the operator of the web server.

d) Template number

The Template number gives the number of a specific template, from a choice of templates provided by the broadcaster. Up to 256 templates per programme service can be addressed.

A.5.3 Coding of the RT+ tag

The coding of the message bits of the application group is shown in Figure A.5.

In the message bits of the RT+ application group two RT+ tags are conveyed. All 'RT+ classes' or 'RT content types' can be put into the one or the other tag of the application group. If an RT+ message contains more than 32 characters, the associated tag information shall be coded in tag 1. Content types of the category 'Descriptor' are always referring to the content type in the other tag (in the same application group) and this gives additional information.

The start addresses in the tags may be chosen according to the needs during the RT generation. Therefore, the sequence of the tags in the application group does not determine the sequence of the information elements in the RT.

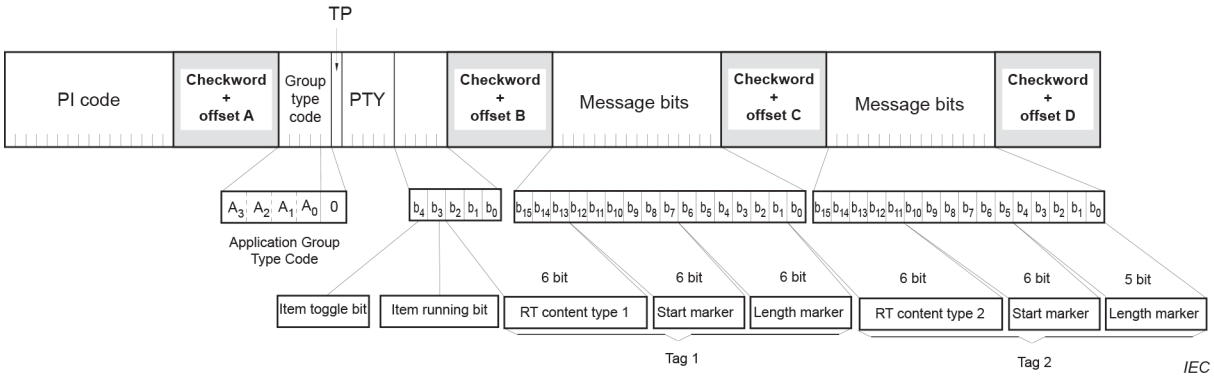

Figure A.5 – Coding of the message bits of the application group

The meaning of the message bits is as follows:

a) 'Item toggle bit'

This bit shall be toggled when a new 'Item' starts.

NOTE 1 Item means a specific programme element (see also A.4.2 and Table A.2).

b) 'Item running bit'

This bit shall be set to 1 if an 'Item' is running. Otherwise, it shall be set to 0.

NOTE 2 The 'Item toggle bit' and the 'Item running bit' will be set or reset independently from the tag information sent out at the same time.

NOTE 3 In the receiver, these two bits can be used to group all 'RT/eRT content types' of the category 'Item' sent for one item and store them in memory (subsequently for several items) or, when storing and presenting information for only one item, to delete all information belonging to the elapsed item before starting to gather information for the new one.

NOTE 4 Even though not intended by this document, these bits can be used for recording purposes.

c) 'RTcontent type'

This 6-bit value specifies the tags by assigning to them a content type according to the 'RT+ class' codes given in Table A.2. If only one RT+ information element (tag) is used, then the content type in the second tag shall be set to 'Dummy'. If no RT+ information element is existing, the content type in both tags shall be set to 'Dummy'. In both cases, the bits in the start and length markers are then undefined.

d) Start marker

This 6-bit value indicates the position of the first character of the RT+ message within the RadioText (start marker 0 means the first character in the RadioText).

e) Length marker

This 6-bit (or 5-bit for length marker in tag 2) value gives the additional length (number of characters following the first character at the start position) of the RT+ message.

As it is not permitted that RT+ messages overlap, only one element may comprise more than 32 characters and 5 bits are then sufficient for coding the length marker in tag 2. Flipping of the two tags is permitted if the second RT+ information element exceeds 32 characters but the first is under 32.

A.5.4 Clearing of RT+ messages

There is no specific clear command. Clearing will be done by overwriting the content of a 'RT+ class' with one or more space(s) taken as RT+ messages out of the current RadioText. This assumes that the RadioText in transmission contains at least one space character and at least one tag is unused and available to address the class to be cleared.

