

BS EN 62106:2009



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Specification of the Radio Data System (RDS) for VHF/FM sound broadcasting in the frequency range from 87,5 MHz to 108,0 MHz

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National foreword

This British Standard is the UK implementation of EN 62106:2009. It is identical to IEC 62106:2009. It supersedes BS EN 62106:2001 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EPL/100, Audio, video and multimedia systems and equipment.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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December 2009

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Supersedes EN 62106:2001

English version

**Specification of the Radio Data System (RDS)
for VHF/FM sound broadcasting in the frequency range
from 87,5 MHz to 108,0 MHz
(IEC 62106:2009)**

Spécification du système de radiodiffusion
de données (RDS) pour la radio
à modulation de fréquence
dans la bande 87,5 MHz à 108,0 MHz
(CEI 62106:2009)

Spezifikation des Radio-Daten-Systems
(RDS) für den VHF/FM Tonrundfunk
im Frequenzbereich
87,5 MHz bis 108,0 MHz
(IEC 62106:2009)

This European Standard was approved by CENELEC on 2009-12-01. CENELEC members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CENELEC member.

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European Committee for Electrotechnical Standardization
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Foreword

The text of document 100/1454/CDV, future edition 2 of IEC 62106, prepared by technical area 1: Terminals for audio, video and data services and content, of IEC TC 100, Audio, video and multimedia systems and equipment, was submitted to the IEC-CENELEC parallel vote and was approved by CENELEC as EN 62106 on 2009-12-01.

This European Standard supersedes EN 62106:2001.

The main changes with respect to EN 62106:2001 are listed below.

- the list of RDS country codes, inclusive of the extended country codes, has been updated in Annexes D and N;
- Annex E, containing the character code tables to be used in RDS has been updated;
- RadioText Plus has been added as a new feature in Annex P;
- Enhanced RadioText has been added as a new feature in Annex Q.

The following dates were fixed:

- | | | |
|--|-------|------------|
| – latest date by which the EN has to be implemented at national level by publication of an identical national standard or by endorsement | (dop) | 2010-09-01 |
| – latest date by which the national standards conflicting with the EN have to be withdrawn | (dow) | 2012-12-01 |

Annex ZA has been added by CENELEC.

Endorsement notice

The text of the International Standard IEC 62106:2009 was approved by CENELEC as a European Standard without any modification.

Annex ZA (normative)

Normative references to international publications with their corresponding European publications

The following referenced documents are indispensable for the application 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.

NOTE When an international publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

<u>Publication</u>	<u>Year</u>	<u>Title</u>	<u>EN/HD</u>	<u>Year</u>
ISO/IEC 10646	- ¹⁾	Information technology - Universal multiple-octet coded character set (UCS)	-	-
ISO 14819	Series	Traffic and Traveller Information (TTI) - TTI messages via traffic message coding	EN ISO 14819	Series
ITU-R Recommendation BS.450-3	- ¹⁾	Transmission standards for FM sound broadcasting at VHF	-	-
ITU-R Recommendation BS.643-2	- ¹⁾	System for automatic tuning and other applications in FM radio receivers for use with the pilot-tone system	-	-
ITU-T Recommendation E.212	- ¹⁾	The international identification plan for public networks and subscriptions	-	-
US NRS-4-A	- ¹⁾	National Radio Systems Committee - NRSC-4-A: United States RBDS standard	-	-
-	-	Digital Audio Broadcasting (DAB); VHF/FM Broadcasting: cross-referencing to simulcast DAB services by RDS-ODA 147	ETSI EN 301 700	- ¹⁾

¹⁾ Undated reference.

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SPECIFICATION OF THE RADIO DATA SYSTEM (RDS) FOR VHF/FM SOUND BROADCASTING IN THE FREQUENCY RANGE FROM 87,5 MHz TO 108,0 MHz

1 Scope

This International Standard describes the Radio Data System, RDS, intended for application to VHF/FM sound broadcasts in the range 87,5 MHz to 108,0 MHz which may carry either stereophonic (pilot-tone system) or monophonic programmes (see clause 2 – Normative references ITU-R Recommendations BS 450-3 and BS 643-2). The main objectives of RDS are to enable improved functionality for FM receivers and to make them more user-friendly by using features such as Programme Identification, Programme Service name display and where applicable, automatic tuning for portable and car radios, in particular. The relevant basic tuning and switching information therefore has to be implemented by the type 0 group (see 6.1.5.1), and it is not optional unlike many of the other possible features in RDS.

2 Normative references

The following referenced documents are indispensable for the application 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.

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

ISO 14819 (all parts), *Traffic and Traveller Information (TTI) – TTI messages via traffic message Coding (TMC)*

ITU-R Recommendation BS.450-3, *Transmission standards for FM sound broadcasting at VHF*

ITU-R Recommendation BS.643-2, *System for automatic tuning and other applications in FM radio receivers for use with the pilot-tone system*

ITU-T Recommendation E.212, *For the three digit Mobile Country Codes used in Annex M of this RDS specification refer to Complement to ITU-T Rec. E.212 (05/2004) published by ITU Geneva as Annex to ITU Operational Bulletin 897, dated 2007-12-01*

US NRSC-4-A, *National Radio Systems Committee – NRSC-4-A: United States RBDS standard*

ETSI EN 301 700, *Digital Audio Broadcasting (DAB); VHF/FM broadcasting: cross referencing to simulcast DAB services by RDS-ODA 147*

3 Abbreviations and conventions

For the purposes of this document, the following terms and definitions apply.

3.1

AM

amplitude modulation (broadcasting)

3.2**ARI**

Autofahrer-Rundfunk-Information, see annex H

3.3**FM**

frequency modulation (broadcasting)

3.4**group type and version**

RDS uses 16 data groups, 0 to 15, each with either a version A or B. The combination of a particular group and a particular version is then called group type, 0A for example, or type 0A group. For example, type 0 group means version A and B of data group 0.

3.5**hexadecimal notation**

throughout this standard the C notation "0x" is used for hex (base 16) numbers

3.6**LF**

long wave broadcasting frequency band (ITU, Region 1 only)

3.7**MF**

medium wave broadcasting frequency band (ITU, all Regions)

3.8**RDS specific abbreviations and definitions**

see Clause 7 and Annex S

3.9**VHF**

very high frequency broadcasting band, here Band II, that is 87,5 MHz to 108,0 MHz, only (ITU)

4 Modulation characteristics of the data channel (physical layer)**4.1 General**

The Radio Data System is intended for application to VHF/FM sound broadcasting transmitters in the range 87,5 MHz to 108,0 MHz, which carry stereophonic (pilot-tone system) or monophonic sound broadcasts specified in ITU-R Recommendation BS.450-3.

It is important that radio-data receivers are not affected by signals in the multiplex spectrum outside the data channel.

The data signals are carried on a subcarrier which is added to the stereo multiplex signal (or monophonic signal as appropriate) at the input to the VHF/FM transmitter. Block diagrams of the data source equipment at the transmitter and a typical receiver arrangement are shown in Figures 1 and 2, respectively.

4.2 Subcarrier frequency

During stereo broadcasts, the subcarrier frequency will be locked to the third harmonic of the 19 kHz pilot-tone. Since the tolerance on the frequency of the 19 kHz pilot-tone is ± 2 Hz (ITU-R Recommendation BS.450-3), the tolerance on the frequency of the subcarrier during stereo broadcasts is ± 6 Hz.

During monophonic broadcasts the frequency of the subcarrier will be $57 \text{ kHz} \pm 6 \text{ Hz}$.