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---
```

'RT content type'	PHONE.HOTLINE
Start marker	9
Length marker	9

'RT content type'	INFO.NEWS
Start marker	8
Length marker	0

The second tag information (transmitted simultaneously with the RadioText 'Hotline: 0123456677') will cause the previously sent message of the class INFO.NEWS to be deleted.

If a class of the category 'Item' is cleared, all classes of category 'Item' shall be cleared.

Table A.2 – Code list and 'RT+ class' description of RT content types

Category	Code[a]	RT+ class	Description
Dummy	0	DUMMY_CLASS	To assign a class if the RadioText contains no RT+ information
Item	1	ITEM.TITLE [b]	Title of item, for example, track title of an album
	2	ITEM.ALBUM [b]	The collection name to which this track belongs
	3	ITEM.TRACKNUMBER [b]	The track number of the item on the album on which it was originally released
	4	ITEM.ARTIST [b]	A person or band/collective generally considered responsible for the work
	5	ITEM.COMPOSITION [b]	A complete composition (classical music broadcasters should use this item to identify the composition)
	6	ITEM.MOVEMENT [b]	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 [b]	The artist(s) who performed the work. In classical music, this would be the conductor
	8	ITEM.COMPOSER [b]	Name of the original composer/author
	9	ITEM.BAND [b]	Band/orchestra/accompaniment/musician
	10	ITEM.COMMENT [b]	Any comment related to the content
	11	ITEM.GENRE [b]	The main genre of the audio, for example 'classical', 'hip hop', 'jazz', 'oldies', 'drama', etc.

Category	Code[a]	RT+ class	Description
Info	12	INFO.NEWS	Message/headline
	13	INFO.NEWS.LOCAL	Local news
	14	INFO.STOCKMARKET [d]	Quote information; either as one part or as several distinct parts: 'name latest value␣␣change high ␣␣low ␣␣volume' [c]
	15	INFO.SPORT [d]	Result of a game; either as one part or as several distinct parts: 'match ␣␣result', for example 'Bayern München: Borussia ␣␣5:5'
	16	INFO.LOTTERY [d]	Raffle/lottery: 'key word ␣␣values'
	17	INFO.HOROSCOPE [d]	Horoscope; either as one part or as two distinct parts: 'key word ␣␣text', for example 'sign of the zodiac ␣␣blablabla'
	18	INFO.DAILY_DIVERSION	Daily tip/diversion/joke
	19	INFO.HEALTH [d]	Information about health: 'key word ␣␣info'
	20	INFO.EVENT	Information about an event
	21	INFO.SCENE	Information about scene (hot locations to be, …)
	22	INFO.CINEMA	Information about movies in cinema
	23	INFO.TV	Information about TV-movies
	24	INFO.DATE_TIME	Information about date and time (receiver to choose between date and time). Not CT (Clock Time); shall not be used to set the internal clock of a device
	25	INFO.WEATHER [d]	Information about weather; either as one part or as two distinct parts: 'key word ␣␣info', e.g. 'Rain ␣␣17 °C'
	26	INFO.TRAFFIC	Information about traffic. This shall not replace TMC, but rather alert users in case of exceptional traffic news
	27	INFO.ALARM	Alarm information
	28	INFO.ADVERTISEMENT	Info about an advertisement. May be in parallel to an audio advertisement
	29	INFO.URL [d]	Link to URL either as one part or as two distinct parts: 'key word ␣␣url'
	30	INFO.OTHER [d]	Other information, not especially specified: 'key word ␣␣info'

Category	Code[a]	RT+ class	Description
Programme	31	STATIONNAME.SHORT	Name describing the radio station (call letters)
	32	STATIONNAME.LONG	Name describing the radio station
	33	PROGRAMME.NOW	EPG info programme now
	34	PROGRAMME.NEXT	EPG info programme next
	35	PROGRAMME.PART	Part of the radio show being broadcast; for example one or more parts of the PROGRAMME.NOW
	36	PROGRAMME.HOST	Name of the host of the radio show
	37	PROGRAMME.EDITORIAL_ STAFF	Name of the editorial staff; for example name of editorial journalist
	38	PROGRAMME.FREQUENCY [d]	Information about radio shows. A link towards another frequency with other content (not AF list). May be one part or two distinct parts: 'key word ␣␣frequency'
	39	PROGRAMME.HOMEPAGE [b]	Link to radio station homepage
	40	PROGRAMME.SUBCHANNEL [d]	For so-called multicasting applications; may be one part or two distinct parts: 'key word ␣␣sub-channel'
Inter-activity	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 [d]	Name and telephone number; either as one part or as two distinct parts: 'key word ␣␣phone number'
	44	SMS.STUDIO	The telephone number of the radio station's studio (to send directly an SMS to the studio)
	45	SMS.OTHER d	Name and SMS number; either as one part or as two distinct parts: 'key word ␣␣sms number'
	46	EMAIL.HOTLINE	The email address of the radio station's hotline
	47	EMAIL.STUDIO	The email address of the radio station's studio
	48	EMAIL.OTHER [d]	Name and email address; either as one part or as two distinct parts: 'key word ␣␣email address'
	49	MMS.OTHER d	Name and MMS number; either as one part or as two distinct parts: 'key word ␣␣mms number'
	50	CHAT	chat content: sent by users to a specific address and broadcast by the radio station
	51	CHAT.CENTRE	Address, where replies to the chat shall be sent (may be URL or SMS)
	52	VOTE.QUESTION	A question (typically binary) which can be answered by 'yes' or 'no' or '1' or '2'
	53	VOTE.CENTRE	URL or SMS number to send the answer to
rfu	54		Class reserved for future use
	55		Class reserved for future use
Private classes [e]	56		
	57		
	58		

Category	Code[a]	RT+ class	Description
Descriptor [f]	59	PLACE	Adds info about a location
	60	APPOINTMENT	Adds info about date and time
	61	IDENTIFIER [b]	For music it is the International Standard Recording Code (http://www.ifpi.org/isrc/)
	62	PURCHASE [b]	Address where item can be purchased, can be a URL or an SMS number
	63	GET_DATA	Retrieves either via an SMS or URL-link more data about the other RT+ message of the same RadioText message. (Info request via point to point, or unicast)

[a] This is the code to be used for 'RT content type' (see A.5.3); the decimal code shall be converted to the corresponding binary code.

[b] For this RT+ class, a corresponding MP3 ID3v2 tag exists.

[c] ␣ = space; two or more consecutive spaces act as a separator between several parts of the RT+ message (see A.4.3).

[d] For this RT+ class the RT+ message may be structured as described in A.4.3.

[e] 'Private classes' may be defined by the service provider (see A.4.2).

[f] Descriptor always defines the other RT+ message of the same RadioText message.

A.6 Broadcasting conventions

When RT+ information is generally available, 3A type groups shall be transmitted at least every 10 s. During the lifetime of a RadioText RT/eRT containing RT+ messages, application groups carrying the tags shall be sent with a minimum frequency of 0,5 groups per second. The tag information sent out shall not change during the period of the associated RadioText ('Item toggle bit' and 'Item running bit' may change).

The RT A/B flag shall be toggled when the RadioText changes. The RT+ tag information for the application group shall be sent to the RDS encoder immediately after the new RadioText.

A.7 Receiving conventions

When the receiver detects a change in the RadioText A/B flag (indicating a new message) RadioText decoding and decoding of RT+ tags may start simultaneously and RT+ information elements may be displayed or stored, once the corresponding part of the RT RadioText is received completely error-free.

The different 'RT+ classes' may be stored and then be displayed automatically or when the user retrieves a certain 'RT content type'. For certain content types, it ~~may~~ can make sense to save more than the current or the last information in the memory (e.g. a list of the 'Titles' belonging to the last 10 'Items').

Depending on the reception conditions, it ~~may~~ can be necessary to evaluate the tag information of a few application groups before decoding RT+ information.

A.8 Marking

Equipment implementing RadioText Plus should be marked with the designation 'RT+'.

Annex B
(normative)

Coding of RadioText Plus(RT+) tagging information for RadioText in the eRT ODA of Annex C

Table B.1 shows the RT+ information elements for enhanced RadioText (eRT).

The assigned Application Identification (AID) is 0x4BD8.

Table B.1 – RT+ information elements for eRT

RT+ information elements		
eRT message	**RT+ identification**	**RT+ tags**
ODA application group for eRT (see Annex C)	AID in group type 3A	ODA application group type A

The coding of the RT+ information is the same as specified for RT in Annex A. Only the AID is different, which permits to have on the same transmission RT messages with RT+ and eRT messages with RT+.

The simultaneous transmission of RT and eRT is possible with RDS2 using the upper streams. If RDS2 is used, eRT can be on the upper streams 1-3 and RT can be at the same time on stream 0.

NOTE When eRT uses RT+ tagging, the eRT message length is limited to 64 characters, given the limitation imposed by RT+ coding as explained in Annex A. The corresponding length of the byte string depends on the characters used for a given language. It cannot exceed 128 bytes, which is the limit of eRT coding. Because of this limitation, even 64 characters cannot always be achieved as the maximum.

Annex C
(normative)

Coding of enhanced RadioText (eRT)

C.1 General

Since eRT is an Open Data Application (ODA), it is completely backwards compatible. All information necessary for implementing the eRT service is carried as an Open Data Application in group type 3A and in an associated ODA application group (see Table C.1).

The ODA Application Identification (AID) assigned to eRT is 0x6552.

Table C.1 – eRT information elements

eRT information elements		
eRT message	eRT identification	Optional RT+ tags
ODA application group type A for eRT	Group type 3A	See Annex B

eRT is a RadioText (128 bytes maximum) alternative to RT in group type 2 A/B that may be used wherever the basic RDS character set defined in IEC 62106-4 is insufficient.

The eRT application group (see Figure C.2) differs only slightly from RT group type 2A/B. The difference is that the text A/B flag bit in block 2 of group 2A/B has in eRT become part of the segment counter, so that in eRT 32 segments instead of 16 in RT become possible.

C.2 Coding eRT in ODA groups

C.2.1 General

To transmit the eRT, the necessary details are defined by Clause C.2.

The message bits of group type 3A carry control data for the application. The RadioText information is carried by the eRT ODA application group. Only type A groups can be used.

C.2.2 eRT identification (Group type 3A) and coding of the text string

The coding of the message bits in group type 3A and the Application Identification (AID) for the ODA eRT is shown in Figure C.1.

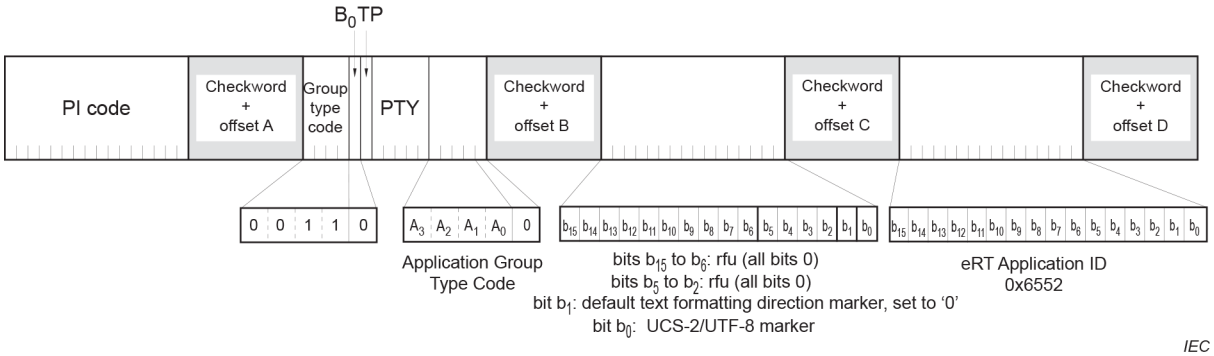

Figure C.1 – Bit allocation for group 3A (message bits and AID)

Application group type code:

- The group type for transmitting the eRT application data can be chosen as specified in IEC 62106-3.
- The group type code is signalled in block 2 of the 3A group.

The meaning of the message bits in block 3 of group type 3A is as follows.

a) Marker for UCS-2 /UTF-8 coding (bit b0):

   Set to '0'– On data-stream 0 for UCS-2 encoding or '1' for UTF-8 encoding reasons of backwards compatibility.

   Set to '1' – On data-streams 1, 2 and 3 where only UTF-8 encoding shall be used.

b) Marker for text formatting direction (bit b1):

   Set to '0', which means transmission of the byte string is always from left to right.

c) Bits b2 to b5 are all set to '0' for the reason of backwards compatibility with the earlier eRT specification (rfu).

d) rfu – bits b6 to b15 are all set to '0'.

C.2.3 Coding of the eRT text string

NOTE For details of UTF-8 (UCS Transformation Format 8), see ISO/IEC 10646.

Figure C.2 shows the coding of message bits of the application group.

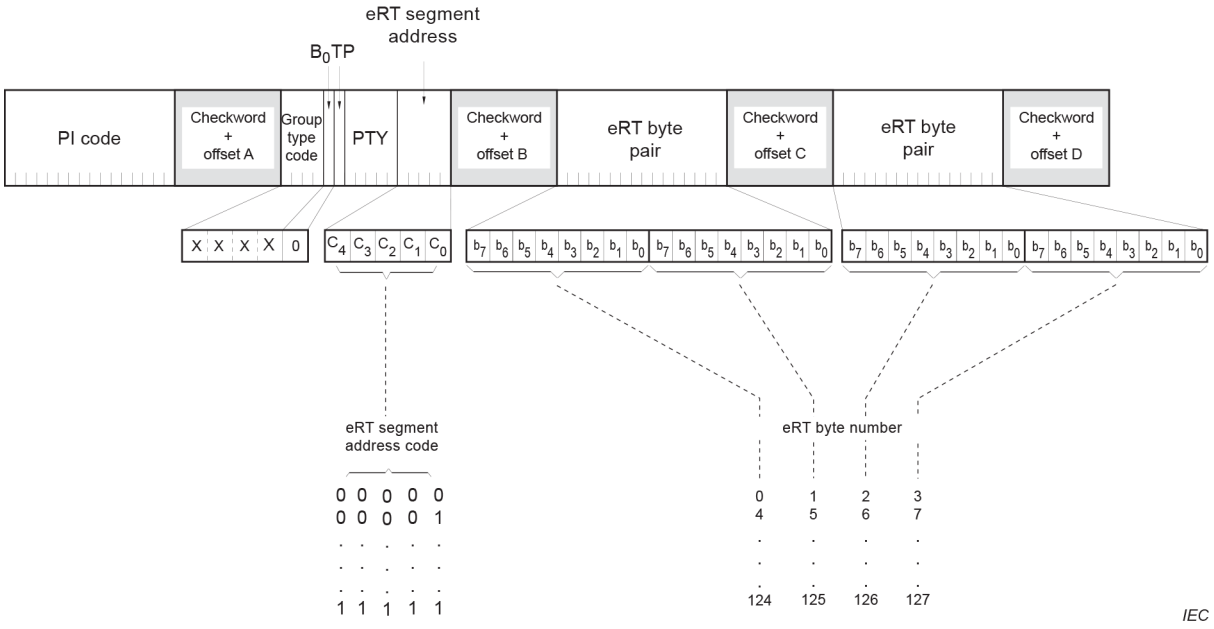

Figure C.2 – Coding of the message bits of the application group type A

If RT+ (see Annex B) is used with eRT text strings, the RT+ information elements shall be derived from the character string, i.e. for the 'Start Marker' and the 'Length Marker' determination of any of the two RT+ tags, the eRT text string in terms of the number of characters within that string shall be evaluated, disregarding the fact that the string is transmitted as a string of UCS-2 or UTF-8 coded characters. The maximum number of characters permitted, if used with RT+, is 64. Without using the RT+ feature, a theoretical maximum message length of 128 characters is possible on the upper data-streams 1,2 and 3, UTF-8 coded and provided they all occupy only one byte per character.

The 5-bit segment address defines the current byte number within the eRT text string, in terms of four bytes each, contained in the third and fourth blocks. The text string increases from left to right and the most significant byte is transmitted first.

A new text shall start with the segment address '00000' segment and there shall be no gaps up to the highest used segment address of the current message. The number of text segments is determined by the length of the message, and each message shall be ended by the control character 'carriage return' 0x0D, if the current message requires less than 128 bytes. The bytes left unused in the same segment address shall also be filled with 0x0D.

To ensure a RadioText message that is no longer valid is cleared from the display, the broadcaster should send a blank message only containing a 0x0D control character. The bytes left unused in the same segment address shall also be filled with 0x0D.

C.2.4 UTF-8 decoding problems when used with RT+

UTF-8 encoding has become very attractive and it is widely used on the Internet. However, in RDS this kind of encoding, attractive as it appears to be on the first look, can create some text decoding problems, specifically if used with RT+. This is due to the fact that the number of bytes needed for a symbol with UTF-8 encoding will vary between one, two or more, and then, when RDS reception is not optimal, gaps in a received text byte string are very likely, as symbols may be spread over two or more different blocks of the eRT application group. Although the UTF-8 decoder can normally recognize the number of bytes belonging to any given symbol, there is a problem with several non-received consecutive bytes, as then it is not possible to detect how many characters such a gap had represented exactly. Spaces can be substituted for what has been missed, but the exact character positions of the respective RT+ tags can then no longer be determined.

Therefore, UTF-8 decoding will only work correctly when RDS receiving conditions are generally good.

C.3 Broadcasting conventions

When eRT RadioText is available, 3A type groups shall be transmitted at least every 10 s. During the lifetime of eRT RadioText messages, the application groups for eRT shall be sent with a minimum frequency of four groups per second.

The same enhanced RadioText messages should be transmitted at least three times to improve reception reliability.

The transmission capacity of RDS is not sufficient to use normally RT and eRT at the same time on stream 0, i.e. it shall be either one or the other RadioText mode. If RDS2 is used, eRT can be on the upper streams 1, 2 and 3 and RT can be at the same time on stream 0.

C.4 Receiving conventions

A space shall be substituted by the receiver for any unrecognized symbol or control character.

C.5 Marking

Equipment implementing eRT RadioText should be marked with the designation 'eRT'.

Annex D
(normative)

Coding of AF lists in the frequency range 64,1 MHz to 107,9 MHz: ODA-AF

D.1 Objective to be achieved

Normally Alternative Frequency lists use 8-bit codes transmitted in group type 0A. The coding was originally conceived for Band II, with the lower limit at 87,5 MHz in mind. Some countries plan to extend their FM frequency band downwards, below 87,5 MHz, so a new mechanism is required to cater for the extended range of AFs. For this purpose, a new 9-bit AF coding has been defined to be carried in this ODA which supplements the existing 8-bit AF codes, defined in IEC 62106-2, carried in group type 0A.

The coding of the 9-bit AFs is similar to that of the existing 8-bit AFs permitting simple conversions between the two. The extended 9-bit range (0 to 511) uses the same AF code definitions in its lower half from the existing 8-bit range (0 to 255) as well as new AF code definitions for frequencies below 87,5 MHz in its upper half (256 to 511).

AF method A or B as specified for the frequency range 87,5 MHz to 108 MHz in IEC 62106-2 can also be used in this ODA to associate AFs with one another or set up regional AF lists in a receiver.

This ODA has the capability with its 9-bit AFs to cover all frequencies of a programme service in the range 64,1 MHz to 107,9 MHz. As such, the complete AF list of a programme service can be carried within this ODA. However, for compatibility with existing legacy receivers without support for this ODA, any AFs of a programme service representing frequencies above 87,5 MHz should still be carried in group type 0A.

The ODA Application Identification (AID) assigned to this ODA is 0x6365, see Figure D.1.

D.2 Description of the coding process

D.2.1 ODA-AF identification (group type 3A)

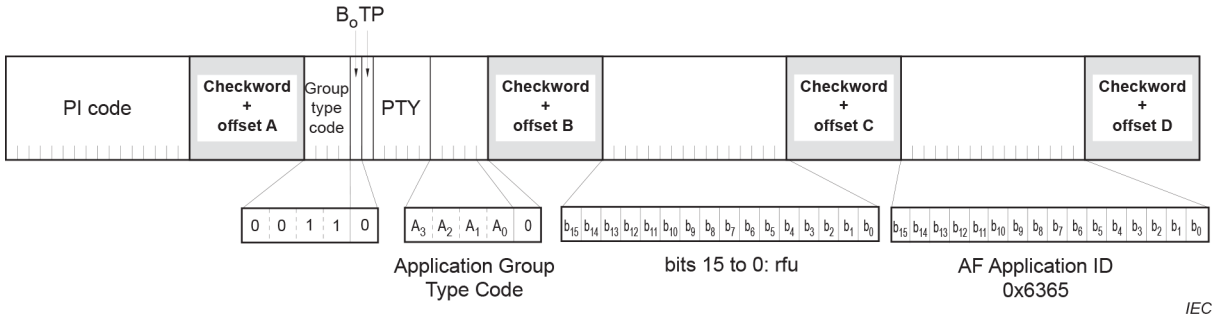

Figure D.1 – New ODA-AF – group type 3A

The application group for the transmission of AF codes is shown in Figure D.2. It shall be transmitted at least once every 10 s.

D.2.2 AF coding in the application group

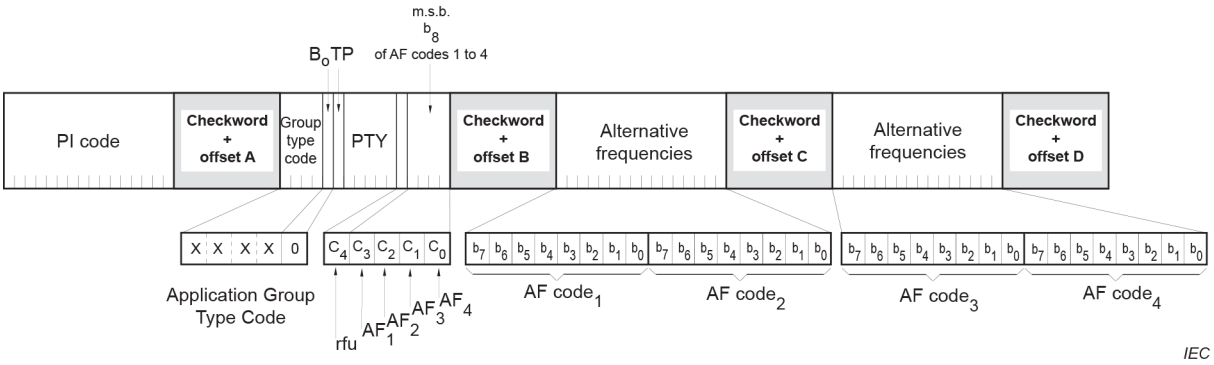

Figure D.2 – New ODA-AF application group – group type A

Figure D.2 shows that the AFs are coded in pairs just like the AFs are coded in group type 0A. This permits to use the same coding methods for the AF lists as described for group type 0A in IEC 62106-2. It is thus possible to choose for the coding either AF method A or AF method B. The only difference is that this ODA uses exclusively 9-bit AFs while group type 0A uses only 8-bit AFs. The 8-bit AF codes in Band II (87,5 MHz to 108,0 MHz) as specified in IEC 62106-2 are compatible with the AF codes used so far, and the same is true for the "special meanings code table". The 9-bit AF codes used by this ODA are shown in Table D.1, Table D.2, Table D.3, Table D.4 and Table D.5.

Table D.1 – 9-bit AF code table for VHF Band I (64,0 MHz to 88,0 MHz)

Number	Binary code	Carrier frequency
256	1 0000 0000	Not assigned
257	1 0000 0001	64,1 MHz
258	1 0000 0010	64,2 MHz
:	:	:
495	1 1110 1111	87,9 MHz
496	1 1111 0000	88,0 MHz
497		Not assigned
:	:	:
511		Not assigned

Table D.2 – 9-bit AF code table for VHF Band II (87,5 MHz to 108 MHz)

Number	Binary code	Carrier frequency
1	0 0000 0001	87,6 MHz
2	0 0000 0010	87,7 MHz
:	:	:
:	:	:
204	0 1100 1100	107,9 MHz

Table D.3 – 9-bit special meanings code table

Number	Binary code	Special meaning
0	0 0000 0000	Not to be used
205	0 1100 1101	Filler code
206	0 1100 1110	Not assigned
207	0 1100 1111	Not assigned
:	:	:
223	0 1101 1111	Not assigned
224	0 1110 0000	No AF exists
225	0 1110 0001	1 AF follows
:	:	:
249	0 1111 1001	25 AFs follow
250	0 1111 1010	An MF frequency follows ~~F/MF frequency follows~~
F/MF frequency follows		
251	0 1111 1011	Not assigned
:	:	:
255	0 1111 1111	Not assigned

Table D.4 – LF/MF code table – ITU regions 1 and 3 (9 kHz spacing)

Number		Binary code	Carrier frequency
LF	1	0 0000 0001	153 kHz
	:	:	:
	:	:	:
	15	0 0000 1111	279 kHz
MF	16	0 0001 0000	531 kHz
	:	:	:
	:	:	:
	:	:	:
	:	:	:
	135	0 1000 0111	1 602 kHz

Table D.5 – MF code table – ITU region 2 (10 kHz spacing)

Number		Binary code	Carrier frequency
MF	16	0 0001 0000	530 kHz
	:	:	:
	:	:	:
	:	:	:
	:	:	:
	124	0 0111 1100	1 610 kHz

To facilitate the automatic tuning process in a receiver, a number of AFs shall be transmitted. Ideally, the AF list shall only comprise frequencies of neighbouring transmitters or repeaters. Two methods of transmitting AFs are possible. AF method A is used for lists up to 25 in number and AF method B is used for larger lists. AF method B is also used where it is required to indicate frequencies of generically related services (see IEC 62106-2).

D.2.3 AF method A

Two AF codes (AF pairs) are carried in each block 3 and 4. The first AF code in the transmitted list (codes 224 to 249) indicates the number of frequencies in that list. This list will also include the frequency of the transmitter originating the list, if it has repeaters.

EXAMPLES:

	Example A	
First AF pair:	#5	AF1
Second AF pair:	AF2	AF3
Third AF pair:	AF4	AF5
Fourth AF pair:	Filler	Filler

Example B	
#4	AF1
AF2	AF3
AF4	Filler
Filler	Filler

Example C	
#4	AF1
AF2	AF3
LF/MF follows	AF4
Filler	Filler

Example A shows a list of five VHF frequencies, where #5 is the number of the following frequencies, represented by code 229.

Example B shows a list of four VHF frequencies, where filler code is 205.

Example C shows a list of three VHF frequencies and 1 LF/MF frequency, where the code is 250 (LF/MF follows) followed by the AF4 frequency code.

D.2.4 AF method B

Method B AF coding is used where the number of AFs used by a transmitter and its associated repeater stations exceeds 25, or where it is required to indicate frequencies which belong to different regions which at times carry different programmes.

Each transmitter and associated repeater stations broadcast the same set of different AF lists in sequence. The number of AF lists within a network is in general identical to the number of transmitters and repeater stations in the network, so as to provide a unique list for each transmitting station. In this protocol, the AFs for the VHF/FM transmitters are individually addressed by transmitting the tuning frequency paired with one AF within one block.

NOTE If the frequency referenced is for an LF/MF transmission, it occupies two AF codes, the first being code 250. Hence, it cannot be referenced to its associated tuning frequency.

Each list starts with a code giving the total number of frequencies within this list, followed by the tuning frequency for which the list is valid. All remaining pairs (up to 12) give the tuning frequency together with a valid AF.

- If the number of AFs of a station is greater than 12, the list shall be split into two or more lists. These lists are transmitted directly one after the other and the receiver shall combine the lists again.
- If a transmitter frequency is used more than once within a network, the respective AF lists are transmitted separately. In order to indicate that these lists with the same tuning frequency belong to different stations, the lists shall be separated by AF lists of other stations. The receiver may combine them or evaluate them separately.

For the transmission of the frequency pairs within one block, the following convention is used.

- They are generally transmitted in ascending order, for example

89,3	99,5	or	99,5	101,8	$F_1 < F_2$

- In special cases they are transmitted in descending order, if they belong to different regions, or carry from time-to-time different programmes, for example

99,5	90,6	or	100,7	99,5	$F_1 > F_2$

In both the above examples, 99,5 MHz is the main tuning frequency.

EXAMPLES:

F_1	F_2	Commentary
# 11	89,3	Total number (11) of frequencies for tuning frequency (89,3)
89,3	99,5	$F_2 > F_1$ hence 99,5 is an AF of tuned frequency 89,3, and is the same programme service
89,3	101,7	$F_2 > F_1$ hence 101,7 is an AF of tuned frequency 89,3, and is the same programme service
88,8	89,3	$F_2 > F_1$ hence 88,8 is an AF of tuned frequency 89,3, and is the same programme service
102,6	89,3	$F_2 < F_1$ hence 102,6 is an AF of tuned frequency 89,3, but is a regional variant of the programme service
89,3	89,0	$F_2 < F_1$ hence 89,0 is an AF of tuned frequency 89,3, but is a regional variant of the programme service

# 9	99,5	Total number (9) of frequencies for tuning frequency (99,5)
89,3	99,5	$F_2 > F_1$ hence 89,3 is an AF of tuned frequency 99,5, and is the same programme service
99,5	100,9	$F_2 > F_1$ hence 100,9 is an AF of tuned frequency 99,5, and is the same programme service
104,8	99,5	$F_2 < F_1$ hence 104,8 is an AF of tuned frequency 99,5, but is a regional variant of the programme service
99,5	89,1	$F_2 < F_1$ hence 89,1 is an AF of tuned frequency 99,5, but is a regional variant of the programme service

Broadcasters using splitting of a network during certain hours of the day should use AF method B, and not AF method A. The lists should be static, i.e. the AFs included in the list that carry a regional variant of the programme service during certain hours of the day, shall be signalled by transmitting in the descending order. The PI codes to identify the different regional variants of the network or programme service shall differ only in the second element (bits 8 to 11) of the code using area codes R1 to R12, see IEC 62106-2.

If switching by the broadcaster of the second element of the PI Code to I, N or S occurs, this informs a receiver that now even AFs transmitted in descending order are carrying the same programme service and the receiver may freely allow switching to these AFs in addition to those transmitted in ascending order.

Even if the PI codes are static at all times, various receiver and customer-specific implementations exist that will, at driver option, permit the receiver to accept not only AFs from the same regional PI code but also those from the different regional variants of the network or programme service.

D.2.5 Convention for identification of the AF method used

The AF method used is not signalled explicitly, but can easily be deduced by receivers from the frequent repetition of the main tuning frequency in the transmitted AF pairs in the case of AF method B.

Annex E
(normative)

Station logo transmission coded in group type C

E.1 Objective to be achieved

ODA to send station logo to visually identify the radio station or programme.

E.2 Application identification code of this ODA

The AID code of this ODA is 0xFF7F.

E.3 Station logo requirements

E.3.1 File type

Either png (preferred) or jpg shall be used as the file type. No file type identifier is needed because all relevant file information is already embedded in the file header of each of those formats.

E.3.2 Logo resolution, file ID, file version and file size

Table E.1 shows the file ID for the four possible options.

Table E.1 – File ID station logo options

File ID	Resolution	Aspect ratio	File size in bytes
0	Lower preferred	1:1 (square)	≤ 3 000
1	Lower preferred	4:3 (rectangular)	≤ 3 000
2	Higher	1:1 (square)	> 3 000
3	Higher	4:3 (rectangular)	> 3 000
4 – 63	Reserved for future use		
NOTE The station logo options have been chosen with the data transmission limitations of RDS on the upper data-streams in mind. They are suitable for receivers with relatively small display screens. For receivers with large display screens, the higher resolution would be more appropriate. This could also be delivered in addition over IP and the appropriate link to a data server can be transmitted using the respective option specified in Annex G.			

The file ID (6 bits) defines the identifier of the file. The file version (3 bits) is changed if the file has changed. The transmission uses first file version = 0. The file version is increased each time the logo changes. The file version code can be used like a toggle bit.

The various options permitted in Table E.1 can be sequenced using the RFT protocol on the upper data-streams.

Two aspect ratios are possible: square 1:1 and rectangular 4:3 (no other possibilities). The actual number of pixels is not important because the receiver can resize the station logo by applying its aspect ratio.

The file size to be transferred will depend on the image content of the logo. Experience has shown that for the preferred resolutions, a file size of less than 3 000 bytes is possible. For higher resolutions, a file size of more than 3 000 bytes is necessary. If this option is used, the acquisition of the file will become more difficult for mobile receivers.

8-bit colours shall be used to achieve the smallest possible file size.

E.3.3 File transport

The file is transmitted using one pipe in the range 0 to 15 on one or more of the upper data-streams using the RFT protocol defined in Annex C of IEC 62106-2:2021.

The CRC-16 shall be used as it can be automatically generated by the encoder using C-type groups with variant code 001.

NOTE 1 The RFT protocol uses as parameters with Assignment group variant code 000: File ID, File version, File size in bytes and CRC flag. All these parameters are required for this ODA.

NOTE 2 In Annex H of IEC 62106-10:2021, an example of UECP coding for this ODA is given.

E.3.4 Display mode

There is no need to define the receiver's display mode. The logo can be used as a tuning aid or in programme listening mode somewhere on the screen. If used as a tuning aid, the station logo shall be centred on the respective tuning button.

E.3.5 Link of the logo with the PI code

In the receiver, the station logo shall be stored with the PI code so that the listener can use the station logo as the visual identity of the radio station or programme.

Annex F
(normative)

ODA app – Slideshow transmission coded in C-group type

F.1 Objectives to be achieved

The objectives to be achieved are:

– broadcast slides which are programme-related, or not;
– a slide can contain an image and text components (all are optional);
– the text consists of structured text components to inform the receiver of what kind of text it is;
– some text components consist of text elements grouped together (such as preview and as URLs);
– the two next slides can be broadcast in advance to inform receivers what is coming next;
– the display by the receiver of the current slide can be synchronized with the audio using a directory trigger group (e.g. for music cover art);
– the directory trigger group signals three slides (current, next, 2nd next);
– the image and all text components can be updated independently of each other.

Several use cases can be covered:

a) Non-programme-related, where the broadcaster does not know what comes next (e.g. sport).
b) Programme-related when the broadcaster knows what comes next (e.g. music playlist).
c) Non-programme-related slideshow where a carousel cycles several slides (advertisements or sequence of news items).