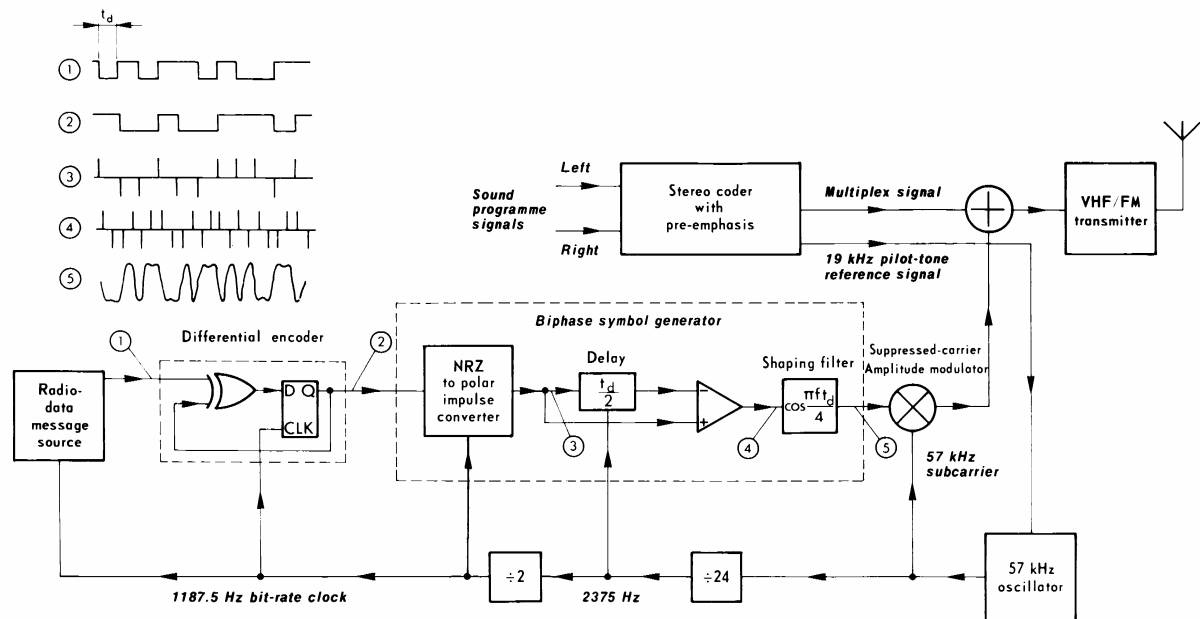
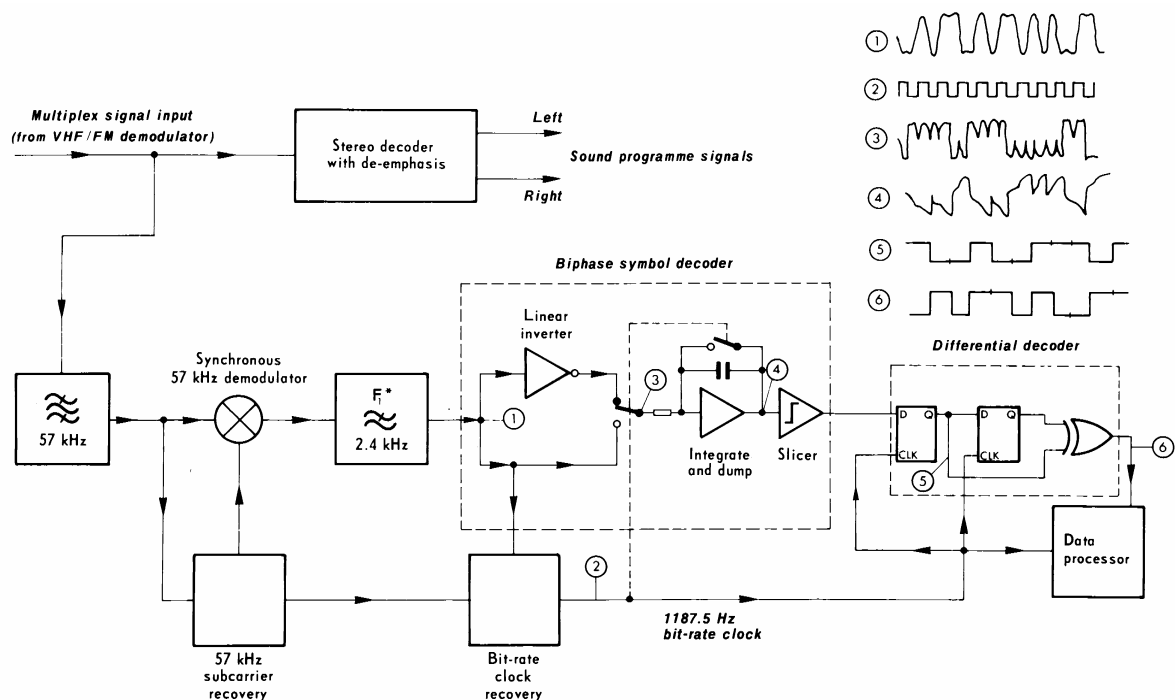


Figure 1 – Block diagram of radio-data equipment at the transmitter



*NOTE The overall data-shaping in this decoder comprises the filter F_1 and the data-shaping inherent in the biphase symbol decoder. The amplitude/frequency characteristic of filter F_1 is, therefore, not the same as that given in Figure 3.

Figure 2 – Block diagram of a typical radio-data receiver/decoder

4.3 Subcarrier phase

During stereo broadcasts, the subcarrier will be locked either in phase or in quadrature to the third harmonic of the 19 kHz pilot-tone. The tolerance on this phase angle is $\pm 10^\circ$, measured at the modulation input to the FM transmitter.

4.4 Subcarrier level

The deviation range of the FM carrier due to the unmodulated subcarrier is from $\pm 1,0$ kHz to $\pm 7,5$ kHz. The recommended best compromise is $\pm 2,0$ kHz (see NOTE). The decoder/demodulator shall also operate properly when the deviation of the subcarrier is varied within these limits during periods not less than 10 ms.

NOTE With this level of subcarrier, the level of each sideband of the subcarrier corresponds to half the nominal peak deviation level of 2,0 kHz for an 'all-zeroes' message data stream (i.e. a continuous bit-rate sine-wave after biphase encoding).

The maximum permitted deviation due to the composite multiplex signal is ± 75 kHz.

4.5 Method of modulation

The subcarrier is amplitude-modulated by the shaped and biphase coded data signal (see 4.8). The subcarrier is suppressed. This method of modulation may alternatively be thought of as a form of two-phase phase-shift-keying (psk) with a phase deviation of $\pm 90^\circ$.

4.6 Clock-frequency and data-rate

The basic clock frequency is obtained by dividing the transmitted subcarrier frequency by 48. Consequently, the basic data-rate of the system (see Figure 1) is 1187,5 bit/s $\pm$ 0,125 bit/s.

4.7 Differential coding

The source data at the transmitter are differentially encoded according to the following rules:

Table 1 – Encoding rules

Previous output (at time t_{i-1})	New input (at time t_i)	New output (at time t_i)
0	0	0
0	1	1
1	0	1
1	1	0

where t_i is some arbitrary time and t_{i-1} is the time one message-data clock-period earlier, and where the message-data clock-rate is equal to 1 187,5 Hz.

Thus, when the input-data level is 0, the output remains unchanged from the previous output bit and when an input 1 occurs, the new output bit is the complement of the previous output bit.

In the receiver, the data may be decoded by the inverse process:

Table 2 – Decoding rules

Previous input (at time t_{i-1})	New input (at time t_i)	New output (at time t_i)
0	0	0
0	1	1
1	0	1
1	1	0

The data is thus correctly decoded whether or not the demodulated data signal is inverted.

4.8 Data-channel spectrum shaping

The power of the data signal at and close to the 57 kHz subcarrier is minimized by coding each source data bit as a biphase symbol.

This is done to avoid data-modulated cross-talk in phase-locked-loop stereo decoders. The principle of the process of generation of the shaped biphase symbols is shown schematically in Figure 1. In concept, each source bit gives rise to an odd impulse-pair, $e(t)$, so that a logic 1 at source gives:

$$e(t) = \delta(t) - \delta(t - t_d/2) \quad (1)$$

and a logic 0 at source gives:

$$e(t) = -\delta(t) + \delta(t - t_d/2) \quad (2)$$

These impulse-pairs are then shaped by a filter $H_T(f)$, to give the required band-limited spectrum where

$$H_T(f) = \begin{cases} \cos \frac{\pi f t_d}{4} & \text{if } 0 \leq f \leq 2/t_d \\ 0 & \text{if } f > 2/t_d \end{cases} \quad (3)$$

and here

$$t_d = \frac{1}{1187,5} \text{ s}$$

The data-spectrum shaping filtering has been split equally between the transmitter and receiver (to give optimum performance in the presence of random noise) so that, ideally, the data filtering at the receiver should be identical to that of the transmitter, i.e. as given above in Equation (3). The overall data-channel spectrum shaping $H_o(f)$ would then be 100 % cosine roll-off.

The specified transmitter and receiver low-pass filter responses, as defined in Equation (3) are illustrated in Figure 3, and the overall data-channel spectrum shaping is shown in Figure 4.

The spectrum of the transmitted biphase-coded radio-data signal is shown in Figure 5 and the time-function of a single biphase symbol (as transmitted) in Figure 6.

The 57 kHz radio-data signal waveform at the output of the radio-data source equipment may be seen in the photograph of Figure 7.

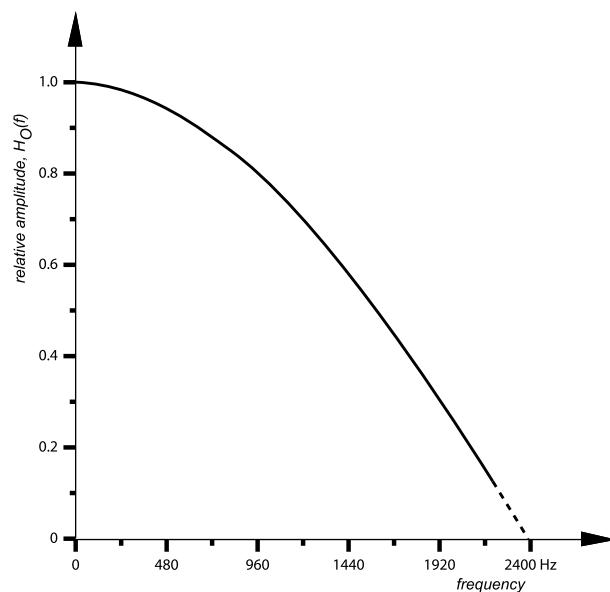


Figure 3 – Amplitude response of the specified transmitter or receiver data-shaping filter