F.2 Application identification code of this ODA

The AID code of this ODA is 0xFF80.

F.3 Image requirements

F.3.1 File type

Either jpg or png shall be used as the file type. No file type identifier is needed because all relevant file info, including the file type, is already embedded in the file header of each of those formats.

F.3.2 Resolution and file size

The required image resolution is expressed in pixels for the width and height. Two aspect ratios are possible: 240 px × 240 px or 320 px × 240 px.

Images not existing in this resolution will need to be re-scaled for transmission by the transmission operator or broadcaster.

NOTE The above slide image resolutions have been chosen with the data transmission limitations of RDS on the upper data-streams in mind. They are suitable for receivers with relatively small display screens. For receivers with large display screens, a higher resolution would be more appropriate. This can only be delivered in addition over IP and the appropriate link to a data server is already specified in Annex G.

The file size to be transferred will depend on the image content. An image file of up to 16 000 bytes is permitted. Typical is a file size between 8 000 bytes and 12 000 bytes.

8-bit colours can help to achieve the smallest possible file size.

For the maximum image acquisition time, in the case where relatively short music items are sequenced, a value of 90 s shall not be exceeded. In all other cases, the acquisition time is less critical.

F.4 Text character coding

All text components shall use UTF-8-character coding.

F.5 Slide structure and file elements used

The [SLIDE] is an ensemble composed of the optional files [IMAGE] and [TEXT]. The element [TEXT] is composed of the three optional files [PREVIEW], [CONTENT] and [URLS].

The slide ensemble is used as shown in Figure F.1.

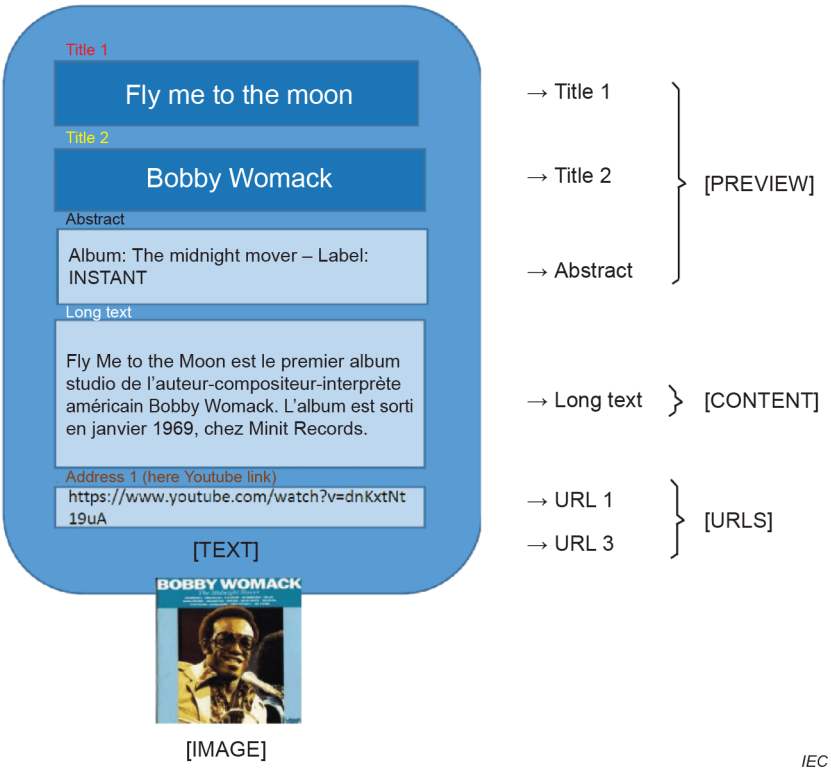

Figure F.1 – Components used in the slideshow

The file [PREVIEW] is composed of the file elements [TITLE1], [TITLE2], [ABSTACT].

The file [CONTENT] is just a string of UTF-8 coded characters. A tag to indicate its length in bytes is not needed.

The file [URLS] is composed of the file elements [URL1], [URL2], [URL3]. These are strings of UTF-8 coded characters

The structure of the [PREVIEW] text file is shown in Figure F.2.

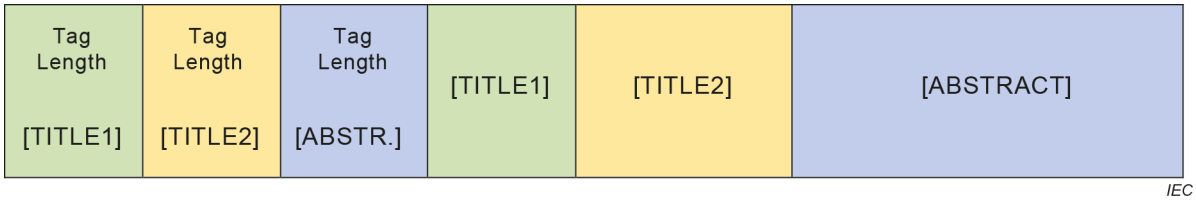

Figure F.2 – Structure of the [PREVIEW] text file

In Figure F.2, the size of the three tags is two bytes each. They indicate the length of the respective text component in bytes, UTF-8 coded for [TITLE1], [TITLE2] and [ABSTRACT]. In this way, the start position of each file element inside the [PREVIEW] file is defined as shown in Table F.1.

Table F.1 – Start position of each file element within [PREVIEW]

Start position (bytes)	File element
Offset 0	Tag length 1: length of [TITLE1]
Offset 2	Tag length 2: length of [TITLE2]
Offset 4	Tag length 3: length of [ABSTRACT]
Offset 6	UTF-8 data of [TITLE1]
Offset 6 + Length 1	UTF-8 data of [TITLE2]
Offset 6 + Length 1 + Length 2	UTF-8 data of [ABSTRACT]

The file element [CONTENT] is just a string of bytes of UTF-8 coded characters.

The structure of the [URLS] text file is shown in Figure F.3.

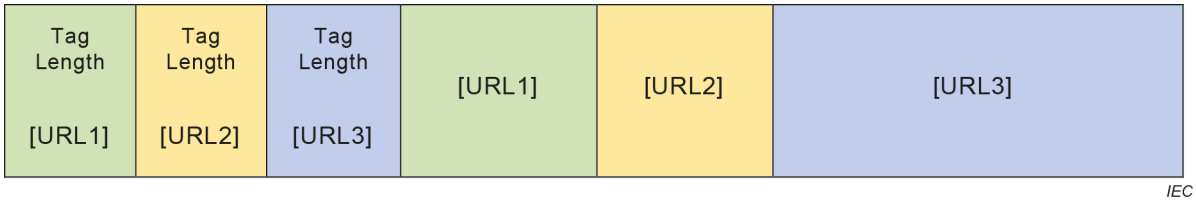

Figure F.3 – Structure of the [URLS] text file

In Figure F.3, the size of the three tags is two bytes each. They indicate the length of the respective URL text component in bytes, UTF-8 coded for [URL1], [URL2] and [URL3]. In this way, the start position of each file element inside the [URLS] file is defined as shown in Table F.2.

With UTF-8 coding, one character can be one or several bytes long.

Coding of the [URLS] file element uses the same structure as [PREVIEW]; see Figure F.3 and Table F.2.

Table F.2 – Start position of each file element within [URL]

Start position (bytes)	File element
Offset 0	Tag length 1: length of [URL1]
Offset 2	Tag length 2: length of [URL2]
Offset 4	Tag length 3: length of [URL3]
Offset 6	UTF-8 data of [URL1]
Offset 6 + Length 1	UTF-8 data of [URL2]
Offset 6 + Length 1 + Length 2	UTF-8 data of [URL3]

F.6 Slide carousel used by the broadcaster, file updating and file transmission

The broadcaster uses a slide carousel from which the slides can be transmitted in any order and for which all components ([IMAGE], [TEXT] and [URLS] can be updated as required. The file ID (6bits) range is 0 to 63, with four file IDs used to identify the four component files [IMAGE], [PREVIEW], [CONTENT] and [URLS] of each [SLIDE]. In total, 16 slides can populate the carousel. Each time a component file is updated, which is possible at any time, the respective file version is increased by 1. Up to two next slides to be broadcast in sequence can be chosen in any order from the slides located on the carousel. Each file is identified with a file ID and a version number using the numbering system shown in Table F.3.

F.7 File transport

F.7.1 General

All files are transmitted using one pipe in the range 0 to 15 on one or more upper data-streams with the RFT protocol defined in Annex C of IEC 62106-2:2021.

The CRC-16 shall be used and is to be automatically generated by the encoder using C-type groups with variant code 001.

The RFT protocol with variant code 000 carries the parameters file ID, file version, file size and CRC flag. All these parameters are required for this ODA.

F.7.2 Identification of the files

The file ID is the principal identifier of the file. The file version is increased by 1 when the file content has changed. The value ‘000’ is always used for the initial file version of version-I, version-P, version-C and version-U.

The file numbering system to be used is shown in Table F.3. Each [SLIDE] consists of a sequence of four file IDs, one for each of the [IMAGE], [PREVIEW], [CONTENT] and [URLS] files. The file ID parameter N is calculated from the slide number S (0 to 15) as follows:

$$N = S \times 4$$

Table F.3 – File numbering system used

Slide component files to be transferred with the RFT	File version (3 bits)	File ID (6 bits)
[IMAGE]	Version-I	N
[PREVIEW]	Version-P	N + 1
[CONTENT]	Version-C	N + 2
[URLS]	Version-U	N + 3

In the RFT, it is variant 0 that carries the parameters file ID (6 bits) and file version (3 bits).

F.8 Directory trigger group

F.8.1 Function

This group informs the receiver which of the buffered and previously downloaded slides are to be displayed in the sequence current, next1 and next2. File ID and version number are used for each of the slide elements and are contained in the message.

This group carries important file management information for the receiver. To avoid incorrect reception, it shall be transmitted in a cycle, at least once every 5 s. The precise definition of the cycle is left to the broadcaster or transmission operator. A burst may be used when the directory content changes.

F.8.2 Specification

Figure F.4 shows the directory trigger group, which is a C type group.

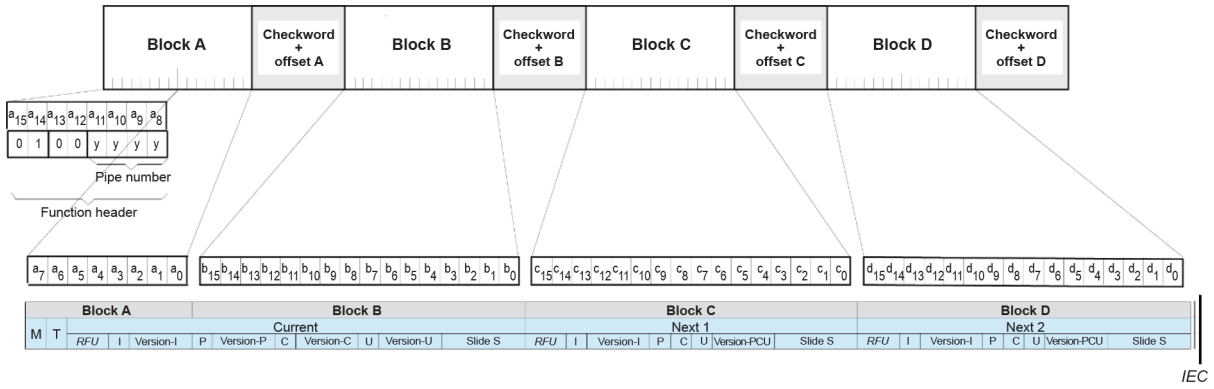

Figure F.4 – Directory trigger group

The function header of Block A uses bits a15 to a8 and is set to 0100yyyy, where yyyy is the pipe number of this ODA.

For the directory trigger group, the data elements to be used are:

- in block A, the bits a7 to a0, and in block B the bits b15 to b0 for M, T and current slide data;
- in block C, the bits c15 to c0 for next1 slide data;
- in block D, the bits d15 to d0 for next2 slide data.

The parameters used by the trigger directory data are listed in Table F.4.

Table F.4 – Parameters used in the directory trigger group

M	**=**	**Mode**		**1 bit**
	0	:	Directory trigger mode	
	1	:	Reserved for future use	
T	**=**	**Toggle**		
	0/1	:	Toggle invalidates the previous directory trigger group data; the bit is toggled only when the content of the directory trigger group changes.	
I	**=**	**Image**		
	0	:	No image for this slide; receiver may instead display the station logo	
	1	:	Slide with image	
P	**=**	**Preview**		
	0	:	There is no preview text	
	1	:	There is preview text	
C	**=**	**Content**		
	0	:	There is no content text	
	1	:	There is content text	
U	**=**	**URLst**		
	0	:	There is no URL	
	1	:	There are URLs	
Version-I, -P, -C, -U, -PCU = version of the respective slide component				3 bits
	Version of the RFT files for image I, preview P, content C, URLs U is 3 bits each. Version-PCU is the version of one of the newly updated text files, P, C or U. Only one of them can be chosen for updating at the same time. The one that is chosen for updating is marked with ‘1’ in P, C or U. When a slide is transferred for the first time, all slide element versions start with ‘000’, which is thus then also the default setting of version-PCU.			
RFU – Reserved for future use				2bits
S = slide number (0 to 15)				4 bits

F.9 Receiver display mode options

The receiver may display all slide elements or instead a selection that corresponds to the display possibilities of the receiver device.

Annex G
(normative)

Internet connection options coded in C-group type

G.1 Objective to be achieved

Many radio devices can also communicate with the Internet. This changes the radio and its use. This ODA allows for hybrid radio functions.

Use cases:

1) Internet radio: streaming of same audio as broadcast over FM.
2) Hybrid radio: get additional visual information/metadata via Internet (still under development).
3) Automatic or manual feedback to the broadcaster.
4) More use cases are under development.

G.2 Application identification code of this ODA

The AID code of this ODA is 0xFF70.

G.3 Choice of the ODA channel number

The application shall use one of the ODA data channels in the range 0 to 63 on one of the upper data-streams. Channels 0 to 15 are reserved for ODAs using files, also if only occasionally. If this is not the case, a channel in the range of 16 to 63 shall be chosen to implement this ODA.

G.4 Coding of IP address with port number

G.4.1 General

There are three address type coding options possible for an IP address with a port number as shown in Table G.1. The port number in the IP address directs the RDS radio receiver to the application server on a host.

G.4.2 IPv4 coding

An address IPv4 with a port number uses the following format:

FF.FF.FF.FF/FFFF where FF is one byte with a number in the range of 0 to 255.

The coding of this format is shown in Figure G.1. The symbols "." and "/" are implicit and do not need to be coded.

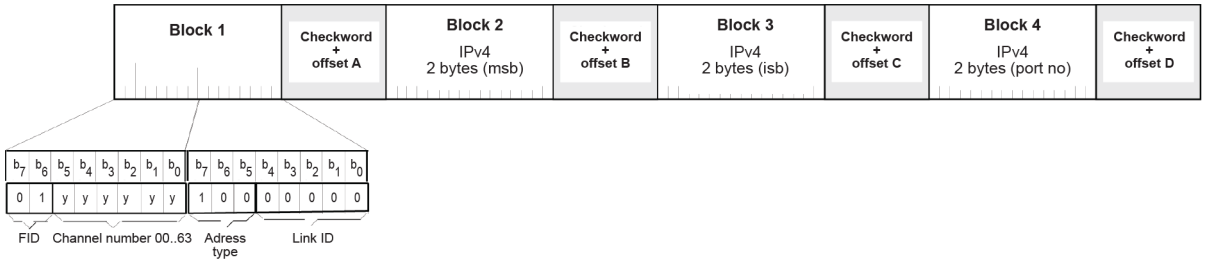

Figure G.1 – Coding of IPv4 address with port number

Coding of the most significant byte in block 1 is as specified in IEC 62106-2 for an ODA application data group, and as indicated in Figure G.1. In the least significant byte of block 1 are two parameters: the address type and the link ID of the server application.

These are to be coded as shown in Table G.1 for the address type, and as shown in Table G.2 for the link ID of the server application using the binary code for the link ID.

Table G.1 – Address type code

Code for Bits b7 to b5	Address type
0xx	Text (xx = part of text group counter bits, see Figure G.2)
100	IPv4
101	IPv6 Part 0
110	IPv6 Part 1
111	IPv6 Part 2

Table G.2 – Link ID code of IP connection

Link ID code binary Bits b4 to b0 IPv4 and IPv6	Link ID code Decimal using Text	Link ID of server application
00000	00	Same audio stream as broadcast over FM
00001	01	RDS data stream only using NFM (see Annex H)
00010	02	Current Slideshow image (see Annex F)
00011	03	Current Slideshow slide (see Annex F)
00100	04	Station logo (see Annex E)
…		rfu
11111	31	rfu

In the two bytes of block 4, the port number is coded. This is to indicate which application server may be connected to the radio receiver. Permitted port numbers are in the range of 0 to 65535, or 0x00 to 0xFF.

G.4.3 IPv6 coding

An IPv6 address (128 bits) with a port number (16 bits) uses the following format:

FFFF.FFFF.FFFF.FFFF.FFFF.FFFF.FFFF.FFFF/FFFF where FFFF are byte-pairs with a number in the range 0 to 65535.

The symbols "." and "/" are implicit and do not need to be coded.

The total code length of this string is 16 bytes for the IPv6 address plus 2 bytes for the port number.

An ODA application data group with the link ID shown in Figure G.1 can transport in blocks 2 to 4 only 6 bytes each. To transport 18 bytes, three C-type groups are needed.

In the least significant byte of block 1 are the two parameters address type and link ID. These are to be coded as shown in Table G.1 for the address type, and as shown in Table G.2 for the link ID of the server application using the binary code for the link ID.

The C-type groups IPv6 Part 0, IPv6 Part 1 and IPv6 Part 2 (blocks 2 and 3) carry the data for the 16 bytes of the IPv6 address. The IPv6 address sequence starts with the most significant byte in block 2 of the C-type group with the address type IPv6 Part 0, and ends with the least significant byte in block 3 of the C-type group with the address type IPv6 Part 2

The C-type group IPv6 Part 2 carries the port number in block 4.

G.4.4 IP address and port number coded as URL text

The coding of the URL text is done as shown in Figure G.2.

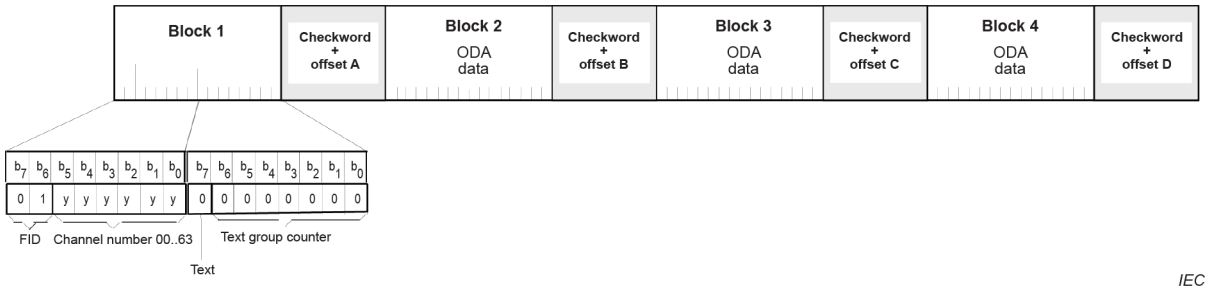

Figure G.2 – URL text coding to connect to an application data server

The 7-bit text group counter covers a range from 0x00 to 0x7F (0 to 127 dec). The text length is limited to 760 bytes (6 × 127 − 2 = 760).

The link ID decimal code in Table G.2 with 32 options (00 to 31 dec) uses the first two bytes of the text string. UTF-8 coding is used for the two characters of this decimal number. The string is terminated with "\0". All bits that can follow are undefined.

UTF-8 is used for the character coding of the text string.

The URL will be translated with the DNS system.

Example:

This ODA sends to the receiver the text string

00https://datasource-one.radio-france.fr/0082\0…

This message tells the receiver on which URL the server can be found that streams the same audio as received on FM (Link ID code ‘00’). The receiver removes the first two bytes with the Link ID code ‘00’ and sends over IP the (fictive) URL https://datasource-one.radio-france.fr/0082 to create the link with the host and with the audio stream signalled.

Annex H
(normative)

ODA tool – RDS data mode NFM

H.1 Objective to be achieved

NFM is a data packet format to transmit the RDS data outside the FM modulated radio stream. It is based on the C-type message format, so it can be processed with the C-type decoder software.

NFM format is intended to be used to store metadata on data carriers, to transmit via Internet or via data channels other broadcasting formats, such as DVB-T/S/C, DAB, DRM and others.

Synchronization of NFM data to the audio content is not part of the format; it shall be done using methods adapted to the carrier.

Size of NFM packets can vary between 16 bytes and 512 Kbytes, including the header group. This shall be adapted to the carrier.

H.2 Specification of the NFM protocol

The NFM structure is derived from the structure of type C groups, organized as packets. A packet is composed of a header followed by one or more C-type data groups.

The C-type group can also carry group types A and B, where types A and B will have to be tunnelled within group type C (see IEC 62106-2:2021, 4.4.1).

NFM is transmitted without the 10-bit CRCs of each of the four data blocks in group types A, B and C. The protection of the data in the NFM message packet is provided by the bearer system used. Each message has in addition a CRC-16 in the packet header to determine the completeness of the message within each packet.

As shown in Figure H.1, a message in the NFM consists of an eight-byte header and one or more groups. They all have the same length of 8 bytes, i.e. 2 bytes for each of the C-type group blocks A, B, C and D. Thus, a message is always a multiple of 8 bytes. The shortest message is thus a 16-byte packet (header + data for one C-type group) and the longest is determined by the possibilities offered by the bearer or the maximum header size of 16 bits.

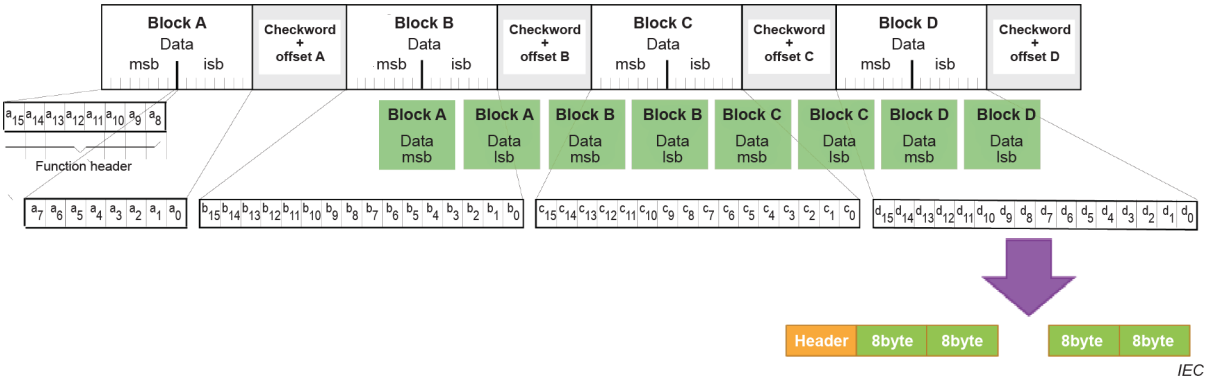

Figure H.1 – NFM message format

The eight-byte header consists of:

– 2 bytes of number of groups including the header (16-bit unsigned integer);
– 2 bytes simple CRC-16 calculated over the data (without header);
– 2 bytes PI code (zero, if undefined);
– 1 byte ECC (zero, if undefined);
– 1 byte of additional information (not yet defined – reserved for future use).

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IEC 62106-5, *Radio data system (RDS) – VHF/FM sound broadcasting in the frequency range from 64,0 MHz to 108,0 MHz – Part 5: Marking of RDS receiver devices*

IEC 62106-9, *Radio Data System (RDS) – VHF/FM sound broadcasting in the frequency range from 64,0 MHz to 108,0 MHz – Part 9: RBDS – RDS variant used in North America*

IEC 62106-10:2021, *Radio data system (RDS) – VHF/FM sound broadcasting in the frequency range from 64,0 MHz to 108,0 MHz – Part 10: UECP – Universal Encoder Communication Protocol*

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INTERNATIONAL STANDARD

colour inside

Radio data system (RDS) – VHF/FM sound broadcasting in the frequency range from 64,0 MHz to 108,0 MHz –
Part 6: Compilation of technical specifications for Open Data Applications in the public domain

IEC 62106-6:2023-05(en)

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

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RADIO DATA SYSTEM (RDS) – VHF/FM SOUND BROADCASTING IN THE FREQUENCY RANGE FROM 64,0 MHz TO 108,0 MHz –

Part 6: Compilation of technical specifications for Open Data Applications in the public domain

FOREWORD

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IEC 62106-6 has been prepared by technical area 1: Terminals for audio, video and data services and contents, of IEC technical committee 100: Audio, video and multimedia systems and equipment. It is an International Standard.

This second edition cancels and replaces the first edition published in 2018. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) Annex E: coding of station logo
b) Annex F: coding of slideshow
c) Annex G: coding of internet connection.
d) Annex H: ODA tool – RDS data stream NFM

The text of this International Standard is based on the following documents:

Draft	Report on voting
100/3807/CDV	100/3871/RVC

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

A list of all parts in the IEC 62106 series, published under the general title *Radio data system (RDS) – VHF/FM sound broadcasting in the frequency range from 64,0 MHz to 108,0 MHz*, can be found on the IEC website.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

IMPORTANT – The "colour inside" logo on the cover page of this document indicates that it contains colours which are considered to be useful for the correct understanding of its contents. Users should therefore print this document using a colour printer.

INTRODUCTION

Since the mid-1980s a fascinating development has taken place. Most of the multimedia applications and standards have been created or redefined significantly. Hardware has become extremely powerful with dedicated software and middleware. In the mid-1980s, Internet as well as its protocols did not exist. Navigation systems became affordable in the late 1990s, and a full range of attractive smartphones now exist. The computing power of all these new products is comparable with that of the mainframe installations in that era.

Listener expectations have grown faster than the technology. Visual experience is now very important, like the Internet look and feel. Scrolling text or delivering just audio is nowadays perceived as insufficient for FM radio, specifically for smartphone users. New types of radio receivers with added value features are therefore required. RDS has so far proven to be very successful.

FM radio with RDS is an analogue-digital hybrid system, which is still a valid data transmission technology and only the applications need adaptation. Now the time has come to solve the only disadvantage, the lack of sufficient data capacity. With RDS2, the need to increase the data capacity can be fulfilled.

RDS was introduced in the early 1980s. During the introductory phase in Europe, the car industry became very involved and that was the start of an extremely successful roll-out. Shortly afterwards, RDS (RBDS) was launched in the USA.

The RDS Forum has investigated a solution to the issue of limited data capacity. For RDS2, both sidebands around the RDS 57 kHz subcarrier can be repeated a few times, up to three, centred on additional subcarriers higher up in the FM multiplex while still remaining compatible with the ITU Recommendations.

The core elements of RDS2 are the additional subcarriers, which will enable a significant increase of RDS data capacity to be achieved, and then only new additional data applications will have to be created, using the RDS-ODA feature, which has been part of the RDS standard IEC 62106 for many years.

In order to update IEC 62106:2015 to the specifications of RDS2, IEC 62106 has been restructured as follows:

Part 1: Modulation characteristics and baseband coding

Part 2: RDS message format, coding and definition of RDS features

Part 3: Usage and registration of Open Data Applications ODAs

Part 4: Registered code tables

Part 5: Marking of RDS and RDS2 devices

Part 6: Compilation of technical specifications for Open Data Applications in the public domain

Part 9: RBDS – RDS variant used in North America

Part 10: Universal Encoder Communication Protocol UECP

NOTE 1 The Part numbers 7 and 8 will not be used.

The original specifications of the RDS system have been maintained and the extra functionalities of RDS2 have been added.

RADIO DATA SYSTEM (RDS) – VHF/FM SOUND BROADCASTING IN THE FREQUENCY RANGE FROM 64,0 MHz TO 108,0 MHz –

Part 6: Compilation of technical specifications for Open Data Applications in the public domain

1 Scope

This part of IEC 62106 contains the technical specifications for Open Data Applications in the public domain. This document is maintained by the RDS Forum Office. The RDS Forum Office applies an easy procedure for registering new Open Data Applications, to ensure that they can be used without the need to change the RDS standard. The ODA feature permits defining new applications that can be decoded on a receiver. The receiver needs to the adequate software handler for the specific AID, which identifies the application. Receivers that have not implemented the software handler needed for decoding are not affected by ODA data received for any of the applications already defined and specified.

The procedure for registering a new ODA is described in IEC 62106-3.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 62106-1, *Radio data system (RDS) – VHF/FM sound broadcasting in the frequency range from 64,0 MHz to 108,0 MHz – Part 1: Modulation characteristics and baseband coding*

IEC 62106-2:2021, *Radio data system (RDS) – VHF/FM sound broadcasting in the frequency range from 64,0 MHz to 108,0 MHz – Part 2: Message format: coding and definition of RDS features*

IEC 62106-3, *Radio data system (RDS) – VHF/FM sound broadcasting in the frequency range from 64,0 MHz to 108,0 MHz – Part 3: Usage and registration of Open Data Applications (ODAs)*

IEC 62106-4, *Radio data system (RDS) – VHF/FM sound broadcasting in the frequency range from 64,0 MHz to 108,0 MHz – Part 4: Registered code tables*

ISO/IEC 10646, *Information technology – Universal Coded Character Set (UCS)*

ISO 14819 (all parts), *Intelligent transport systems – Traffic and travel information messages via traffic message coding*

3 Terms, definitions, abbreviated terms and conventions

3.1 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 62106-1 apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- IEC Electropedia: available at https://www.electropedia.org/
- ISO Online browsing platform: available at https://www.iso.org/obp

3.2 Abbreviated terms

For the purposes of this document, the abbreviated terms given in IEC 62106-1 and IEC 62106-2 apply.

3.3 Notation and conventions

The notation and conventions given in IEC 62106-1 apply.

4 ODAs in the public domain

4.1 ODAs in the group type A structure

4.1.1 Traffic Message Channel (TMC)

This ODA has been standardized in ISO 14819 (all parts).

4.1.2 Other public ODAs

There exist four other public ODAs:

- Annex A: Coding of RadioText Plus (RT+) tagging information for RadioText in group type 2A/B.
- Annex B: Coding of RadioText Plus (RT+) tagging information for enhanced RadioText (eRT).
- Annex C: Coding of enhanced RadioText (eRT) using UTF-8 coding as standardized in ISO/IEC 10646.
- Annex D: Coding of AF lists in the frequency range 64,1 MHz to 107,9 MHz.

4.2 ODAs in the group type C structure for the upper data-streams 1, 2 and 3

Three public ODAs exist in this category:

- Annex E: Coding of Station logo
- Annex F: Coding of Slideshow
- Annex G: Coding of Internet connection.

5 Protocol to stream RDS on bearers different from FM (NFM)

The NFM protocol is specified in Annex H. It is an ODA development tool.

Annex A
(normative)

Coding of RadioText Plus (RT+) tagging information for RadioText in group type 2A/B

A.1 General

RT+ is designed to let the listener (or user) take additional benefit from the RadioText (RT) service by enabling receivers to offer direct access to specific elements of RadioText messages (e.g. to the title of the broadcast song transmitted at the same time, to news, to telephone numbers such as those used for voting, to web addresses for browsing web content offered by the radio programme provider, etc.).

These RT+ messages carried in the RadioText messages are identified by their location within the message and by the class code of their RT content type (see Table A.2). Thus, a receiver is able to store the different RT+ messages, and the listener may then select and request a specific content type from the storage at any instant in time that fits the user's needs. The advantage of this method is that a user is no longer forced to watch a lot of information passing by. The listener rather gets the opportunity to select specifically any favourite information to be shown on a static display.

Moreover, RT+ gives the possibility to present selected RT message elements to car drivers on a quasi−static display without any major risk of distracting the attention of the driver. Furthermore, RT+ is well suited for mobile phones with built-in RDS FM receivers: telephone numbers may be routed directly from the RadioText to the dialer.

RT+ is based on RT messages and is completely backwards compatible. All additional information necessary for implementing the RT+ service is carried as an Open Data Application in group type 3A and in an associated ODA application group (see Table A.1).

The Application Identification (AID) assigned to RT+ for RT in group type 2A/B is 0x4BD7.

Table A.1 – RT+ information elements for RT

RT+ information elements		
RT message	**RT+ identification**	**RT+ tags**
Group type 2A/B (see IEC 62106-2)	AID in group type 3A	ODA application group type A

A.2 Terms used

Category: The 'RT content types' listed in Table A.2 are grouped into categories: Item (information on programme element), Info (general information services), Programme (information on the programme), Interactivity (related information), Descriptors (places and addresses, date, time, etc.) and Private classes (to be defined by individual broadcasters) and reserved codes for future amendments.

Descriptor: a category of 'RT content types' used for describing places and addresses, date and time, specific identifiers, etc.

Length marker: part of the RT+ information element which describes the additional length of the tagged RadioText message. Counted are characters (64 maximum), not bytes. The addresses of the RadioText characters range from 0 to 63.

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

RT+: an extension of the RT RadioText feature, which allows storing and filtering of parts of the RadioText messages in the receiver terminal as RT+ objects that then can be displayed, selected and accessed by the listener, also independently from the transmitted RadioText messages sent at the same time.

'RT content type': the content of an RT+ message is characterized by an RT+ class code, listed in Table A.2. Sixty-four different codes exist in this table.

RT+ information elements: these are all RT+ elements for any given RT+ message, i.e. the RT+ element defined for group 3A, the RT+ ODA application group elements and the corresponding tagged RadioText elements (RT).

RT+ message: the basic information entity that is sent by the broadcaster to the listener. The listener can select the RT+ messages by their content type.

RT+ content: the RT+ content consists of one or two tagged RadioText elements (RT in group type 2A/B).

RadioText: feature of RDS for providing a programme with text messages.

RadioText message: text messages that are associated with a programme. One single RT message is not likely to be sufficient for complete comprehension by the user.

Start marker: part of the RT+ information element which describes the start position (number found by counting the text character positions within a text string) of the respective tagged RadioText message element (RT).

A.3 RT+ tag

When a RadioText message like "You are listening to 'House of the rising sun' by Eric Burdon" is sent out, the RT+ information elements 'Title' and 'Artist' are marked by two RT+ tags.

An RT+ tag consists of three elements:

a) RT content type;
b) start marker pointing to the position (inside the RT) of the first character of that RT+ message;
c) length marker indicating the additional length (in addition to the character at the start position) of that RT+ message.

The 'RT content type' is taken from a list with 64 entries (see Table A.2).

For the example given below, the two tags are as follows:

RT content type	ITEM.TITLE
Start marker	22
Length marker	22

RT content type	ITEM.ARTIST
Start marker	50
Length marker	10

Start marker and length marker can be derived from the following scheme below:

```
You are listening to 'House of the rising sun' by Eric Burdon
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---
```

The addresses of the RadioText characters range from 0 to 63, so the start marker can take the same values.

The length marker is ranging from 0 to 63 and from 0 to 31 respectively (see A.5.3).

If two RT+ messages are contained in the RadioText, they shall not overlap.

The tag information sent out should not change during the lifetime of the associated RadioText.

A.4 RT+ information elements and data model

A.4.1 General

The content of RT+ messages is carried in the RadioText (RT) messages. Their content is described by RT content type code (see Table A.2) in each RT+ tag.

A.4.2 List of RT content types

The list of defined RT content type codes, grouped in categories, is given in Table A.2. There are 64 RT+ classes of content type available, which a programme service provider can offer and the listener can select from, each with a specific RT+ class. The classes can be grouped into the following categories.

a) Item

The programme is made up of a sequence of programme items (see NOTE), corresponding to an entry in a programme schedule. A programme item may consist again of several programme elements. For all programme elements which can be designated by RT+ classes of the category "Item" in Table A.2, this document uses the term "Item". In popular music programmes, an item is a song; in a programme with classical music, it can be a complete symphony. A speech-based programme item may also be assembled from different items (see the NOTE below). Programme elements like News and Talk as shown in Figure A.2 and Figure A.3 are not "Items", as there do not exist any appropriate RT+ classes of the category "Item" in Table A.2. A programme item can be described by one, several or even all classes of this category, but for the duration of the "Item", the associated RT+ message of each class can only have a single value, for example the RT+ message classified as "Item". "Title" will remain fixed to "House of the rising sun" until the start of the next song.

NOTE A programme item can consist of only one element (e.g. radio drama) and can also be designated by RT+ classes of the category "Item" in Table A.2.

b) Info

RT+ messages of this category carry textual service information that is more or less unrelated to the audio service, but is offering important additional information to the listener, including info about alarms, advertisements and events.

c) Programme

RT content types of this category describe the programme service.

d) Interactivity

Telephone numbers, short message text SMS used for mobile phone services addressed with SMS numbers, e-mail addresses or web addresses (URLs) are given. The listener can send contributions for chat conversations to a chat centre. These contributions can be broadcast by the radio station. Questions for voting may be sent as RT+ content. The listener can send a response back to the voting centre.

e) Private classes

While all other RT+ classes describe precisely the RT content type, also to permit their interpretation by automatic routines within the receiver terminal or by a human user, the Private classes can be freely defined just as required for a specific programme service provider. The interpretation is then dependent on the programme service and does require a template on the receiver terminal. Alternatively, a program provider may supply his customers with special receivers, where the facilities to interpret own Private classes are already built in. In this particular case, no template is required.

f) Descriptors

An RT+ message belonging to one of the categories above can be complemented by an information element of the category Descriptor. Both shall always be transmitted in the same RadioText just as the corresponding tags in the same application group. As an example: the Descriptor GET_DATA contains the URL-address or the SMS number for retrieving more data describing the RT+ message the Descriptor is referring to. The listener can then get access to more information for the music item, special news, events, etc.

A.4.3 Structures of RT+ messages

For some classes, RT+ messages may be structured by the programme service provider following a general pattern, for example results of football matches may be given as RT content type INFO.SPORT with two parts, one indicating the match and the other the result.

"Bayern München:AC Milano 5:5"

This specification generalizes the scheme given above as follows:

The two different parts are separated by two or more consecutive space characters (see NOTE below), that are redundant spaces. The redundant spaces serve as a delimiter between these two parts. The first part is called the key word and will be used primarily for explanation of the text which follows.

NOTE In the examples given in this text, a space character is represented by the symbol "␣".

The key word carries an explanation for the user, whereas the second part may also carry a phone number, the SMS- or MMS-telephone number or the email address to be contacted.

This scheme permits an advanced receiver to accumulate all information (carried in the sequence of RT+ messages of the same RT content type) and then to build one table for presentation to the user.

This scheme may be used for the categories 'Info', 'Programme', and 'Interactivity', and shall not be used for the categories 'Item' and 'Descriptor' for the specific RT+ classes, identified in Table A.2 with footnote d.

For explanation, the following examples are given for different classes, first lines indicating the structure, and then a line giving a specific example:

- INFO.STOCKMARKET

  [Name␣␣Latest value in €] or more extended:

  [Name␣␣Latest value in €␣␣Change␣␣High␣␣Low␣␣Volume] e.g.

  'Nokia␣␣12,27␣␣0,41␣␣12,31␣␣12,15␣␣23 332 238'

- INFO.SPORT

  [Match␣␣Result] or more extended:

  [Kind of sport␣␣Match␣␣Result] e.g.

  'Football␣␣Bayern München:AC Milano␣␣5:5'

- INFO.WEATHER
  [Description␣␣Temperature] e.g.
  'Raining␣␣16 degrees C' or
  'Munich␣␣23 degrees C'
- Interactivity
- PHONE.OTHER
  [Description␣␣Phone Number] e.g.
  'Deutsches Museum␣␣089323990'

If it makes sense, elements may be omitted from the right in a given structure

(e.g. INFO.STOCKMARKET: 'Nokia␣␣12,27␣␣0,41␣␣12,31␣␣12,15')

Alternatively, the description of the classes PHONE.OTHER, SMS.OTHER, EMAIL.OTHER and MMS.OTHER may be put into tag 1 and the second part, i.e. the phone number or the address, will be put into tag 2. This then gives the text editor more freedom to introduce some additional glue words in the RadioText message.

EXAMPLE 'The match Bayern München:AC Milano ended 5:5'

RadioText messages may contain several space characters for optimizing the layout in static displays. However, if the RT messages are used in context with an RT+ service, redundant spaces in parts marked by RT+, are only allowed for the purpose of delimiting two or more parts of the RT+ content.

A.4.4 Receiver data model

The RT+ feature is designed to allow a broad range of receiver models with different display capabilities and memory complexity to be used. The broadcaster may provide special radio skins (templates) for presenting RT+ information on the receiver display. Each programme provider may deposit various templates for different programme types on a web server (to be defined). This web server can be addressed by the receiver for downloading a particular template (see also A.5.2). This requires the receiver to be able to download actively external data (pull information by unicast, for example to download templates using a telephone connection).

A simple receiver will store a small selection of RT+ classes only. The storage will contain only the current content of the 'RT+ classes'. The storage of a given class will be overwritten by a new version of that same class. The receiver may offer a choice to the listener to enable a selection of any particular 'RT+ class' to be presented on the display. For example, a listener might want to see one or several 'RT+ classes' of the category 'Item' simultaneously, i.e. 'Title' and 'Artist' of the 'Item' received at that moment.

More complex receivers will store not only the current content of several classes, but will use a memory to keep the information collected during the past. For reviewing the list of earlier received 'Items', it is essential for the receiver that it can combine the different RT+ information elements (received at different times) correctly, so that elements of different 'Items' are not mixed. For that purpose, an 'Item toggle bit' changes every time a new 'Item' starts and the 'Item running bit' indicates whether the 'Item' is still running. Both bits are sent continuously together with every pair of the RT+ tags.

The examples in Figure A.1, Figure A.2 and Figure A.3 show the setting of the 'Item toggle bit' and the 'Item running bit' for different audio sequences.

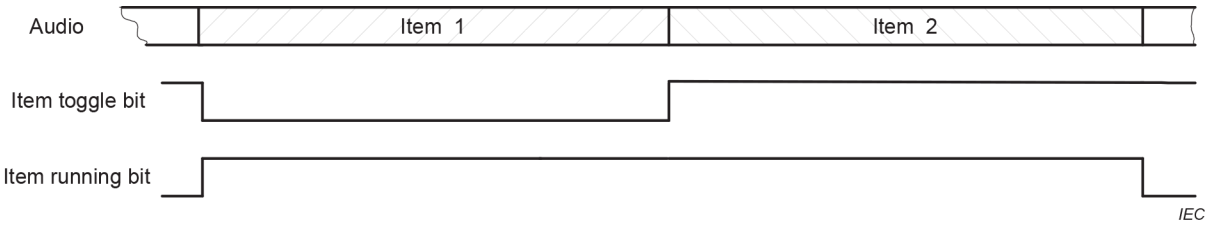

Figure A.1 – Example 1: RT+ information of the category 'Item' (see Table A.2) will be attached to the programme elements Item 1 and Item 2

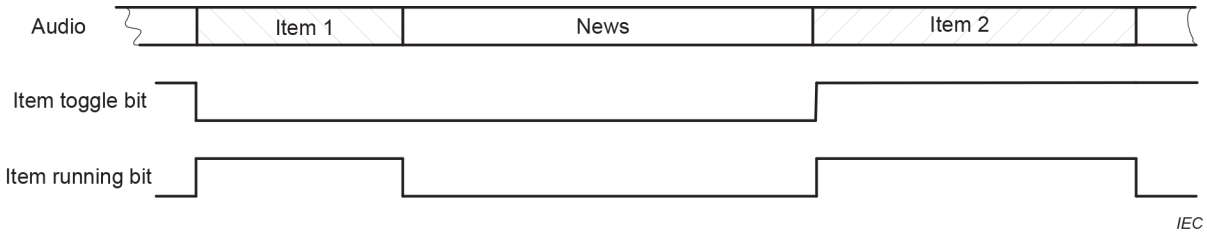

Figure A.2 – Example 2: RT+ information of the category 'Item' will be attached to the programme elements Item 1 and Item 2, but not to the programme element News

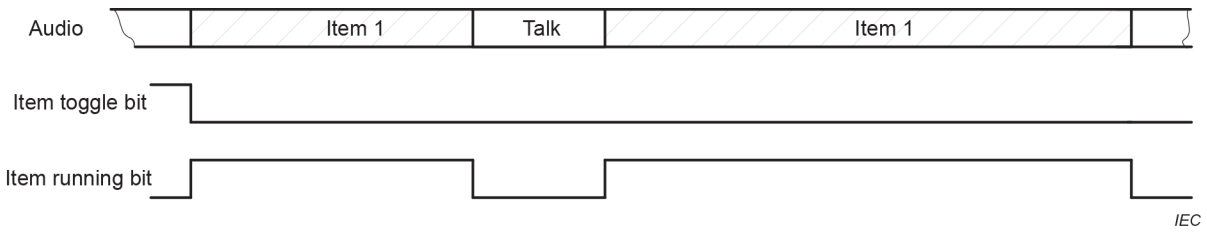

Figure A.3 – Example 3: RT+ information of the category 'Item' will be attached only to the programme element Item 1, but not to the programme element Talk

Receivers can provide more convenience by assembling an ordered cumulative list of all RT+ content of a specific class. For example, the class INFO.SPORT may be displayed as a list of the football match results. This is easy to implement for those classes of the category 'Info' that use redundant space characters as a delimiter between several parts of the text. The first part, the keyword, can then be used to establish a table which is ordered according to the keywords. Updating is also possible, if the keyword is not changed.

NOTE 1 The broadcaster can set the 'Item toggle bit' and the 'Item running bit' as required.

NOTE 2 The default setting for both the 'Item toggle bit' and the 'Item running bit' is '0'.

A.5 RT+ coding for RT

A.5.1 General

To transmit the RT+ tags, the ODA feature is used and the necessary details are defined by A.5.2 to A.5.4.

The message bits of group type 3A in block 3 carry control data for the application AID 0x4BD7 in block 4. The tag information, to identify the RT+ messages within the RadioText, is carried by the RT+ ODA application group, signalled in block 2 of the 3A group. Only type A groups can be used for the application group.

A.5.2 RT+ identification (group type 3A)

The coding of the message bits in group type 3A and the Application Identification (AID) for the ODA RT+ is shown in Figure A.4.

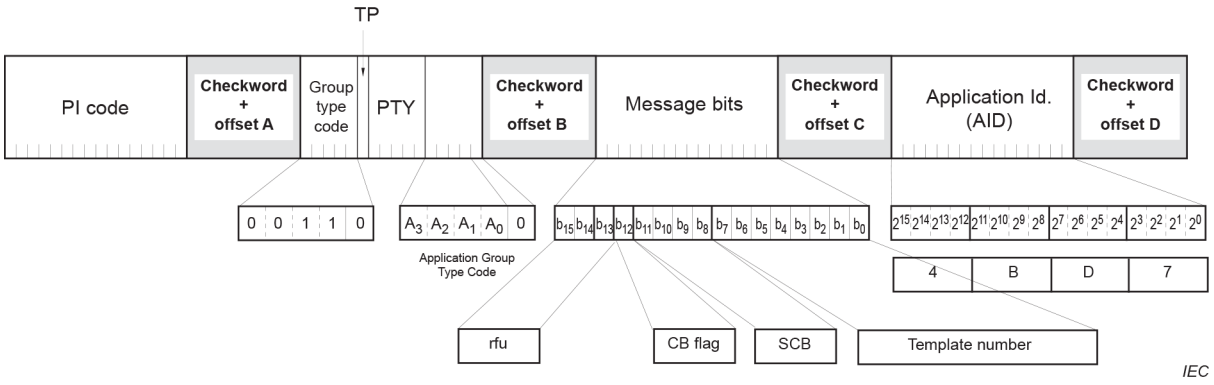

Figure A.4 – Bit allocation for group 3A (message bits and AID)

Application group type code:

- The group type for transmitting the RT+ application data can be chosen from IEC 62106-3.
- The group type code is signalled in block 2 of the 3A group.

The meaning of the message bits of group type 3A is as follows:

a) rfu

Reserved for future use, and not affecting any of the functions of the other bits. The rfu bits shall be set to zero until they are defined.

b) CB flag

The CB flag gives the information, if there is a template available for the ongoing programme. The template may already be present in the receiver (downloaded previously) or can be downloaded at that moment, if the user wants it. The identification of the desired template is accomplished by sending back from the receiver terminal to the web server the PI code and the Extended Country Code (ECC), the 'Server Control Bits' and the 'Template number'.

If the CB flag is set to '0', no special radio skin (template) is available and 'Server Control Bits' and 'Template number' bits are reserved for future use.

If the CB flag is set to '1', a special radio skin (template) is available for the ongoing transmission.

c) Server Control Bits (SCB)

It can occur that the same PI code is used repeatedly within a national area (e.g. for local programme stations far away from each other). In these cases, the Server Control Bits are used to distinguish between programmes using the same PI code.

NOTE The Server Control Bits are allocated by the operator of the web server.

d) Template number

The Template number gives the number of a specific template, from a choice of templates provided by the broadcaster. Up to 256 templates per programme service can be addressed.

A.5.3 Coding of the RT+ tag

The coding of the message bits of the application group is shown in Figure A.5.

In the message bits of the RT+ application group two RT+ tags are conveyed. All 'RT+ classes' or 'RT content types' can be put into the one or the other tag of the application group. If an RT+ message contains more than 32 characters, the associated tag information shall be coded in tag 1. Content types of the category 'Descriptor' are always referring to the content type in the other tag (in the same application group) and this gives additional information.

The start addresses in the tags may be chosen according to the needs during the RT generation. Therefore, the sequence of the tags in the application group does not determine the sequence of the information elements in the RT.

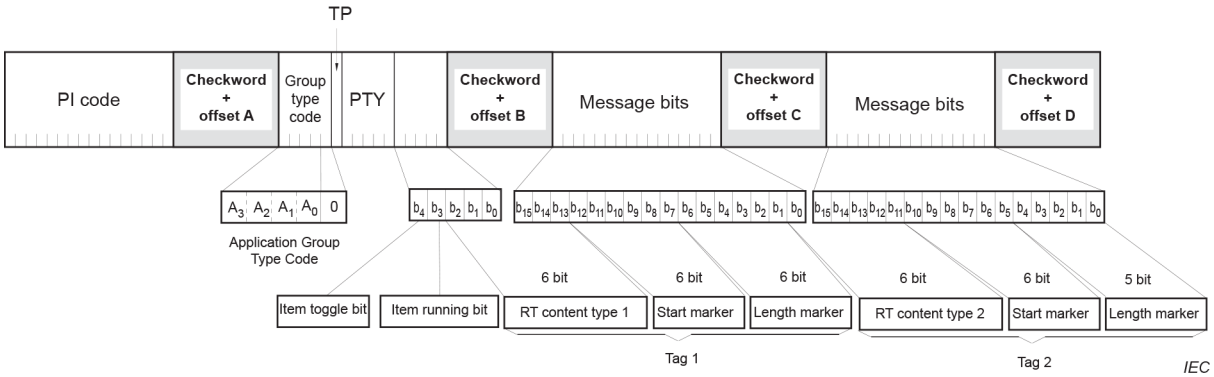

Figure A.5 – Coding of the message bits of the application group

The meaning of the message bits is as follows:

a) 'Item toggle bit'

This bit shall be toggled when a new 'Item' starts.

NOTE 1 Item means a specific programme element (see also A.4.2 and Table A.2).

b) 'Item running bit'

This bit shall be set to 1 if an 'Item' is running. Otherwise, it shall be set to 0.

NOTE 2 The 'Item toggle bit' and the 'Item running bit' will be set or reset independently from the tag information sent out at the same time.

NOTE 3 In the receiver, these two bits can be used to group all 'RT/eRT content types' of the category 'Item' sent for one item and store them in memory (subsequently for several items) or, when storing and presenting information for only one item, to delete all information belonging to the elapsed item before starting to gather information for the new one.

NOTE 4 Even though not intended by this document, these bits can be used for recording purposes.

c) 'RTcontent type'

This 6-bit value specifies the tags by assigning to them a content type according to the 'RT+ class' codes given in Table A.2. If only one RT+ information element (tag) is used, then the content type in the second tag shall be set to 'Dummy'. If no RT+ information element is existing, the content type in both tags shall be set to 'Dummy'. In both cases, the bits in the start and length markers are then undefined.

d) Start marker

This 6-bit value indicates the position of the first character of the RT+ message within the RadioText (start marker 0 means the first character in the RadioText).

e) Length marker

This 6-bit (or 5-bit for length marker in tag 2) value gives the additional length (number of characters following the first character at the start position) of the RT+ message.

As it is not permitted that RT+ messages overlap, only one element may comprise more than 32 characters and 5 bits are then sufficient for coding the length marker in tag 2. Flipping of the two tags is permitted if the second RT+ information element exceeds 32 characters but the first is under 32.

A.5.4 Clearing of RT+ messages

There is no specific clear command. Clearing will be done by overwriting the content of a 'RT+ class' with one or more space(s) taken as RT+ messages out of the current RadioText. This assumes that the RadioText in transmission contains at least one space character and at least one tag is unused and available to address the class to be cleared.

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---
```