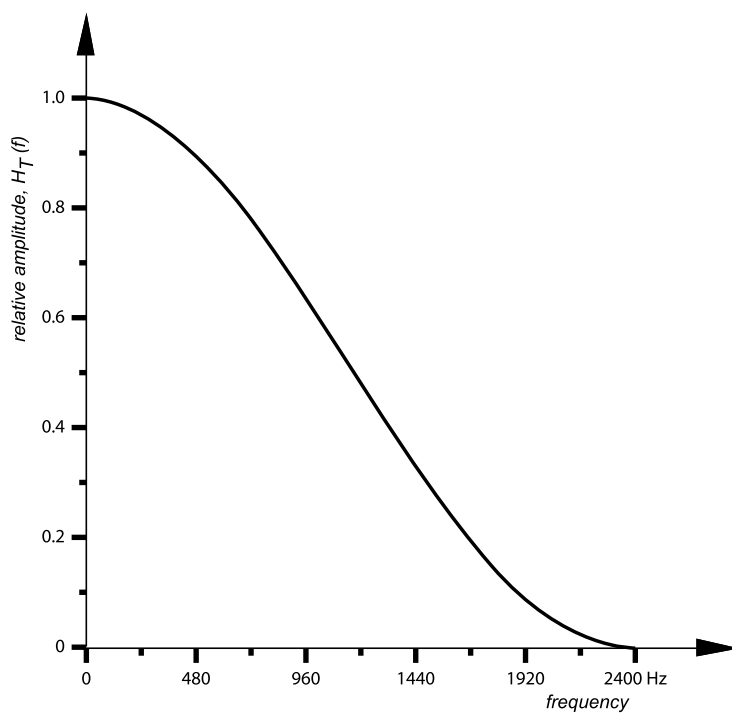


Figure 4 – Amplitude response of the combined transmitter and receiver data-shaping filters

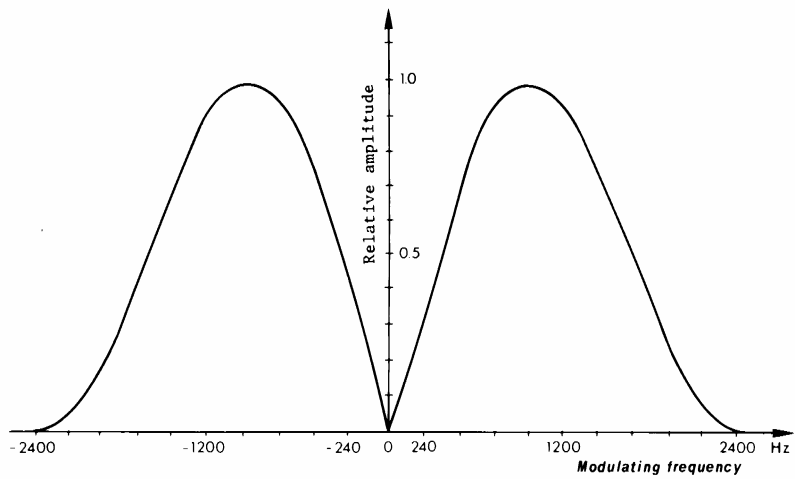


Figure 5 – Spectrum of biphase coded radio-data signals

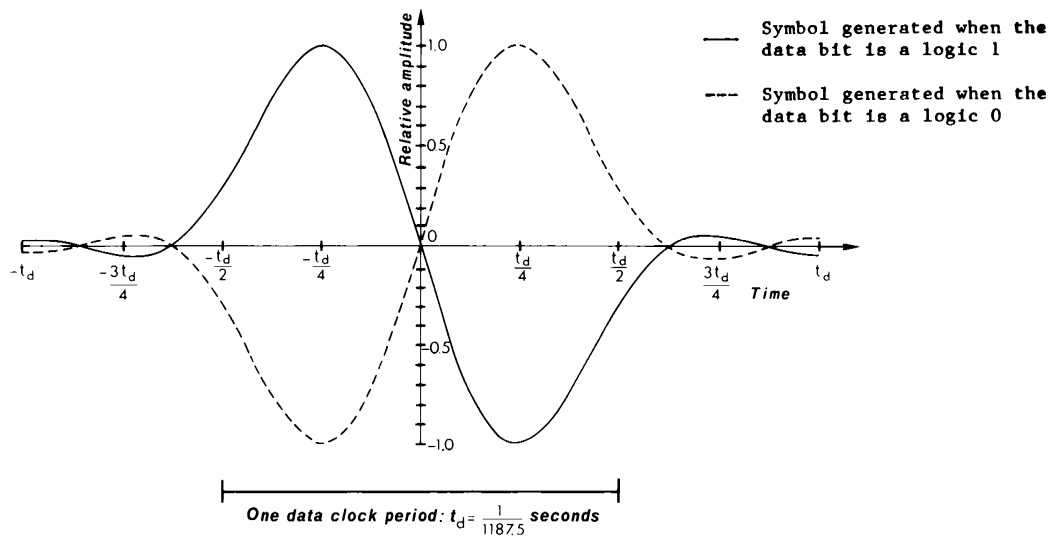


Figure 6 – Time-function of a single biphase symbol

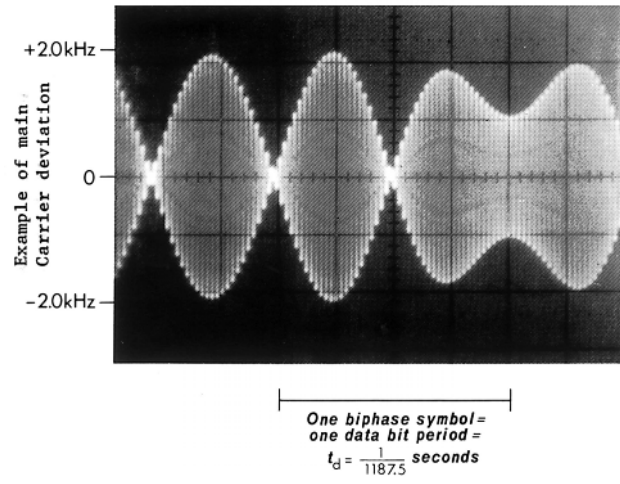


Figure 7 – 57 kHz radio-data signals

5 Baseband coding (data-link layer)

5.1 Baseband coding structure

Figure 8 shows the structure of the baseband coding. The largest element in the structure is called a 'group' of 104 bits each. Each group comprises 4 blocks of 26 bits each. Each block comprises an information word and a checkword. Each information word comprises 16 bits. Each checkword comprises 10 bits (see 5.3).

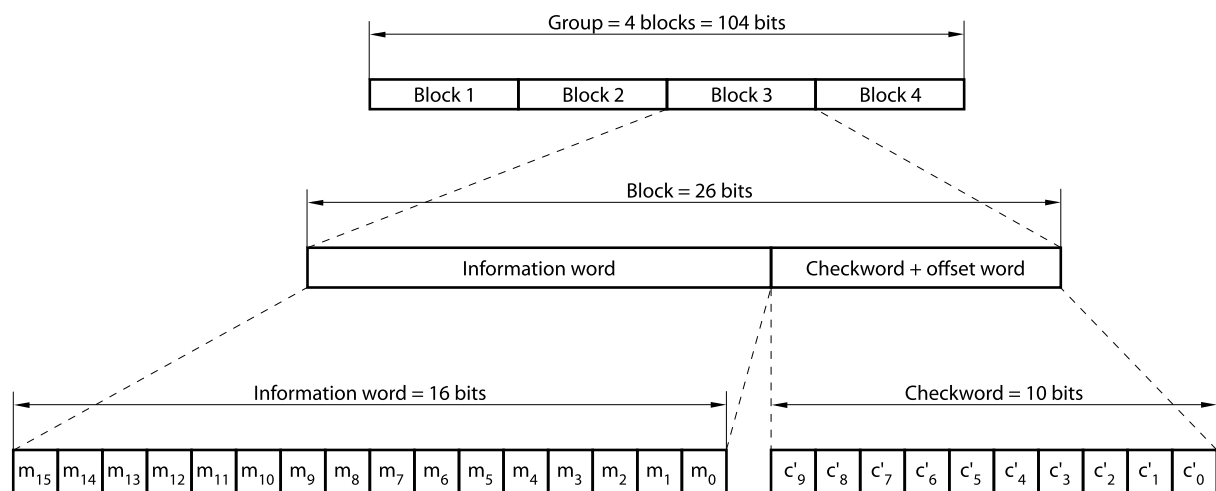
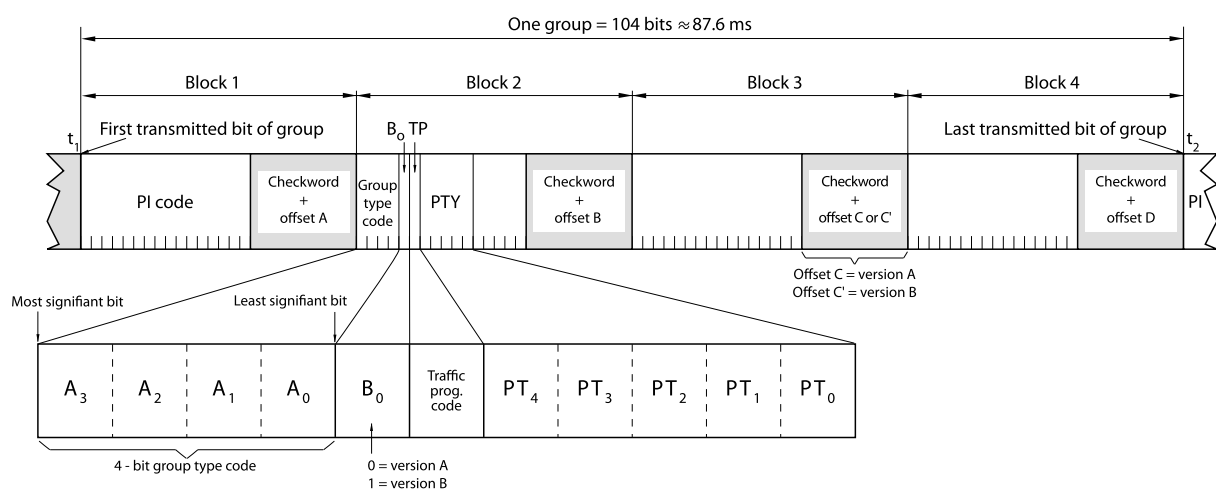


Figure 8 – Structure of the baseband coding

5.2 Order of bit transmission

All information words, checkwords, binary numbers or binary address values have their most significant bit (m.s.b.) transmitted first (see Figure 9). Thus the last bit transmitted in a binary number or address has weight 2^0 .