'RT content type'	PHONE.HOTLINE
Start marker	9
Length marker	9

'RT content type'	INFO.NEWS
Start marker	8
Length marker	0

The second tag information (transmitted simultaneously with the RadioText 'Hotline: 0123456677') will cause the previously sent message of the class INFO.NEWS to be deleted.

If a class of the category 'Item' is cleared, all classes of category 'Item' shall be cleared.

Table A.2 – Code list and 'RT+ class' description of RT content types

Category	Code[a]	RT+ class	Description
Dummy	0	DUMMY_CLASS	To assign a class if the RadioText contains no RT+ information
Item	1	ITEM.TITLE [b]	Title of item, for example, track title of an album
	2	ITEM.ALBUM [b]	The collection name to which this track belongs
	3	ITEM.TRACKNUMBER [b]	The track number of the item on the album on which it was originally released
	4	ITEM.ARTIST [b]	A person or band/collective generally considered responsible for the work
	5	ITEM.COMPOSITION [b]	A complete composition (classical music broadcasters should use this item to identify the composition)
	6	ITEM.MOVEMENT [b]	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 [b]	The artist(s) who performed the work. In classical music, this would be the conductor
	8	ITEM.COMPOSER [b]	Name of the original composer/author
	9	ITEM.BAND [b]	Band/orchestra/accompaniment/musician
	10	ITEM.COMMENT [b]	Any comment related to the content
	11	ITEM.GENRE [b]	The main genre of the audio, for example 'classical', 'hip hop', 'jazz', 'oldies', 'drama', etc.