The data transmission is fully synchronous and there are no gaps between the groups or blocks.



NOTE 1 Group type code = 4 bits (see 6.1).

NOTE 2 B_0 = version code = 1 bit (see 6.1).

NOTE 3 PI code = Programme Identification code = 16 bits (see 6.2.1.1 and Annex D).

NOTE 4 TP = Traffic Programme Identification code = 1 bit (see 6.2.1.3).

NOTE 5 PTY = Programme Type code = 5 bits (see 6.2.1.2 and Annex F).

NOTE 6 Checkword + offset 'N' = 10 bits added to provide error protection and block and group synchronization information (see 5.3 and 5.4 and Annexes A, B and C).

NOTE 7 $t_1 < t_2$: Block 1 of any particular group is transmitted first and block 4 last.

Figure 9 – Message format and addressing

5.3 Error protection

Each transmitted 26-bit block contains a 10-bit checkword which is primarily intended to enable the receiver/decoder to detect and correct errors which occur in transmission. This checkword (i.e. $c'_9, c'_8, \dots, c'_0$ in Figure 8) is the sum (modulo 2) of

- a) the remainder after multiplication by x^{10} and then division (modulo 2) by the generator polynomial $g(x)$, of the 16-bit information word;
- b) a 10-bit binary string $d(x)$, called the 'offset word'

where the generator polynomial, $g(x)$ is given by

$$g(x) = x^{10} + x^8 + x^7 + x^5 + x^4 + x^3 + 1$$

and where the offset values, $d(x)$, which are different for each block within a group (see 5.4) are given in Annex A.

The purpose of adding the offset word is to provide a group and block synchronisation system in the receiver/decoder (see 5.4). Because the addition of the offset is reversible in the decoder, the normal additive error-correcting and detecting properties of the basic code are unaffected.

The checkword thus generated is transmitted m.s.b. (i.e. the coefficient of c'_9 in the checkword) first and is transmitted at the end of the block which it protects.

The above description of the error protection may be regarded as definitive, but further explanatory notes on the generation and theory of the code are given in Annexes B and C.

The error-protecting code has the following error-checking capabilities [3, 4]¹:

- a) detects all single and double bit errors in a block;
- b) detects any single error burst spanning 10 bits or less;
- c) detects about 99,8 % of bursts spanning 11 bits and about 99,9 % of all longer bursts.

The code is also an optimal burst error correcting code [5] and is capable of correcting any single burst of span 5 bits or less.

¹ Figures in square brackets refer to the Bibliography.

5.4 Synchronisation of blocks and groups

The blocks within each group are identified by the offset words A, B, C or C' and D added to blocks 1, 2, 3, and 4 respectively in each group (see Annex A).

The beginnings and ends of the data blocks may be recognized in the receiver decoder by using the fact that the error-checking decoder will, with a high level of confidence, detect block synchronisation slip as well as additive errors. This system of block synchronisation is made reliable by the addition of the offset words (which also serve to identify the blocks within the group). These offset words destroy the cyclic property of the basic code so that in the modified code, cyclic shifts of codewords do not give rise to other codewords [6, 7].

Further explanation of a technique for extracting the block synchronisation information at the receiver is given in Annex C.

6 Message format (session and presentation layers)

6.1 Addressing

6.1.1 Design principles

The basic design principles underlying the message format and addressing structure are as follows:

- a) the messages which are to be repeated most frequently, and for which a short acquisition time is required, for example Programme Identification (PI) codes, in general, occupy the same fixed positions within every group. They can therefore be decoded without reference to any block outside the one which contains the information;
- b) there is no fixed rhythm of repetition of the various types of group, i.e. there is ample flexibility to interleave the various kinds of message to suit the needs of the users at any given time and to allow for future developments;
- c) addressing is required to identify the information content of those blocks, which are not dedicated to the high-repetition-rate information;
- d) each group is, as far as possible, fully addressed to identify the information content of the various blocks;
- e) the mixture of different kinds of message within any one group is minimized, for example one group type is reserved for basic tuning information, another for RadioText, etc. This is important so that broadcasters who do not wish to transmit messages of certain kinds are not forced to waste channel capacity by transmitting groups with unused blocks. Instead, they are able to repeat more frequently those group types which contain the messages they want to transmit;
- f) to allow for future applications the data formatting has been made flexible. For example, a number of group types (see Table 6) may be used for Open Data Applications (see 6.1.4 and 7.9).

6.1.2 Principal features

The main features of the message structure have been illustrated in Figure 9. These may be seen to be:

- a) the first block in every group always contains a Programme Identification (PI) code;
- b) the first four bits of the second block of every group are allocated to a four-bit code which specifies the application of the group. Groups will be referred to as 0 to 15 according to the binary weighting $A_3 = 8$, $A_2 = 4$, $A_1 = 2$, $A_0 = 1$ (see Figure 9). For each group (0 to 15) two 'versions' can be defined. The 'version' is specified by the fifth bit (B_0) of block 2 as follows:
 - 1) $B_0 = 0$: the PI code is inserted in block 1 only. This will be called version A, for example group type 0A, 1A, etc.
 - 2) $B_0 = 1$: the PI code is inserted in block 1 and block 3 of all group types. This will be called version B, for example group type 0B, 1B, etc.

In general, any mixture of version A and B groups may be transmitted.

- c) the Programme Type code (PTY) and Traffic Programme identification (TP) occupy fixed locations in block 2 of every group.

The PI, PTY and TP codes can be decoded without reference to any block outside the one that contains the information. This is essential to minimize acquisition time for these kinds of message and to retain the advantages of the short (26-bit) block length. To permit this to be done for the PI codes in block 3 of version B groups, a special offset word (which we shall call C') is used in block 3 of version B groups. The occurrence of offset C' in block 3 of any group can then be used to indicate directly that block 3 is a PI code, without any reference to the value of B_0 in block 2.

6.1.3 Group types

Table 3 – Group types

Group type	Group type code					Flagged in type 1A groups	Description
	A ₃	A ₂	A ₁	A ₀	B ₀		
0 A	0	0	0	0	0		Basic tuning and switching information only (see 6.1.5.1)
0 B	0	0	0	0	1		Basic tuning and switching information only (see 6.1.5.1)
1A	0	0	0	1	0		Programme Item Number and slow labelling codes only (see 6.1.5.2)
1B	0	0	0	1	1		Programme Item Number (see 6.1.5.2)
2 A	0	0	1	0	0		RadioText only (see 6.1.5.3)
2 B	0	0	1	0	1		RadioText only (see 6.1.5.3)
3 A	0	0	1	1	0		Applications Identification for ODA only (see 6.1.5.5)
3 B	0	0	1	1	1		Open Data Applications
4 A	0	1	0	0	0		Clock-time and date only (see 6.1.5.6)
4 B	0	1	0	0	1		Open Data Applications
5 A	0	1	0	1	0		Transparent Data Channels (32 channels) or ODA (see 6.1.5.8)
5 B	0	1	0	1	1		Transparent Data Channels (32 channels) or ODA (see 6.1.5.8)
6 A	0	1	1	0	0		In House applications or ODA (see 6.1.5.9)
6 B	0	1	1	0	1		In House applications or ODA (see 6.1.5.9)
7 A	0	1	1	1	0	Y	Radio Paging or ODA (see 6.1.5.10 and annex M)
7 B	0	1	1	1	1		Open Data Applications
8 A	1	0	0	0	0		Traffic Message Channel or ODA (see 6.1.5.12)
8 B	1	0	0	0	1		Open Data Applications
9 A	1	0	0	1	0	Y	Emergency Warning Systems or ODA (see 6.1.5.13)
9 B	1	0	0	1	1		Open Data Applications
10 A	1	0	1	0	0		Programme Type Name
10 B	1	0	1	0	1		Open Data Applications
11 A	1	0	1	1	0		Open Data Applications
11 B	1	0	1	1	1		Open Data Applications
12 A	1	1	0	0	0		Open Data Applications
12 B	1	1	0	0	1		Open Data Applications
13 A	1	1	0	1	0	Y	Enhanced Radio Paging or ODA (see Annex M)
13 B	1	1	0	1	1		Open Data Applications
14 A	1	1	1	0	0		Enhanced Other Networks information only (see 6.1.5.19)
14 B	1	1	1	0	1		Enhanced Other Networks information only (see 6.1.5.19)
15 A	1	1	1	1	0		Open Data Applications
15 B	1	1	1	1	1		Fast switching information only (see 6.1.5.21)

NOTE Mark "Y" indicates that group type 1A will be transmitted for the identification of the application using block 3 of group type 1A (except for an ODA, where the application identification is in group 3A instead).

It was described above (see also Figure 9) that the first five bits of the second block of every group are allocated to a five-bit code which specifies the application of the group type and its version, as shown in Table 3.

The appropriate repetition rates for some of the main features are indicated in Table 4.

Table 4 – Main feature repetition rates

Main features	Group types which contain this information	Appropriate repetition rate per second
Programme Identification (PI) code	all	11.4 ^a
Programme Type (PTY) code	all	11.4 ^a
Traffic Programme (TP) identification code	all	11.4 ^a
Programme Service (PS) name ^d	0A, 0B	1
Alternative frequency (AF) code pairs	0A	4
Traffic announcement (TA) code	0A, 0B, 14B, 15B	4
Decoder identification (DI) code	0A, 0B, 15B	1
Music Speech (MS) code	0A, 0B, 15B	4
RadioText (RT) message	2A, 2B	0.2 ^b
Enhanced other networks information (EON)	14A	up to 2 ^c
^a Valid codes for this item will normally be transmitted with at least this repetition rate whenever the transmitter carries a normal broadcast programme. ^b A total of 16 type 2A groups are required to transmit a 64 character RadioText message and therefore, to transmit this message in 5 s, 3.2 type 2A groups will be required per second. ^c The maximum cycle time for the transmission of all data relating to all cross-referenced programme services shall be less than 2 min. ^d PS shall only be used for identifying the programme service and it must not be used for other messages giving sequential information.		

A total of four type 0A groups are required to transmit the entire PS name and therefore four type 0A groups will be required per second. The repetition rate of the type 0A group may be reduced if more capacity is needed for other applications. But a minimum of two type 0A groups per second is necessary to ensure correct functioning of PS and AF features. However, with EON receivers search tuning is affected by the repetition rate of type 0 groups (TP/TA, see 6.2.1.3). It shall be noted that in this case transmission of the complete PS will take 2 s. However, under typical reception conditions the introduction of errors will cause the receiver to take 4 s or more to acquire the PS name for display.

The following mixture of groups is suitable to meet the repetition rates noted above.

Table 5 – Group repetition rates

Group types	Features	Typical proportion of groups of this type transmitted %
0A or 0B	PI, PS, PTY, TP, AF ^a , TA, DI, MS	40
1A or 1B	PI, PTY, TP, PIN	10
2A or 2B	PI, PTY, TP, RT	15 ^b
14A or 14B	PI, PTY, TP, EON	10
Any other	Other applications	25
^a Type 0A group only.		
^b Assuming that type 2A groups are used to transmit a 32-character RadioText message. A mixture of type 2A and 2B groups in any given message shall be avoided (see 6.1.5.3).		

6.1.4 Open data channel/Applications Identification

6.1.4.1 Use of Open Data Applications

Open Data Applications (ODA) are not explicitly specified in this standard. They are subject to a registration process and registered applications are listed in the EBU/RDS Forum – ODA Directory (see Annex L), which references appropriate standards and normative specifications. These specifications may be public (specification in the public domain, i.e. TMC, eRT, RT+ and ODA 147 (see ETSI EN 301 700), see Annexes P and Q and Clause 2) or privately owned (and not in the public domain). The terms public and private do not imply the degree of access to services provided by an application, for example a public domain service may well include encryption, as in TMC for example.

ODAs, whether public or private, must conform to all requirements of this, the RDS, or RBDS specification (as appropriate). Nothing in any ODA may require any aspect of a primary RDS feature to be changed or not to be transmitted in accordance with this specification. This is to ensure that the transmission of an ODA cannot adversely affect devices built in accordance with the RDS and RBDS specifications.

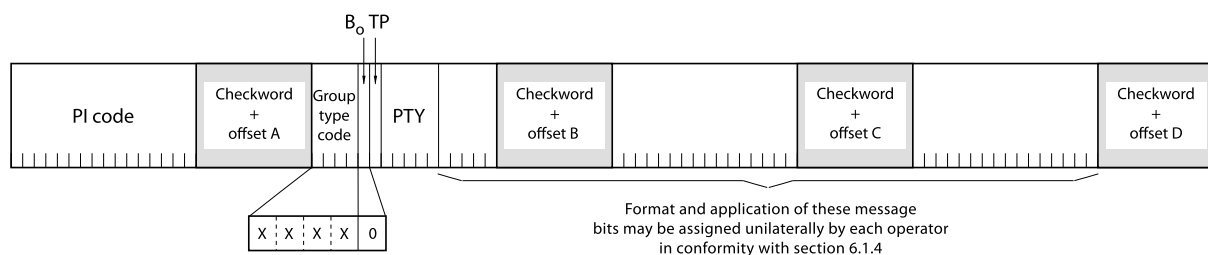
Table 6 – ODA group availability signalled in type 3A groups

Group type	Application group type code	Availability for Open Data Applications
	00000	Special meaning: not carried in associated group
3B	00111	Available unconditionally
4B	01001	Available unconditionally
5A	01010	Available when not used for TDC
5B	01011	Available when not used for TDC
6A	01100	Available when not used for IH
6B	01101	Available when not used for IH
7A	01110	Available when not used for RP
7B	01111	Available unconditionally
8A	10000	Available when not used for TMC
8B	10001	Available unconditionally
9A	10010	Available when not used for EWS
9B	10011	Available unconditionally
10B	10101	Available unconditionally
11A	10110	Available unconditionally
11B	10111	Available unconditionally
12A	11000	Available unconditionally
12B	11001	Available unconditionally
13A	11010	Available when not used for RP
13B	11011	Available unconditionally
15A	11110	Available unconditionally
	11111	Special meaning: temporary data fault (encoder status)

An ODA may use version A and/or version B groups, however it must not be designed to operate with a specific group type. An exception is TMC, which uses group type 8A. In any case, the specific group type used by the ODA in any particular transmission is signalled in the Applications Identification (AID) carried in type 3A groups (see 6.1.5.4). Table 6 shows the version A and version B groups that may be allocated to ODA. Group types not shown in Table 6 are not available for ODA.

6.1.4.2 Open Data Applications – Group structure

Open Data Applications shall use the format shown in Figure 10 for ODA type A groups and in Figure 11 for ODA type B groups.

**Figure 10 – ODA version A groups**

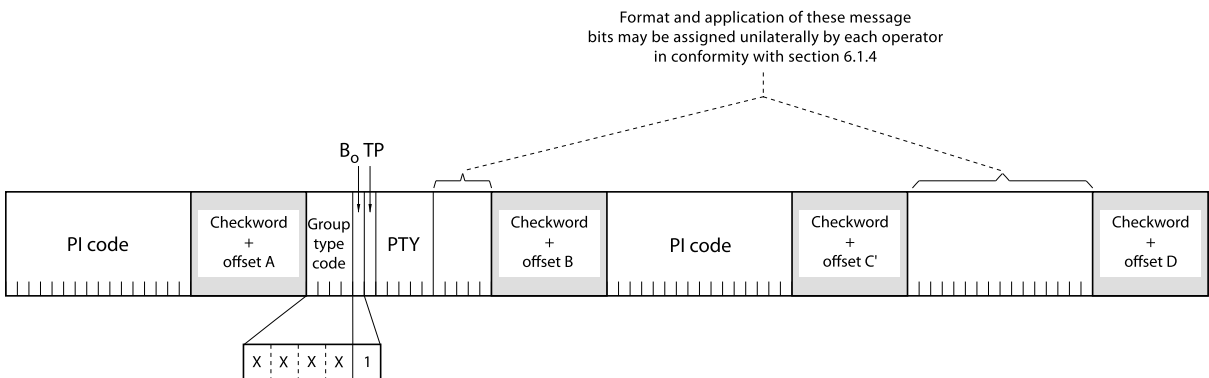


Figure 11 – ODA version B groups

6.1.5 Coding of the Group types

6.1.5.1 Type 0 groups: Basic tuning and switching information

The repetition rates of type 0 groups must be chosen in compliance with 6.1.3.

Figure 12 shows the format of type 0A groups and Figure 13 the format of type 0B groups.