Category	Code[a]	RT+ class	Description
Info	12	INFO.NEWS	Message/headline
	13	INFO.NEWS.LOCAL	Local news
	14	INFO.STOCKMARKET [d]	Quote information; either as one part or as several distinct parts: 'name latest value␣␣change high ␣␣low ␣␣volume' [c]
	15	INFO.SPORT [d]	Result of a game; either as one part or as several distinct parts: 'match ␣␣result', for example 'Bayern München: Borussia ␣␣5:5'
	16	INFO.LOTTERY [d]	Raffle/lottery: 'key word ␣␣values'
	17	INFO.HOROSCOPE [d]	Horoscope; either as one part or as two distinct parts: 'key word ␣␣text', for example 'sign of the zodiac ␣␣blablabla'
	18	INFO.DAILY_DIVERSION	Daily tip/diversion/joke
	19	INFO.HEALTH [d]	Information about health: 'key word ␣␣info'
	20	INFO.EVENT	Information about an event
	21	INFO.SCENE	Information about scene (hot locations to be, …)
	22	INFO.CINEMA	Information about movies in cinema
	23	INFO.TV	Information about TV-movies
	24	INFO.DATE_TIME	Information about date and time (receiver to choose between date and time). Not CT (Clock Time); shall not be used to set the internal clock of a device
	25	INFO.WEATHER [d]	Information about weather; either as one part or as two distinct parts: 'key word ␣␣info', e.g. 'Rain ␣␣17 °C'
	26	INFO.TRAFFIC	Information about traffic. This shall not replace TMC, but rather alert users in case of exceptional traffic news
	27	INFO.ALARM	Alarm information
	28	INFO.ADVERTISEMENT	Info about an advertisement. May be in parallel to an audio advertisement
	29	INFO.URL [d]	Link to URL either as one part or as two distinct parts: 'key word ␣␣url'
	30	INFO.OTHER [d]	Other information, not especially specified: 'key word ␣␣info'

Category	Code[a]	RT+ class	Description
Programme	31	STATIONNAME.SHORT	Name describing the radio station (call letters)
	32	STATIONNAME.LONG	Name describing the radio station
	33	PROGRAMME.NOW	EPG info programme now
	34	PROGRAMME.NEXT	EPG info programme next
	35	PROGRAMME.PART	Part of the radio show being broadcast; for example one or more parts of the PROGRAMME.NOW
	36	PROGRAMME.HOST	Name of the host of the radio show
	37	PROGRAMME.EDITORIAL_ STAFF	Name of the editorial staff; for example name of editorial journalist
	38	PROGRAMME.FREQUENCY [d]	Information about radio shows. A link towards another frequency with other content (not AF list). May be one part or two distinct parts: 'key word ␣␣frequency'
	39	PROGRAMME.HOMEPAGE [b]	Link to radio station homepage
	40	PROGRAMME.SUBCHANNEL [d]	For so-called multicasting applications; may be one part or two distinct parts: 'key word ␣␣sub-channel'
Inter-activity	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 [d]	Name and telephone number; either as one part or as two distinct parts: 'key word ␣␣phone number'
	44	SMS.STUDIO	The telephone number of the radio station's studio (to send directly an SMS to the studio)
	45	SMS.OTHER d	Name and SMS number; either as one part or as two distinct parts: 'key word ␣␣sms number'
	46	EMAIL.HOTLINE	The email address of the radio station's hotline
	47	EMAIL.STUDIO	The email address of the radio station's studio
	48	EMAIL.OTHER [d]	Name and email address; either as one part or as two distinct parts: 'key word ␣␣email address'
	49	MMS.OTHER d	Name and MMS number; either as one part or as two distinct parts: 'key word ␣␣mms number'
	50	CHAT	chat content: sent by users to a specific address and broadcast by the radio station
	51	CHAT.CENTRE	Address, where replies to the chat shall be sent (may be URL or SMS)
	52	VOTE.QUESTION	A question (typically binary) which can be answered by 'yes' or 'no' or '1' or '2'
	53	VOTE.CENTRE	URL or SMS number to send the answer to
rfu	54		Class reserved for future use
	55		Class reserved for future use
Private classes [e]	56		
	57		
	58		

Category	Code[a]	RT+ class	Description
Descriptor [f]	59	PLACE	Adds info about a location
	60	APPOINTMENT	Adds info about date and time
	61	IDENTIFIER [b]	For music it is the International Standard Recording Code (http://www.ifpi.org/isrc/)
	62	PURCHASE [b]	Address where item can be purchased, can be a URL or an SMS number
	63	GET_DATA	Retrieves either via an SMS or URL-link more data about the other RT+ message of the same RadioText message. (Info request via point to point, or unicast)

[a] This is the code to be used for 'RT content type' (see A.5.3); the decimal code shall be converted to the corresponding binary code.

[b] For this RT+ class, a corresponding MP3 ID3v2 tag exists.

[c] ␣ = space; two or more consecutive spaces act as a separator between several parts of the RT+ message (see A.4.3).

[d] For this RT+ class the RT+ message may be structured as described in A.4.3.

[e] 'Private classes' may be defined by the service provider (see A.4.2).

[f] Descriptor always defines the other RT+ message of the same RadioText message.

A.6 Broadcasting conventions

When RT+ information is generally available, 3A type groups shall be transmitted at least every 10 s. During the lifetime of a RadioText RT/eRT containing RT+ messages, application groups carrying the tags shall be sent with a minimum frequency of 0,5 groups per second. The tag information sent out shall not change during the period of the associated RadioText ('Item toggle bit' and 'Item running bit' may change).

The RT A/B flag shall be toggled when the RadioText changes. The RT+ tag information for the application group shall be sent to the RDS encoder immediately after the new RadioText.

A.7 Receiving conventions

When the receiver detects a change in the RadioText A/B flag (indicating a new message) RadioText decoding and decoding of RT+ tags may start simultaneously and RT+ information elements may be displayed or stored, once the corresponding part of the RT RadioText is received completely error-free.

The different 'RT+ classes' may be stored and then be displayed automatically or when the user retrieves a certain 'RT content type'. For certain content types, it can make sense to save more than the current or the last information in the memory (e.g. a list of the 'Titles' belonging to the last 10 'Items').

Depending on the reception conditions, it can be necessary to evaluate the tag information of a few application groups before decoding RT+ information.

A.8 Marking

Equipment implementing RadioText Plus should be marked with the designation 'RT+'.

Annex B
(normative)

Coding of RadioText Plus(RT+) tagging information for RadioText in the eRT ODA of Annex C

Table B.1 shows the RT+ information elements for enhanced RadioText (eRT).

The assigned Application Identification (AID) is 0x4BD8.

Table B.1 – RT+ information elements for eRT

RT+ information elements		
eRT message	**RT+ identification**	**RT+ tags**
ODA application group for eRT (see Annex C)	AID in group type 3A	ODA application group type A

The coding of the RT+ information is the same as specified for RT in Annex A. Only the AID is different, which permits to have on the same transmission RT messages with RT+ and eRT messages with RT+.

The simultaneous transmission of RT and eRT is possible with RDS2 using the upper streams. If RDS2 is used, eRT can be on the upper streams 1-3 and RT can be at the same time on stream 0.

NOTE When eRT uses RT+ tagging, the eRT message length is limited to 64 characters, given the limitation imposed by RT+ coding as explained in Annex A. The corresponding length of the byte string depends on the characters used for a given language. It cannot exceed 128 bytes, which is the limit of eRT coding. Because of this limitation, even 64 characters cannot always be achieved as the maximum.

Annex C
(normative)

Coding of enhanced RadioText (eRT)

C.1 General

Since eRT is an Open Data Application (ODA), it is completely backwards compatible. All information necessary for implementing the eRT service is carried as an Open Data Application in group type 3A and in an associated ODA application group (see Table C.1).

The ODA Application Identification (AID) assigned to eRT is 0x6552.

Table C.1 – eRT information elements

eRT information elements		
eRT message	eRT identification	Optional RT+ tags
ODA application group type A for eRT	Group type 3A	See Annex B

eRT is a RadioText (128 bytes maximum) alternative to RT in group type 2 A/B that may be used wherever the basic RDS character set defined in IEC 62106-4 is insufficient.

The eRT application group (see Figure C.2) differs only slightly from RT group type 2A/B. The difference is that the text A/B flag bit in block 2 of group 2A/B has in eRT become part of the segment counter, so that in eRT 32 segments instead of 16 in RT become possible.

C.2 Coding eRT in ODA groups

C.2.1 General

To transmit the eRT, the necessary details are defined by Clause C.2.

The message bits of group type 3A carry control data for the application. The RadioText information is carried by the eRT ODA application group. Only type A groups can be used.

C.2.2 eRT identification (Group type 3A) and coding of the text string

The coding of the message bits in group type 3A and the Application Identification (AID) for the ODA eRT is shown in Figure C.1.

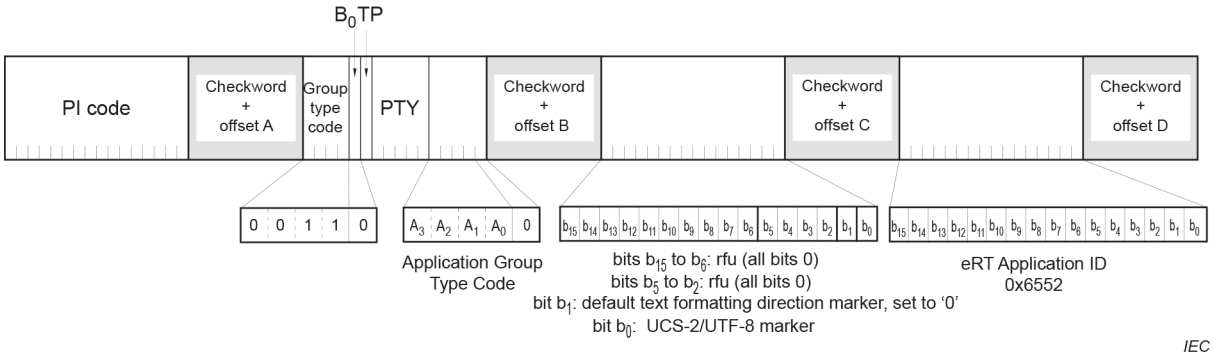

Figure C.1 – Bit allocation for group 3A (message bits and AID)

Application group type code:

- The group type for transmitting the eRT application data can be chosen as specified in IEC 62106-3.
- The group type code is signalled in block 2 of the 3A group.

The meaning of the message bits in block 3 of group type 3A is as follows.

a) Marker for UCS-2 /UTF-8 coding (bit b0):

   Set to '0'– On data-stream 0 for UCS-2 encoding or '1' for UTF-8 encoding reasons of backwards compatibility.

   Set to '1' – On data-streams 1, 2 and 3 where only UTF-8 encoding shall be used.

b) Marker for text formatting direction (bit b1):

   Set to '0', which means transmission of the byte string is always from left to right.

c) Bits b2 to b5 are all set to '0' for the reason of backwards compatibility with the earlier eRT specification (rfu).

d) rfu – bits b6 to b15 are all set to '0'.

C.2.3 Coding of the eRT text string

NOTE For details of UTF-8 (UCS Transformation Format 8), see ISO/IEC 10646.

Figure C.2 shows the coding of message bits of the application group.

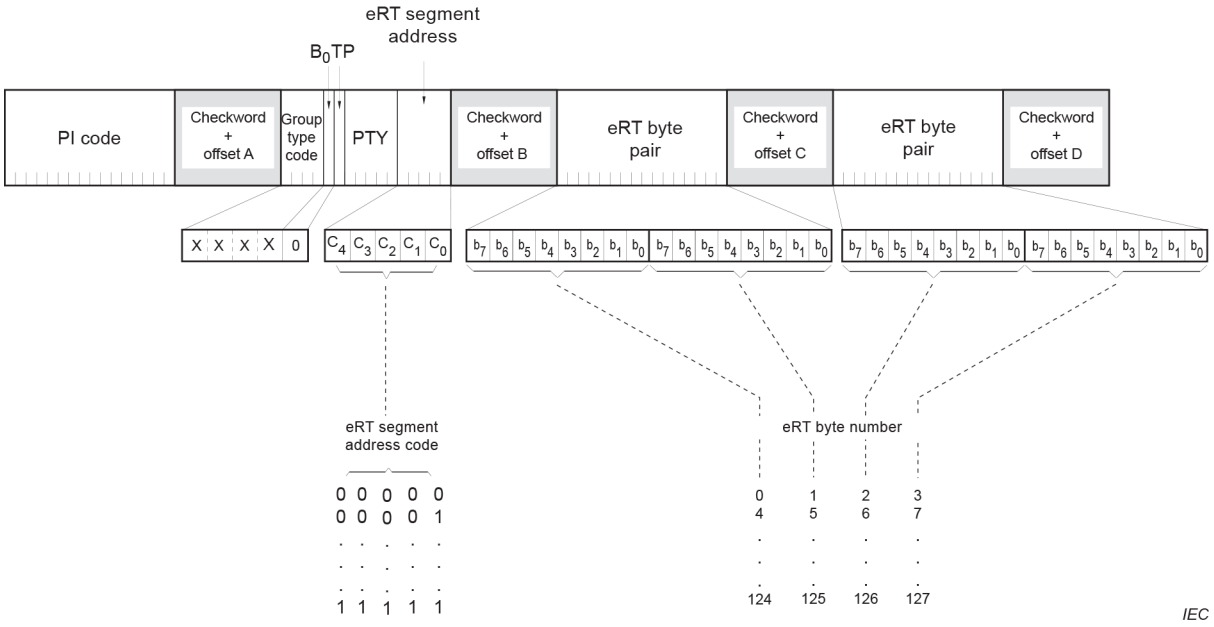

Figure C.2 – Coding of the message bits of the application group type A

If RT+ (see Annex B) is used with eRT text strings, the RT+ information elements shall be derived from the character string, i.e. for the 'Start Marker' and the 'Length Marker' determination of any of the two RT+ tags, the eRT text string in terms of the number of characters within that string shall be evaluated, disregarding the fact that the string is transmitted as a string of UCS-2 or UTF-8 coded characters. The maximum number of characters permitted, if used with RT+, is 64. Without using the RT+ feature, a theoretical maximum message length of 128 characters is possible on the upper data-streams 1,2 and 3, UTF-8 coded and provided they all occupy only one byte per character.

The 5-bit segment address defines the current byte number within the eRT text string, in terms of four bytes each, contained in the third and fourth blocks. The text string increases from left to right and the most significant byte is transmitted first.

A new text shall start with the segment address '00000' segment and there shall be no gaps up to the highest used segment address of the current message. The number of text segments is determined by the length of the message, and each message shall be ended by the control character 'carriage return' 0x0D, if the current message requires less than 128 bytes. The bytes left unused in the same segment address shall also be filled with 0x0D.

To ensure a RadioText message that is no longer valid is cleared from the display, the broadcaster should send a blank message only containing a 0x0D control character. The bytes left unused in the same segment address shall also be filled with 0x0D.

C.2.4 UTF-8 decoding problems when used with RT+

UTF-8 encoding has become very attractive and it is widely used on the Internet. However, in RDS this kind of encoding, attractive as it appears to be on the first look, can create some text decoding problems, specifically if used with RT+. This is due to the fact that the number of bytes needed for a symbol with UTF-8 encoding will vary between one, two or more, and then, when RDS reception is not optimal, gaps in a received text byte string are very likely, as symbols may be spread over two or more different blocks of the eRT application group. Although the UTF-8 decoder can normally recognize the number of bytes belonging to any given symbol, there is a problem with several non-received consecutive bytes, as then it is not possible to detect how many characters such a gap had represented exactly. Spaces can be substituted for what has been missed, but the exact character positions of the respective RT+ tags can then no longer be determined.

Therefore, UTF-8 decoding will only work correctly when RDS receiving conditions are generally good.

C.3 Broadcasting conventions

When eRT RadioText is available, 3A type groups shall be transmitted at least every 10 s. During the lifetime of eRT RadioText messages, the application groups for eRT shall be sent with a minimum frequency of four groups per second.

The same enhanced RadioText messages should be transmitted at least three times to improve reception reliability.

The transmission capacity of RDS is not sufficient to use normally RT and eRT at the same time on stream 0, i.e. it shall be either one or the other RadioText mode. If RDS2 is used, eRT can be on the upper streams 1, 2 and 3 and RT can be at the same time on stream 0.

C.4 Receiving conventions

A space shall be substituted by the receiver for any unrecognized symbol or control character.

C.5 Marking

Equipment implementing eRT RadioText should be marked with the designation 'eRT'.

Annex D
(normative)

Coding of AF lists in the frequency range 64,1 MHz to 107,9 MHz: ODA-AF

D.1 Objective to be achieved

Normally Alternative Frequency lists use 8-bit codes transmitted in group type 0A. The coding was originally conceived for Band II, with the lower limit at 87,5 MHz in mind. Some countries plan to extend their FM frequency band downwards, below 87,5 MHz, so a new mechanism is required to cater for the extended range of AFs. For this purpose, a new 9-bit AF coding has been defined to be carried in this ODA which supplements the existing 8-bit AF codes, defined in IEC 62106-2, carried in group type 0A.

The coding of the 9-bit AFs is similar to that of the existing 8-bit AFs permitting simple conversions between the two. The extended 9-bit range (0 to 511) uses the same AF code definitions in its lower half from the existing 8-bit range (0 to 255) as well as new AF code definitions for frequencies below 87,5 MHz in its upper half (256 to 511).

AF method A or B as specified for the frequency range 87,5 MHz to 108 MHz in IEC 62106-2 can also be used in this ODA to associate AFs with one another or set up regional AF lists in a receiver.

This ODA has the capability with its 9-bit AFs to cover all frequencies of a programme service in the range 64,1 MHz to 107,9 MHz. As such, the complete AF list of a programme service can be carried within this ODA. However, for compatibility with existing legacy receivers without support for this ODA, any AFs of a programme service representing frequencies above 87,5 MHz should still be carried in group type 0A.

The ODA Application Identification (AID) assigned to this ODA is 0x6365, see Figure D.1.

D.2 Description of the coding process

D.2.1 ODA-AF identification (group type 3A)

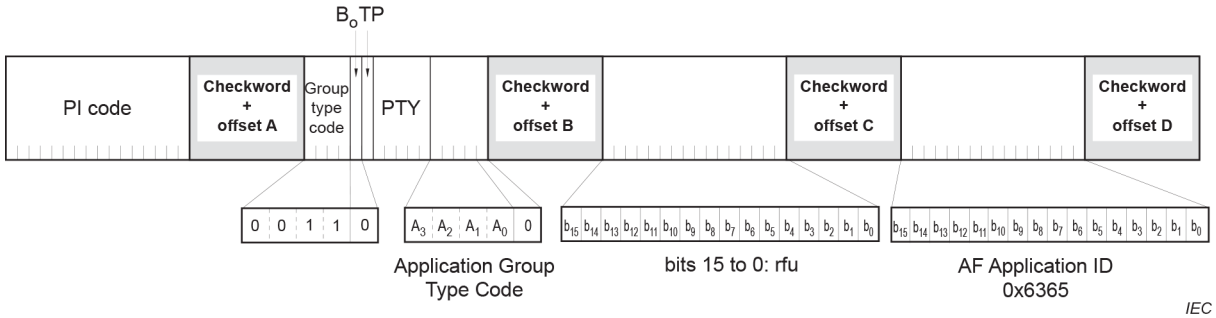

Figure D.1 – New ODA-AF – group type 3A

The application group for the transmission of AF codes is shown in Figure D.2. It shall be transmitted at least once every 10 s.