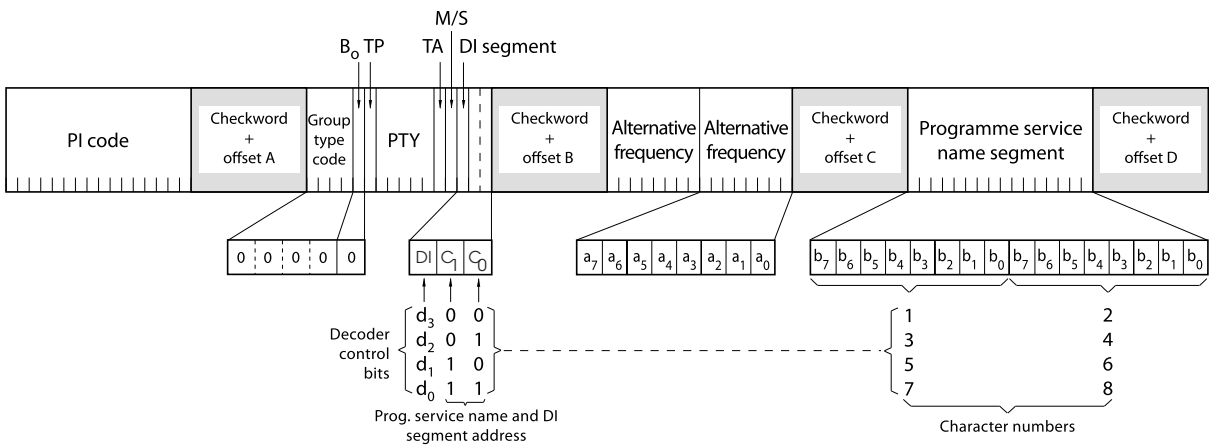


Figure 12 – Basic tuning and switching information – Type 0A group

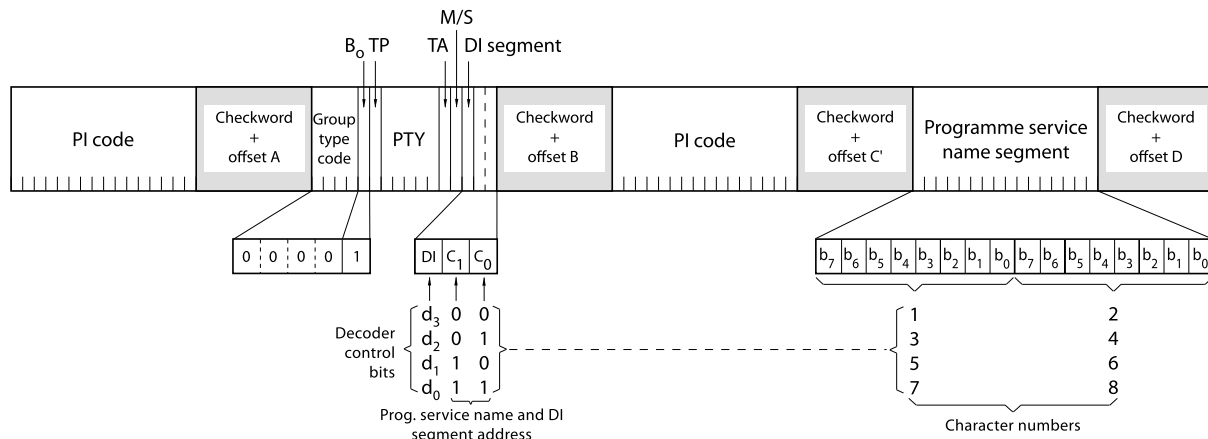


Figure 13 – Basic tuning and switching information – Type 0B group

Type 0A groups are usually transmitted whenever alternative frequencies exist. Type 0B groups without any type 0A groups may be transmitted only when no alternative frequencies exist.

There are two methods (A and B) for transmission of alternative frequencies (see 6.2.1.6.2).

The Programme Service name comprises eight characters, intended for static display on a receiver. It is the primary aid to listeners in programme service identification and selection. The use of PS to transmit text other than a single eight character name is not permitted (see also 6.2.2). Transmission of a PS name usually takes four type 0A groups, but to allow an instant display of the PS when a receiver pre-set is selected, the PS name is often stored for subsequent recall from memory when a programme service is selected. For this reason PS shall generally be invariant.

If a broadcaster wishes to transmit longer Programme Service names, programme-related information or any other text, then RadioText provides this feature.

NOTE 1 Version B differs from version A only in the contents of block 3, the offset word in block 3, and, of course, the version code B₀.

NOTE 2 For details of Programme Identification (PI), Programme Type (PTY) and Traffic Programme (TP) code, see Figure 9, 6.2.1 and Annexes D and F.

NOTE 3 TA = Traffic Announcement code (1 bit) (see 6.2.1.3).

NOTE 4 MS = Music Speech switch code (1 bit) (see 6.2.1.4).

NOTE 5 DI = Decoder-Identification control code (4 bits) (see 6.2.1.5). This code is transmitted as 1 bit in each type 0 group. The Programme Service name and DI segment address code (C₁ and C₀) serves to locate these bits in the DI codeword. Thus in a group with C₁C₀ = '00' the DI bit in that group is d₃. These code bits are transmitted most significant bit (d₃) first.

NOTE 6 Alternative frequency codes (2 x 8 bits) (see 6.2.1.6).

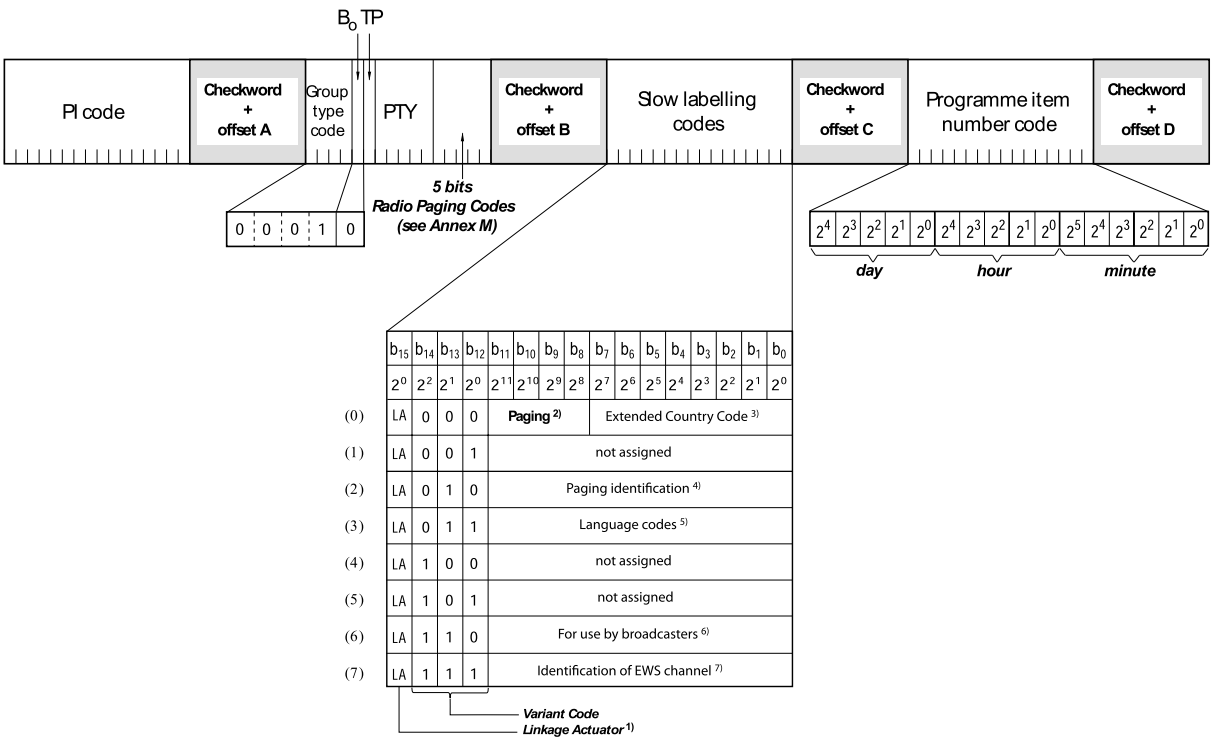
NOTE 7 Programme Service name (for display) is transmitted as 8-bit characters as defined in the 8-bit code-table, Table E.1. Eight characters (including spaces) are allowed for each network and are transmitted as a 2-character segment in each type 0 group. These segments are located in the displayed name by the code bits C₁ and C₀ in block 2. The addresses of the characters increase from left to right in the display. The most significant bit (b₇) of each character is transmitted first.

6.1.5.2 Type 1 groups: Programme Item Number and slow labelling codes

Figure 14 shows the format of type 1A groups and Figure 15 the format of type 1B groups.

When a Programme Item Number is changed, a type 1 group shall be repeated four times with a separation of about 0,5 s. The unused bits in block 2 (type 1B only) are reserved for future applications.

Where Radio Paging is implemented in RDS, a type 1A group will be transmitted in an invariable sequence, regularly once per second, except at each full minute, where it is replaced by one type 4A group.



NOTE 1 The Linkage Actuator is defined in the 'Method for Linking RDS Programme Services' (see 6.2.1.8.3).

NOTE 2 Normally set to zero except when used for the Operator Code in Radio Paging with the Enhanced Paging Protocol, defined in Annex M (see M.3.2.2 and M.3.2.4).

NOTE 3 Extended country codes are defined separately (see Annex D).

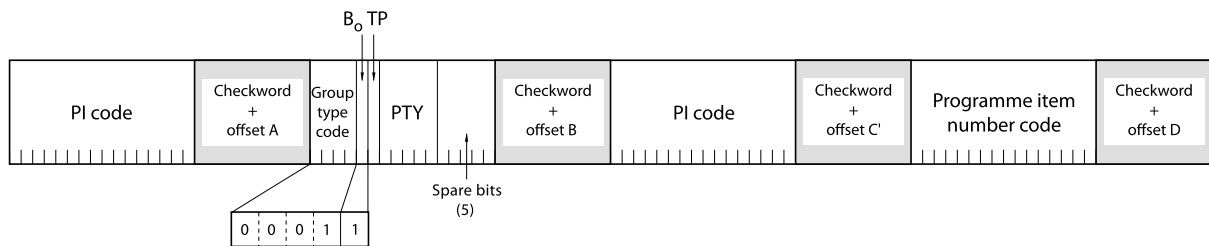
NOTE 4 The Paging Identification is defined in the 'Multi Operator/Area paging' section (see Annex M).

NOTE 5 Language codes are defined separately (see Annex J).

NOTE 6 The coding of this information may be decided unilaterally by the broadcaster to suit the application. RDS consumer receivers should entirely ignore this information.

NOTE 7 The Emergency Warning Systems (EWS) are defined separately (see 6.2.6). This identification should not be used when EWS is implemented as an ODA.

Figure 14 – Programme Item Number and slow labelling codes – Type 1A group



NOTE 1 Version B differs from version A in the contents of blocks 2 and 3, the offset word in block 3, and, of course, the version code B_0 .

NOTE 2 The Programme Item Number is the scheduled broadcast start time and day of month as published by the broadcaster. The day of month is transmitted as a five-bit binary number in the range 1-31. Hours are transmitted as a five-bit binary number in the range 0-23. The spare codes are not used. Minutes are transmitted as a six-bit binary number in the range 0-59. The spare codes are not used.

NOTE 3 The most significant five bits in block 4 which convey the day of the month, if set to zero, indicate that no valid Programme Item Number is being transmitted. In this case, if no Radio Paging is implemented, the remaining bits in block 4 are undefined. However, in the case of type 1A groups only, if Enhanced Radio Paging is implemented, the remaining bits carry Service Information (see Annex M).

NOTE 4 Bits b_{14} , b_{13} and b_{12} of block 3 of version A form the variant code, which determines the application of data carried in bits b_{11} to b_0 . A broadcaster may use as many or as few of the variant codes as wished, in any proportion and order.

Figure 15 – Programme Item Number – Type 1B group

6.1.5.3 Type 2 groups: RadioText

Figure 16 shows the format of type 2A groups and Figure 17 the format of type 2B groups.

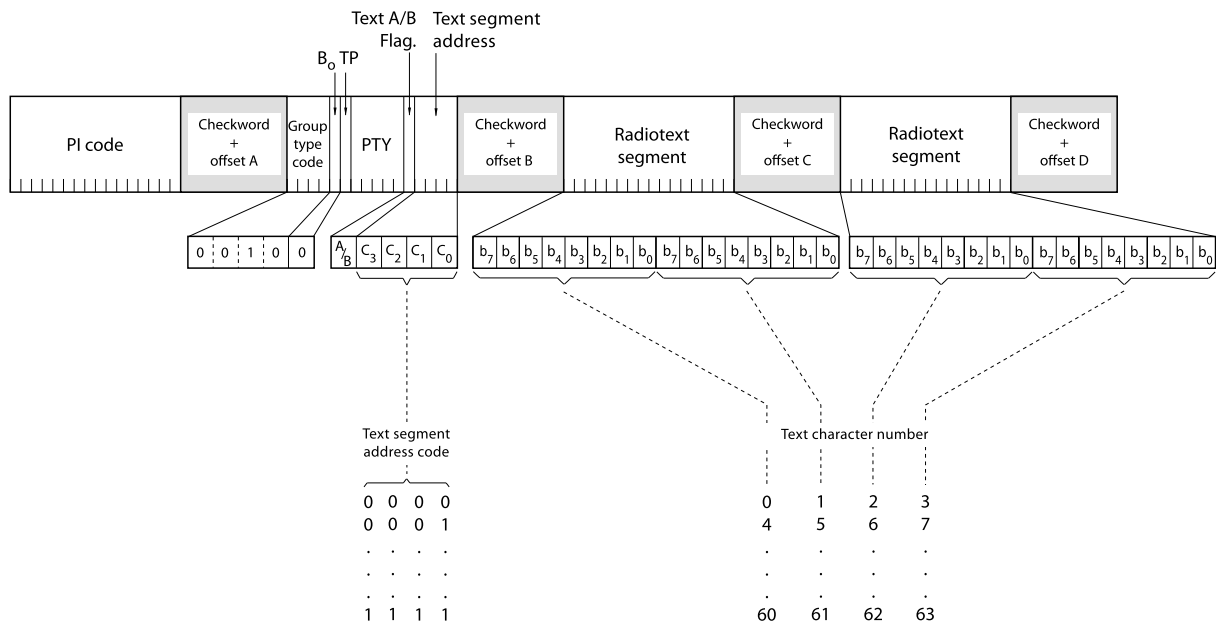


Figure 16 – RadioText – Type 2A group

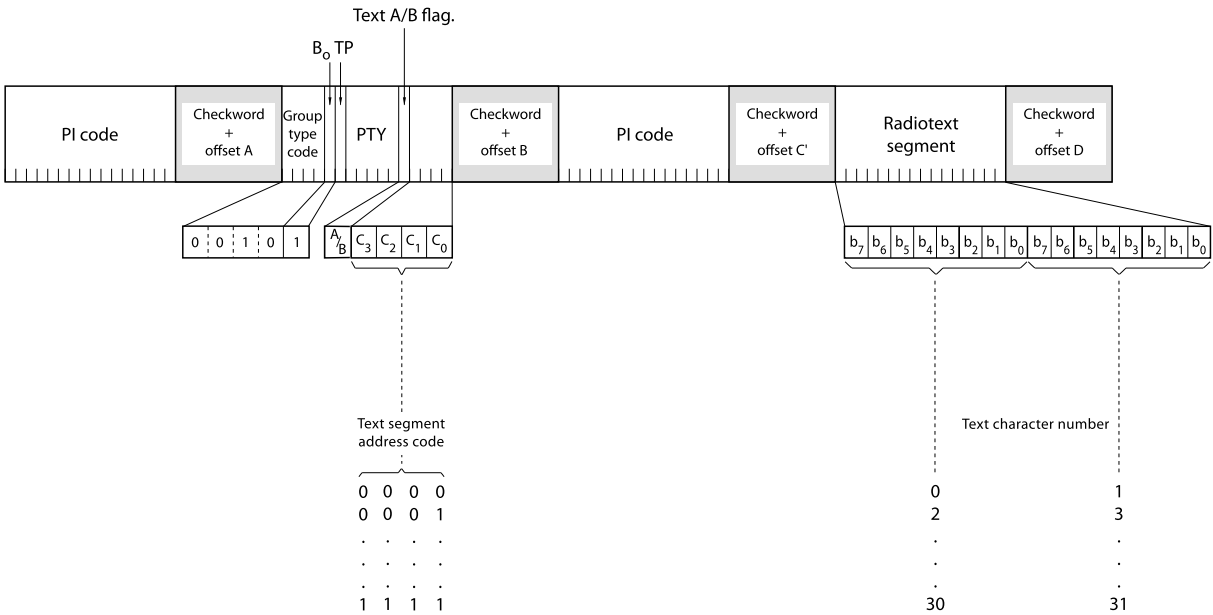


Figure 17 – RadioText – Type 2B group

The 4-bit text segment address defines in the current text the position of the text segments contained in the third (version A only) and fourth blocks. Since each text segment in type 2A groups comprises four characters, messages of up to 64 characters in length can be sent using this version. In type 2B groups, each text segment comprises only two characters and therefore when using this version, the maximum message length is 32 characters.

A new text must start with binary segment address '0000' and there must 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 code 0x0D – carriage return – if the current message requires less than 16 segment addresses.

If a display which has fewer than 64 characters is used to display the RadioText message then memory shall be provided in the receiver/decoder so that elements of the message can be displayed sequentially. This may, for example, be done by displaying elements of text one at a time in sequence, or, alternatively by scrolling the displayed characters of the message from right to left.

Code 0x0A – line feed – may be inserted to indicate a preferred line break.

The following codes could possibly be used with certain reservations noted.

Code 0x0B: end of headline. This marker may be placed anywhere within the first 32 character positions and indicates that the text up to that point is considered by the broadcaster to be the 'headline' portion of the text. It is inserted by the broadcaster on the assumption that a 2 line, 16 character format has been adopted on the receiver. It may stand in place of a space character in the text string. (Note: the use of the <0x0B> code is expected not to cause any difficulty because evidence suggests that receivers universally substitute a space for any unrecognised character.)

Code 0x1F: soft hyphen. This marker indicates the position(s) in long words where the author of the text would prefer a receiver to break a word between display lines if there is a need to do so. It has application only for multi-line non-scrolling displays.

NOTE The use of the 0x1F code is not compatible with earlier RDS receivers, because unwanted spaces will appear in words where 0x1F codes have been used.

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

It should be noted that because of the above considerations there is possible ambiguity between the addresses contained in version A and those contained in version B. For this reason a mixture of type 2A and type 2B groups shall not be used when transmitting any one given message.