D.2.2 AF coding in the application group

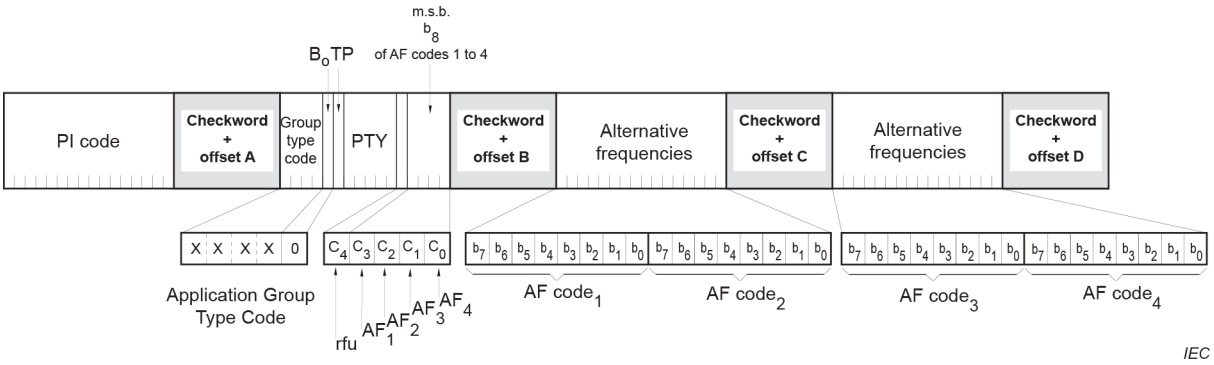

Figure D.2 – New ODA-AF application group – group type A

Figure D.2 shows that the AFs are coded in pairs just like the AFs are coded in group type 0A. This permits to use the same coding methods for the AF lists as described for group type 0A in IEC 62106-2. It is thus possible to choose for the coding either AF method A or AF method B. The only difference is that this ODA uses exclusively 9-bit AFs while group type 0A uses only 8-bit AFs. The 8-bit AF codes in Band II (87,5 MHz to 108,0 MHz) as specified in IEC 62106-2 are compatible with the AF codes used so far, and the same is true for the "special meanings code table". The 9-bit AF codes used by this ODA are shown in Table D.1, Table D.2, Table D.3, Table D.4 and Table D.5.

Table D.1 – 9-bit AF code table for VHF Band I (64,0 MHz to 88,0 MHz)

Number	Binary code	Carrier frequency
256	1 0000 0000	Not assigned
257	1 0000 0001	64,1 MHz
258	1 0000 0010	64,2 MHz
:	:	:
495	1 1110 1111	87,9 MHz
496	1 1111 0000	88,0 MHz
497		Not assigned
:	:	:
511		Not assigned

Table D.2 – 9-bit AF code table for VHF Band II (87,5 MHz to 108 MHz)

Number	Binary code	Carrier frequency
1	0 0000 0001	87,6 MHz
2	0 0000 0010	87,7 MHz
:	:	:
:	:	:
204	0 1100 1100	107,9 MHz

Table D.3 – 9-bit special meanings code table

Number	Binary code	Special meaning
0	0 0000 0000	Not to be used
205	0 1100 1101	Filler code
206	0 1100 1110	Not assigned
207	0 1100 1111	Not assigned
:	:	:
223	0 1101 1111	Not assigned
224	0 1110 0000	No AF exists
225	0 1110 0001	1 AF follows
:	:	:
249	0 1111 1001	25 AFs follow
250	0 1111 1010	An MF frequency follows
F/MF frequency follows		
251	0 1111 1011	Not assigned
:	:	:
255	0 1111 1111	Not assigned

Table D.4 – LF/MF code table – ITU regions 1 and 3 (9 kHz spacing)

Number		Binary code	Carrier frequency
LF	1	0 0000 0001	153 kHz
	:	:	:
	:	:	:
	15	0 0000 1111	279 kHz
MF	16	0 0001 0000	531 kHz
	:	:	:
	:	:	:
	:	:	:
	:	:	:
	135	0 1000 0111	1 602 kHz

Table D.5 – MF code table – ITU region 2 (10 kHz spacing)

Number		Binary code	Carrier frequency
MF	16	0 0001 0000	530 kHz
	:	:	:
	:	:	:
	:	:	:
	:	:	:
	124	0 0111 1100	1 610 kHz

To facilitate the automatic tuning process in a receiver, a number of AFs shall be transmitted. Ideally, the AF list shall only comprise frequencies of neighbouring transmitters or repeaters. Two methods of transmitting AFs are possible. AF method A is used for lists up to 25 in number and AF method B is used for larger lists. AF method B is also used where it is required to indicate frequencies of generically related services (see IEC 62106-2).

D.2.3 AF method A

Two AF codes (AF pairs) are carried in each block 3 and 4. The first AF code in the transmitted list (codes 224 to 249) indicates the number of frequencies in that list. This list will also include the frequency of the transmitter originating the list, if it has repeaters.

EXAMPLES:

	Example A	
First AF pair:	#5	AF1
Second AF pair:	AF2	AF3
Third AF pair:	AF4	AF5
Fourth AF pair:	Filler	Filler

Example B	
#4	AF1
AF2	AF3
AF4	Filler
Filler	Filler

Example C	
#4	AF1
AF2	AF3
LF/MF follows	AF4
Filler	Filler

Example A shows a list of five VHF frequencies, where #5 is the number of the following frequencies, represented by code 229.

Example B shows a list of four VHF frequencies, where filler code is 205.

Example C shows a list of three VHF frequencies and 1 LF/MF frequency, where the code is 250 (LF/MF follows) followed by the AF4 frequency code.

D.2.4 AF method B

Method B AF coding is used where the number of AFs used by a transmitter and its associated repeater stations exceeds 25, or where it is required to indicate frequencies which belong to different regions which at times carry different programmes.

Each transmitter and associated repeater stations broadcast the same set of different AF lists in sequence. The number of AF lists within a network is in general identical to the number of transmitters and repeater stations in the network, so as to provide a unique list for each transmitting station. In this protocol, the AFs for the VHF/FM transmitters are individually addressed by transmitting the tuning frequency paired with one AF within one block.

NOTE If the frequency referenced is for an LF/MF transmission, it occupies two AF codes, the first being code 250. Hence, it cannot be referenced to its associated tuning frequency.

Each list starts with a code giving the total number of frequencies within this list, followed by the tuning frequency for which the list is valid. All remaining pairs (up to 12) give the tuning frequency together with a valid AF.

- If the number of AFs of a station is greater than 12, the list shall be split into two or more lists. These lists are transmitted directly one after the other and the receiver shall combine the lists again.
- If a transmitter frequency is used more than once within a network, the respective AF lists are transmitted separately. In order to indicate that these lists with the same tuning frequency belong to different stations, the lists shall be separated by AF lists of other stations. The receiver may combine them or evaluate them separately.

For the transmission of the frequency pairs within one block, the following convention is used.

- They are generally transmitted in ascending order, for example

89,3	99,5	or	99,5	101,8	$F_1 < F_2$

- In special cases they are transmitted in descending order, if they belong to different regions, or carry from time-to-time different programmes, for example

99,5	90,6	or	100,7	99,5	$F_1 > F_2$

In both the above examples, 99,5 MHz is the main tuning frequency.

EXAMPLES:

F_1	F_2	Commentary
# 11	89,3	Total number (11) of frequencies for tuning frequency (89,3)
89,3	99,5	$F_2 > F_1$ hence 99,5 is an AF of tuned frequency 89,3, and is the same programme service
89,3	101,7	$F_2 > F_1$ hence 101,7 is an AF of tuned frequency 89,3, and is the same programme service
88,8	89,3	$F_2 > F_1$ hence 88,8 is an AF of tuned frequency 89,3, and is the same programme service
102,6	89,3	$F_2 < F_1$ hence 102,6 is an AF of tuned frequency 89,3, but is a regional variant of the programme service
89,3	89,0	$F_2 < F_1$ hence 89,0 is an AF of tuned frequency 89,3, but is a regional variant of the programme service

# 9	99,5	Total number (9) of frequencies for tuning frequency (99,5)
89,3	99,5	$F_2 > F_1$ hence 89,3 is an AF of tuned frequency 99,5, and is the same programme service
99,5	100,9	$F_2 > F_1$ hence 100,9 is an AF of tuned frequency 99,5, and is the same programme service
104,8	99,5	$F_2 < F_1$ hence 104,8 is an AF of tuned frequency 99,5, but is a regional variant of the programme service
99,5	89,1	$F_2 < F_1$ hence 89,1 is an AF of tuned frequency 99,5, but is a regional variant of the programme service

Broadcasters using splitting of a network during certain hours of the day should use AF method B, and not AF method A. The lists should be static, i.e. the AFs included in the list that carry a regional variant of the programme service during certain hours of the day, shall be signalled by transmitting in the descending order. The PI codes to identify the different regional variants of the network or programme service shall differ only in the second element (bits 8 to 11) of the code using area codes R1 to R12, see IEC 62106-2.

If switching by the broadcaster of the second element of the PI Code to I, N or S occurs, this informs a receiver that now even AFs transmitted in descending order are carrying the same programme service and the receiver may freely allow switching to these AFs in addition to those transmitted in ascending order.

Even if the PI codes are static at all times, various receiver and customer-specific implementations exist that will, at driver option, permit the receiver to accept not only AFs from the same regional PI code but also those from the different regional variants of the network or programme service.

D.2.5 Convention for identification of the AF method used

The AF method used is not signalled explicitly, but can easily be deduced by receivers from the frequent repetition of the main tuning frequency in the transmitted AF pairs in the case of AF method B.

Annex E
(normative)

Station logo transmission coded in group type C

E.1 Objective to be achieved

ODA to send station logo to visually identify the radio station or programme.

E.2 Application identification code of this ODA

The AID code of this ODA is 0xFF7F.

E.3 Station logo requirements

E.3.1 File type

Either png (preferred) or jpg shall be used as the file type. No file type identifier is needed because all relevant file information is already embedded in the file header of each of those formats.

E.3.2 Logo resolution, file ID, file version and file size

Table E.1 shows the file ID for the four possible options.

Table E.1 – File ID station logo options

File ID	Resolution	Aspect ratio	File size in bytes
0	Lower preferred	1:1 (square)	≤ 3 000
1	Lower preferred	4:3 (rectangular)	≤ 3 000
2	Higher	1:1 (square)	> 3 000
3	Higher	4:3 (rectangular)	> 3 000
4 – 63	Reserved for future use		
NOTE The station logo options have been chosen with the data transmission limitations of RDS on the upper data-streams in mind. They are suitable for receivers with relatively small display screens. For receivers with large display screens, the higher resolution would be more appropriate. This could also be delivered in addition over IP and the appropriate link to a data server can be transmitted using the respective option specified in Annex G.			

The file ID (6 bits) defines the identifier of the file. The file version (3 bits) is changed if the file has changed. The transmission uses first file version = 0. The file version is increased each time the logo changes. The file version code can be used like a toggle bit.

The various options permitted in Table E.1 can be sequenced using the RFT protocol on the upper data-streams.

Two aspect ratios are possible: square 1:1 and rectangular 4:3 (no other possibilities). The actual number of pixels is not important because the receiver can resize the station logo by applying its aspect ratio.

The file size to be transferred will depend on the image content of the logo. Experience has shown that for the preferred resolutions, a file size of less than 3 000 bytes is possible. For higher resolutions, a file size of more than 3 000 bytes is necessary. If this option is used, the acquisition of the file will become more difficult for mobile receivers.

8-bit colours shall be used to achieve the smallest possible file size.

E.3.3 File transport

The file is transmitted using one pipe in the range 0 to 15 on one or more of the upper data-streams using the RFT protocol defined in Annex C of IEC 62106-2:2021.

The CRC-16 shall be used as it can be automatically generated by the encoder using C-type groups with variant code 001.

NOTE 1 The RFT protocol uses as parameters with Assignment group variant code 000: File ID, File version, File size in bytes and CRC flag. All these parameters are required for this ODA.

NOTE 2 In Annex H of IEC 62106-10:2021, an example of UECP coding for this ODA is given.

E.3.4 Display mode

There is no need to define the receiver's display mode. The logo can be used as a tuning aid or in programme listening mode somewhere on the screen. If used as a tuning aid, the station logo shall be centred on the respective tuning button.

E.3.5 Link of the logo with the PI code

In the receiver, the station logo shall be stored with the PI code so that the listener can use the station logo as the visual identity of the radio station or programme.

Annex F
(normative)

ODA app – Slideshow transmission coded in C-group type

F.1 Objectives to be achieved

The objectives to be achieved are:

– broadcast slides which are programme-related, or not;
– a slide can contain an image and text components (all are optional);
– the text consists of structured text components to inform the receiver of what kind of text it is;
– some text components consist of text elements grouped together (such as preview and as URLs);
– the two next slides can be broadcast in advance to inform receivers what is coming next;
– the display by the receiver of the current slide can be synchronized with the audio using a directory trigger group (e.g. for music cover art);
– the directory trigger group signals three slides (current, next, 2nd next);
– the image and all text components can be updated independently of each other.

Several use cases can be covered:

a) Non-programme-related, where the broadcaster does not know what comes next (e.g. sport).
b) Programme-related when the broadcaster knows what comes next (e.g. music playlist).
c) Non-programme-related slideshow where a carousel cycles several slides (advertisements or sequence of news items).

F.2 Application identification code of this ODA

The AID code of this ODA is 0xFF80.

F.3 Image requirements

F.3.1 File type

Either jpg or png shall be used as the file type. No file type identifier is needed because all relevant file info, including the file type, is already embedded in the file header of each of those formats.

F.3.2 Resolution and file size

The required image resolution is expressed in pixels for the width and height. Two aspect ratios are possible: 240 px × 240 px or 320 px × 240 px.

Images not existing in this resolution will need to be re-scaled for transmission by the transmission operator or broadcaster.

NOTE The above slide image resolutions have been chosen with the data transmission limitations of RDS on the upper data-streams in mind. They are suitable for receivers with relatively small display screens. For receivers with large display screens, a higher resolution would be more appropriate. This can only be delivered in addition over IP and the appropriate link to a data server is already specified in Annex G.

The file size to be transferred will depend on the image content. An image file of up to 16 000 bytes is permitted. Typical is a file size between 8 000 bytes and 12 000 bytes.

8-bit colours can help to achieve the smallest possible file size.

For the maximum image acquisition time, in the case where relatively short music items are sequenced, a value of 90 s shall not be exceeded. In all other cases, the acquisition time is less critical.

F.4 Text character coding

All text components shall use UTF-8-character coding.

F.5 Slide structure and file elements used

The [SLIDE] is an ensemble composed of the optional files [IMAGE] and [TEXT]. The element [TEXT] is composed of the three optional files [PREVIEW], [CONTENT] and [URLS].

The slide ensemble is used as shown in Figure F.1.

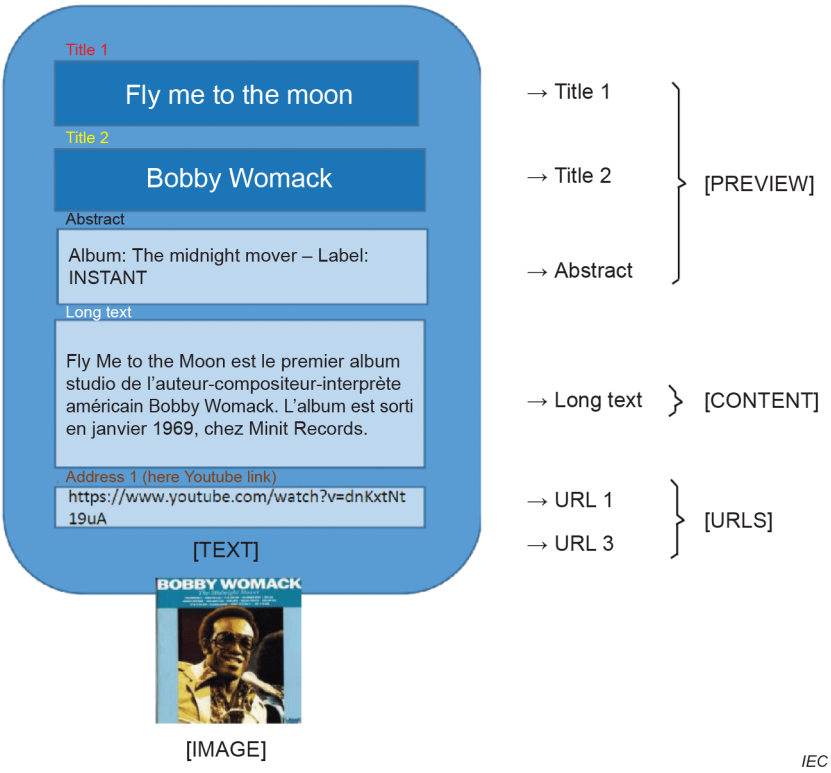

Figure F.1 – Components used in the slideshow

The file [PREVIEW] is composed of the file elements [TITLE1], [TITLE2], [ABSTACT].

The file [CONTENT] is just a string of UTF-8 coded characters. A tag to indicate its length in bytes is not needed.

The file [URLS] is composed of the file elements [URL1], [URL2], [URL3]. These are strings of UTF-8 coded characters

The structure of the [PREVIEW] text file is shown in Figure F.2.

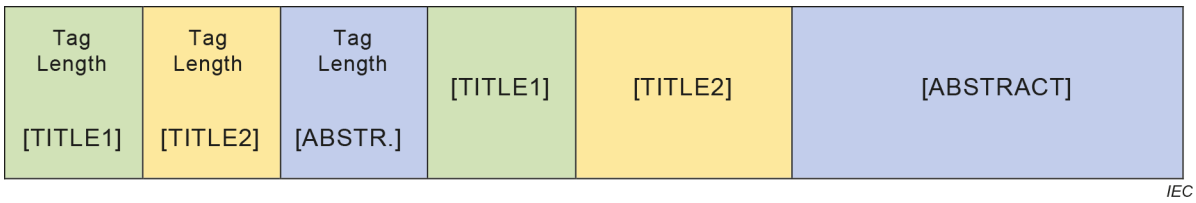

Figure F.2 – Structure of the [PREVIEW] text file

In Figure F.2, the size of the three tags is two bytes each. They indicate the length of the respective text component in bytes, UTF-8 coded for [TITLE1], [TITLE2] and [ABSTRACT]. In this way, the start position of each file element inside the [PREVIEW] file is defined as shown in Table F.1.

Table F.1 – Start position of each file element within [PREVIEW]

Start position (bytes)	File element
Offset 0	Tag length 1: length of [TITLE1]
Offset 2	Tag length 2: length of [TITLE2]
Offset 4	Tag length 3: length of [ABSTRACT]
Offset 6	UTF-8 data of [TITLE1]
Offset 6 + Length 1	UTF-8 data of [TITLE2]
Offset 6 + Length 1 + Length 2	UTF-8 data of [ABSTRACT]

The file element [CONTENT] is just a string of bytes of UTF-8 coded characters.

The structure of the [URLS] text file is shown in Figure F.3.

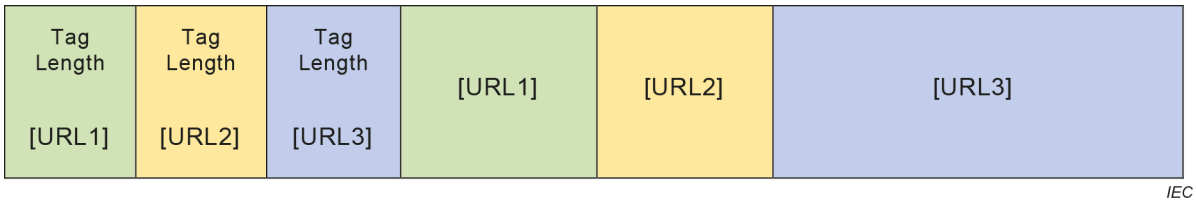

Figure F.3 – Structure of the [URLS] text file

In Figure F.3, the size of the three tags is two bytes each. They indicate the length of the respective URL text component in bytes, UTF-8 coded for [URL1], [URL2] and [URL3]. In this way, the start position of each file element inside the [URLS] file is defined as shown in Table F.2.

With UTF-8 coding, one character can be one or several bytes long.

Coding of the [URLS] file element uses the same structure as [PREVIEW]; see Figure F.3 and Table F.2.

Table F.2 – Start position of each file element within [URL]

Start position (bytes)	File element
Offset 0	Tag length 1: length of [URL1]
Offset 2	Tag length 2: length of [URL2]
Offset 4	Tag length 3: length of [URL3]
Offset 6	UTF-8 data of [URL1]
Offset 6 + Length 1	UTF-8 data of [URL2]
Offset 6 + Length 1 + Length 2	UTF-8 data of [URL3]

F.6 Slide carousel used by the broadcaster, file updating and file transmission

The broadcaster uses a slide carousel from which the slides can be transmitted in any order and for which all components ([IMAGE], [TEXT] and [URLS] can be updated as required. The file ID (6bits) range is 0 to 63, with four file IDs used to identify the four component files [IMAGE], [PREVIEW], [CONTENT] and [URLS] of each [SLIDE]. In total, 16 slides can populate the carousel. Each time a component file is updated, which is possible at any time, the respective file version is increased by 1. Up to two next slides to be broadcast in sequence can be chosen in any order from the slides located on the carousel. Each file is identified with a file ID and a version number using the numbering system shown in Table F.3.

F.7 File transport

F.7.1 General

All files are transmitted using one pipe in the range 0 to 15 on one or more upper data-streams with the RFT protocol defined in Annex C of IEC 62106-2:2021.

The CRC-16 shall be used and is to be automatically generated by the encoder using C-type groups with variant code 001.

The RFT protocol with variant code 000 carries the parameters file ID, file version, file size and CRC flag. All these parameters are required for this ODA.

F.7.2 Identification of the files

The file ID is the principal identifier of the file. The file version is increased by 1 when the file content has changed. The value ‘000’ is always used for the initial file version of version-I, version-P, version-C and version-U.

The file numbering system to be used is shown in Table F.3. Each [SLIDE] consists of a sequence of four file IDs, one for each of the [IMAGE], [PREVIEW], [CONTENT] and [URLS] files. The file ID parameter N is calculated from the slide number S (0 to 15) as follows:

$$N = S \times 4$$

Table F.3 – File numbering system used

Slide component files to be transferred with the RFT	File version (3 bits)	File ID (6 bits)
[IMAGE]	Version-I	N
[PREVIEW]	Version-P	N + 1
[CONTENT]	Version-C	N + 2
[URLS]	Version-U	N + 3

In the RFT, it is variant 0 that carries the parameters file ID (6 bits) and file version (3 bits).

F.8 Directory trigger group

F.8.1 Function

This group informs the receiver which of the buffered and previously downloaded slides are to be displayed in the sequence current, next1 and next2. File ID and version number are used for each of the slide elements and are contained in the message.

This group carries important file management information for the receiver. To avoid incorrect reception, it shall be transmitted in a cycle, at least once every 5 s. The precise definition of the cycle is left to the broadcaster or transmission operator. A burst may be used when the directory content changes.

F.8.2 Specification

Figure F.4 shows the directory trigger group, which is a C type group.

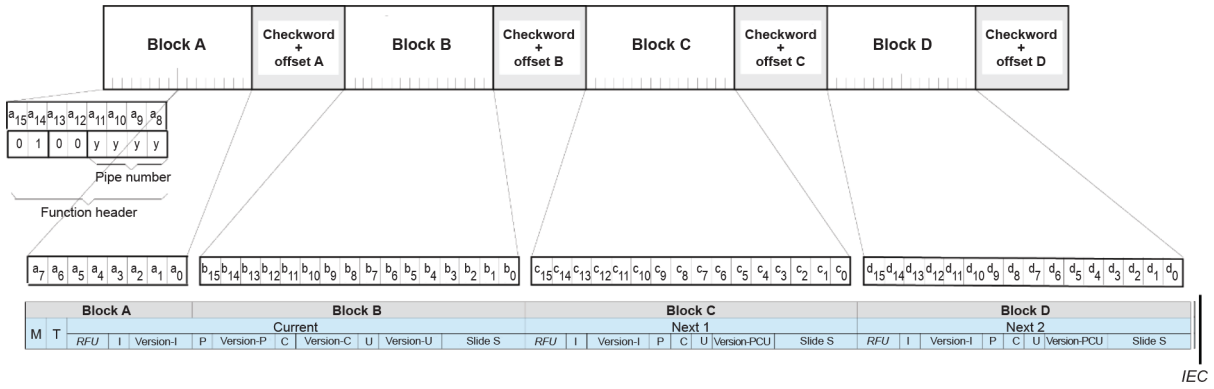

Figure F.4 – Directory trigger group

The function header of Block A uses bits a15 to a8 and is set to 0100yyyy, where yyyy is the pipe number of this ODA.

For the directory trigger group, the data elements to be used are:

- in block A, the bits a7 to a0, and in block B the bits b15 to b0 for M, T and current slide data;
- in block C, the bits c15 to c0 for next1 slide data;
- in block D, the bits d15 to d0 for next2 slide data.

The parameters used by the trigger directory data are listed in Table F.4.

Table F.4 – Parameters used in the directory trigger group

M	**=**	**Mode**		**1 bit**
	0	:	Directory trigger mode	
	1	:	Reserved for future use	
T	**=**	**Toggle**		
	0/1	:	Toggle invalidates the previous directory trigger group data; the bit is toggled only when the content of the directory trigger group changes.	
I	**=**	**Image**		
	0	:	No image for this slide; receiver may instead display the station logo	
	1	:	Slide with image	
P	**=**	**Preview**		
	0	:	There is no preview text	
	1	:	There is preview text	
C	**=**	**Content**		
	0	:	There is no content text	
	1	:	There is content text	
U	**=**	**URLst**		
	0	:	There is no URL	
	1	:	There are URLs	
Version-I, -P, -C, -U, -PCU = version of the respective slide component				3 bits
	Version of the RFT files for image I, preview P, content C, URLs U is 3 bits each. Version-PCU is the version of one of the newly updated text files, P, C or U. Only one of them can be chosen for updating at the same time. The one that is chosen for updating is marked with ‘1’ in P, C or U. When a slide is transferred for the first time, all slide element versions start with ‘000’, which is thus then also the default setting of version-PCU.			
RFU – Reserved for future use				2bits
S = slide number (0 to 15)				4 bits

F.9 Receiver display mode options

The receiver may display all slide elements or instead a selection that corresponds to the display possibilities of the receiver device.

Annex G
(normative)

Internet connection options coded in C-group type

G.1 Objective to be achieved

Many radio devices can also communicate with the Internet. This changes the radio and its use. This ODA allows for hybrid radio functions.

Use cases:

1) Internet radio: streaming of same audio as broadcast over FM.
2) Hybrid radio: get additional visual information/metadata via Internet (still under development).
3) Automatic or manual feedback to the broadcaster.
4) More use cases are under development.

G.2 Application identification code of this ODA

The AID code of this ODA is 0xFF70.

G.3 Choice of the ODA channel number

The application shall use one of the ODA data channels in the range 0 to 63 on one of the upper data-streams. Channels 0 to 15 are reserved for ODAs using files, also if only occasionally. If this is not the case, a channel in the range of 16 to 63 shall be chosen to implement this ODA.

G.4 Coding of IP address with port number

G.4.1 General

There are three address type coding options possible for an IP address with a port number as shown in Table G.1. The port number in the IP address directs the RDS radio receiver to the application server on a host.

G.4.2 IPv4 coding

An address IPv4 with a port number uses the following format:

FF.FF.FF.FF/FFFF where FF is one byte with a number in the range of 0 to 255.

The coding of this format is shown in Figure G.1. The symbols "." and "/" are implicit and do not need to be coded.

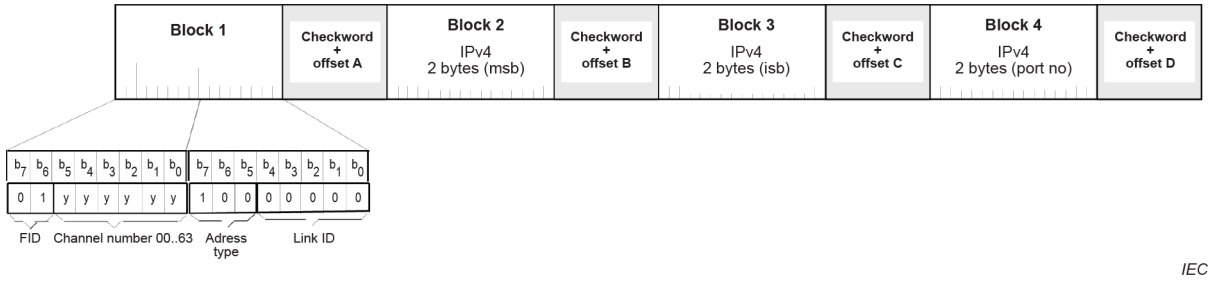

Figure G.1 – Coding of IPv4 address with port number

Coding of the most significant byte in block 1 is as specified in IEC 62106-2 for an ODA application data group, and as indicated in Figure G.1. In the least significant byte of block 1 are two parameters: the address type and the link ID of the server application.

These are to be coded as shown in Table G.1 for the address type, and as shown in Table G.2 for the link ID of the server application using the binary code for the link ID.

Table G.1 – Address type code

Code for Bits b7 to b5	Address type
0xx	Text (xx = part of text group counter bits, see Figure G.2)
100	IPv4
101	IPv6 Part 0
110	IPv6 Part 1
111	IPv6 Part 2

Table G.2 – Link ID code of IP connection

Link ID code binary Bits b4 to b0 IPv4 and IPv6	Link ID code Decimal using Text	Link ID of server application
00000	00	Same audio stream as broadcast over FM
00001	01	RDS data stream only using NFM (see Annex H)
00010	02	Current Slideshow image (see Annex F)
00011	03	Current Slideshow slide (see Annex F)
00100	04	Station logo (see Annex E)
…		rfu
11111	31	rfu

In the two bytes of block 4, the port number is coded. This is to indicate which application server may be connected to the radio receiver. Permitted port numbers are in the range of 0 to 65535, or 0x00 to 0xFF.

G.4.3 IPv6 coding

An IPv6 address (128 bits) with a port number (16 bits) uses the following format:

FFFF.FFFF.FFFF.FFFF.FFFF.FFFF.FFFF.FFFF/FFFF where FFFF are byte-pairs with a number in the range 0 to 65535.

The symbols "." and "/" are implicit and do not need to be coded.

The total code length of this string is 16 bytes for the IPv6 address plus 2 bytes for the port number.

An ODA application data group with the link ID shown in Figure G.1 can transport in blocks 2 to 4 only 6 bytes each. To transport 18 bytes, three C-type groups are needed.

In the least significant byte of block 1 are the two parameters address type and link ID. These are to be coded as shown in Table G.1 for the address type, and as shown in Table G.2 for the link ID of the server application using the binary code for the link ID.

The C-type groups IPv6 Part 0, IPv6 Part 1 and IPv6 Part 2 (blocks 2 and 3) carry the data for the 16 bytes of the IPv6 address. The IPv6 address sequence starts with the most significant byte in block 2 of the C-type group with the address type IPv6 Part 0, and ends with the least significant byte in block 3 of the C-type group with the address type IPv6 Part 2

The C-type group IPv6 Part 2 carries the port number in block 4.

G.4.4 IP address and port number coded as URL text

The coding of the URL text is done as shown in Figure G.2.

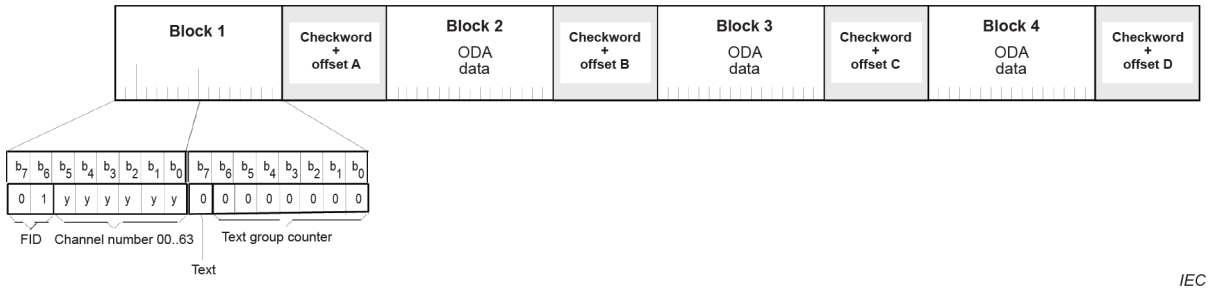

Figure G.2 – URL text coding to connect to an application data server

The 7-bit text group counter covers a range from 0x00 to 0x7F (0 to 127 dec). The text length is limited to 760 bytes (6 × 127 − 2 = 760).

The link ID decimal code in Table G.2 with 32 options (00 to 31 dec) uses the first two bytes of the text string. UTF-8 coding is used for the two characters of this decimal number. The string is terminated with "\0". All bits that can follow are undefined.

UTF-8 is used for the character coding of the text string.

The URL will be translated with the DNS system.

Example:

This ODA sends to the receiver the text string

00https://datasource-one.radio-france.fr/0082\0…

This message tells the receiver on which URL the server can be found that streams the same audio as received on FM (Link ID code ‘00’). The receiver removes the first two bytes with the Link ID code ‘00’ and sends over IP the (fictive) URL https://datasource-one.radio-france.fr/0082 to create the link with the host and with the audio stream signalled.

Annex H
(normative)

ODA tool – RDS data mode NFM

H.1 Objective to be achieved

NFM is a data packet format to transmit the RDS data outside the FM modulated radio stream. It is based on the C-type message format, so it can be processed with the C-type decoder software.

NFM format is intended to be used to store metadata on data carriers, to transmit via Internet or via data channels other broadcasting formats, such as DVB-T/S/C, DAB, DRM and others.

Synchronization of NFM data to the audio content is not part of the format; it shall be done using methods adapted to the carrier.

Size of NFM packets can vary between 16 bytes and 512 Kbytes, including the header group. This shall be adapted to the carrier.

H.2 Specification of the NFM protocol

The NFM structure is derived from the structure of type C groups, organized as packets. A packet is composed of a header followed by one or more C-type data groups.

The C-type group can also carry group types A and B, where types A and B will have to be tunnelled within group type C (see IEC 62106-2:2021, 4.4.1).

NFM is transmitted without the 10-bit CRCs of each of the four data blocks in group types A, B and C. The protection of the data in the NFM message packet is provided by the bearer system used. Each message has in addition a CRC-16 in the packet header to determine the completeness of the message within each packet.

As shown in Figure H.1, a message in the NFM consists of an eight-byte header and one or more groups. They all have the same length of 8 bytes, i.e. 2 bytes for each of the C-type group blocks A, B, C and D. Thus, a message is always a multiple of 8 bytes. The shortest message is thus a 16-byte packet (header + data for one C-type group) and the longest is determined by the possibilities offered by the bearer or the maximum header size of 16 bits.

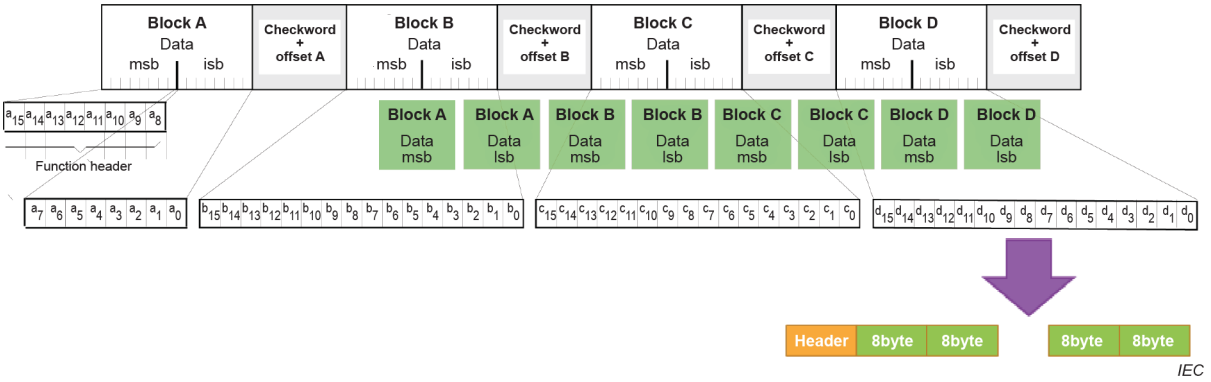

Figure H.1 – NFM message format

The eight-byte header consists of:

– 2 bytes of number of groups including the header (16-bit unsigned integer);
– 2 bytes simple CRC-16 calculated over the data (without header);
– 2 bytes PI code (zero, if undefined);
– 1 byte ECC (zero, if undefined);
– 1 byte of additional information (not yet defined – reserved for future use).

Bibliography

IEC 62106-5, *Radio data system (RDS) – VHF/FM sound broadcasting in the frequency range from 64,0 MHz to 108,0 MHz – Part 5: Marking of RDS receiver devices*

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INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

3, rue de Varembé
PO Box 131
CH-1211 Geneva 20
Switzerland

Tel: + 41 22 919 02 11
info@iec.ch
www.iec.ch