An important feature of type 2 groups is the Text A/B flag contained in the second block. Two cases occur:

- if the receiver detects a change in the flag (from binary '0' to binary '1' or vice-versa), then the whole RadioText display shall be cleared and the newly received RadioText message segments shall be written into the display;
- if the receiver detects no change in the flag, then the received text segments or characters shall be written into the existing displayed message and those segments or characters for which no update is received shall be left unchanged.

When this application is used to transmit a 32-character message, at least three type 2A groups or at least six type 2B groups shall be transmitted in every two seconds.

It may be found from experience that all RadioText messages should be transmitted at least twice to improve reception reliability.

NOTE 1 RadioText is transmitted as 8-bit characters as defined in the 8-bit code-table, Table E.1. The most significant bit (b_7) of each character is transmitted first.

NOTE 2 The addresses of the characters increase from left to right in the display.

6.1.5.4 Type 3A groups: Application identification for Open data

Figure 18 shows the format of type 3A groups. These groups are used to identify the Open Data Application in use, on an RDS transmission (see 6.1.4).

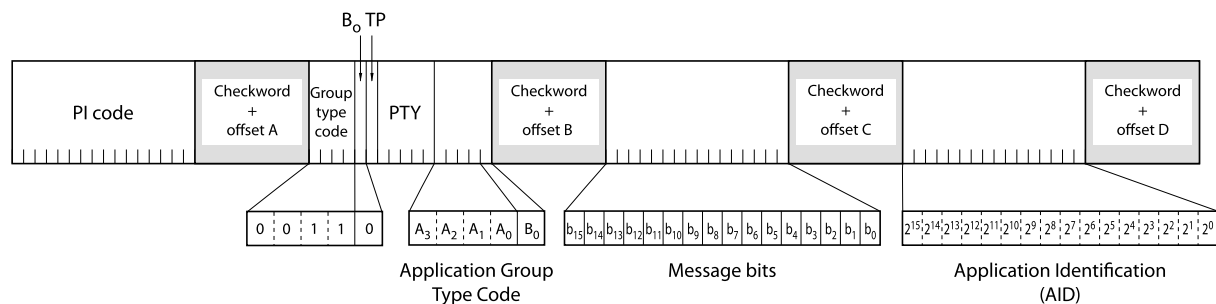


Figure 18 – Application Identification for Open data – Type 3A group

The type 3A group conveys, to a receiver, information about which Open Data Applications are carried on a particular transmission and in which groups they will be found. The type 3A group comprises three elements: the Application Group type code used by that application, 16 message bits for the actual ODA and the Applications Identification (AID) code. Applications which actively utilise both, version A and B groups, are signalled using two type 3A groups.

The Application Group type code indicates the group type used, in the particular transmission, to carry the specified ODA. Table 6 specifies the permitted group types. The bit designation is as per Figure 9, 4-bit for group type code and 1-bit for the version code. Two special conditions may be indicated: Binary 00000 – Not carried in associated group; binary 11111 – Temporary data fault (Encoder status) which means that incoming data to the encoder cannot be transmitted. The AID determines which software handler a receiver needs to use.

This supplements information carried in the type 1A group and permits groups specified in this standard for EWS, IH, RP and TMC to be re-allocated when these features are not used. This

method of allocating and defining Open Data Applications in an RDS transmission allows the addition and subtraction of ODAs, without constraint or the need to await the publication of new standards.

For each group type addressed by the Application Group Type codes of a particular transmission, only one application may be identified as the current user of the channel.

The AID code 0x0000 may be used to indicate that the respective group type is being used for the normal feature specified in this standard. Application Identification codes 0x0001 to 0xFFFF indicate applications as specified in the ODA Directory.

The ODA Directory specification associated with a particular AID code defines the use of version A and version B groups as follows:

- version A groups used alone (mode 1.1)
- version B groups used alone (mode 1.2)
- version A groups and version B groups used as alternatives (mode 2)
- version A groups and version B groups used together (mode 3)

It is important to note that the ODA Directory specification shall not specify the actual version A and version B groups to be used, since these are assigned in each transmission by the type 3A group.

The AID feature indicates that a particular ODA is being carried in a transmission. Each application will have unique requirements for transmission of its respective AID, in terms of repetition rate and timing. These requirements must be detailed in the respective ODA specification. The specification must also detail the AID signalling requirements for such times when an application assumes or loses the use of a group type channel. Some applications may not allow reconfiguration in this way.

6.1.5.5 Type 3B groups: Open Data Application

Figure 19 shows the format of type 3B groups. These groups are usable for Open Data (see 6.1.4).

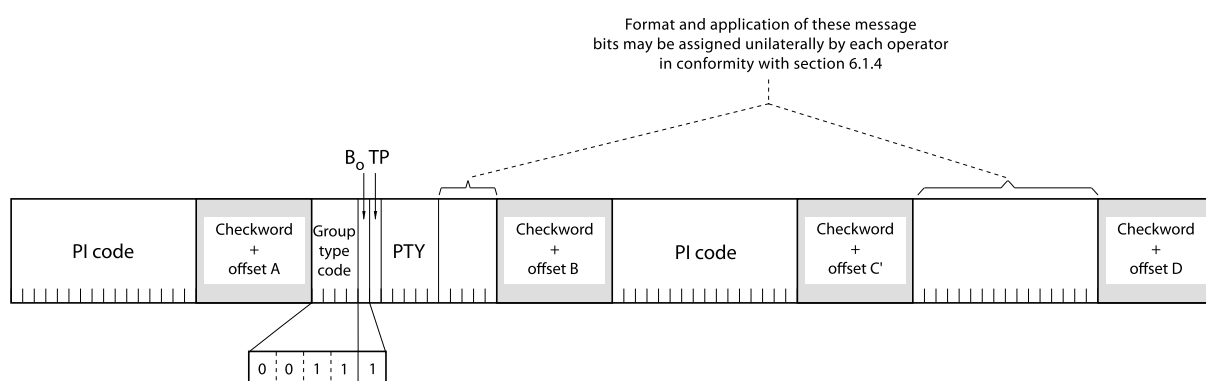


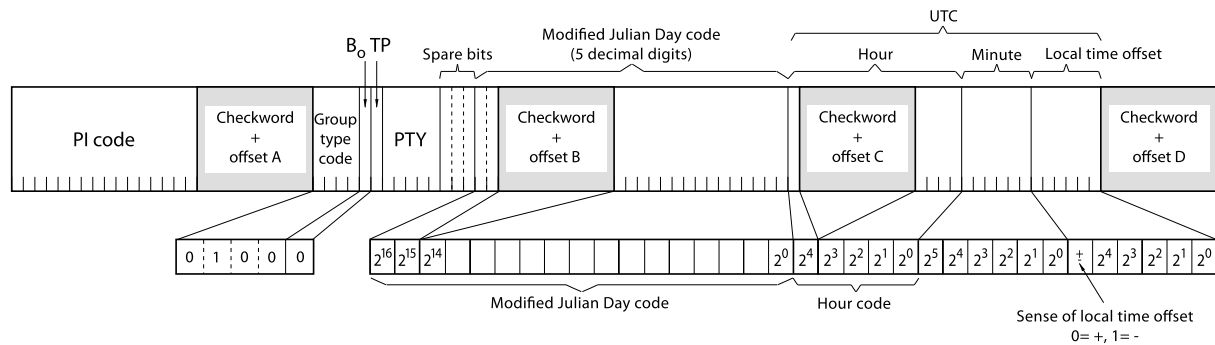
Figure 19 – Open data – Type 3B group

6.1.5.6 Type 4A groups: Clock-time and date

The transmitted clock-time and date shall be accurately set to UTC plus local offset time. Otherwise, the transmitted CT codes shall all be set to zero.

Figure 20 shows the format of type 4A groups.

When this application is used, one type 4A group will be transmitted every minute.



NOTE 1 The local time is composed of Coordinated Universal Time (UTC) plus local time offset.

NOTE 2 The local time offset is **expressed in multiples of half hours** within the range -15,5 h to +15,5 h and is coded as a six-bit binary number. '0' = positive offset (East of zero degrees longitude), and '1' = negative offset (west of zero degrees longitude).

NOTE 3 The information relates to the epoch immediately following the start of the next group.

NOTE 4 The Clock time group is inserted so that the minute edge will occur within $\pm 0,1$ s of the end of the Clock time group.

NOTE 5 Minutes are coded as a six-bit binary number in the range 0-59. The spare codes are not used.

NOTE 6 Hours are coded as five-bit binary number in the range 0-23. The spare codes are not used.

NOTE 7 The date is expressed in terms of Modified Julian Day and coded as a 17-bit binary number in the range 0-99999. Simple conversion formulas to month and day, or to week number and day of week are given in Annex G. Note that the Modified Julian Day date changes at UTC midnight, **not** at local midnight.

NOTE 8 Accurate CT based on UTC plus local time offset must be implemented on the transmission where TMC and/or Radio paging is implemented.

Figure 20 – Clock-time and date transmission – Type 4A group

6.1.5.7 Type 4B groups: Open Data Application

Figure 21 shows the format of type 4B groups. These groups are usable for Open data (see 6.1.4).

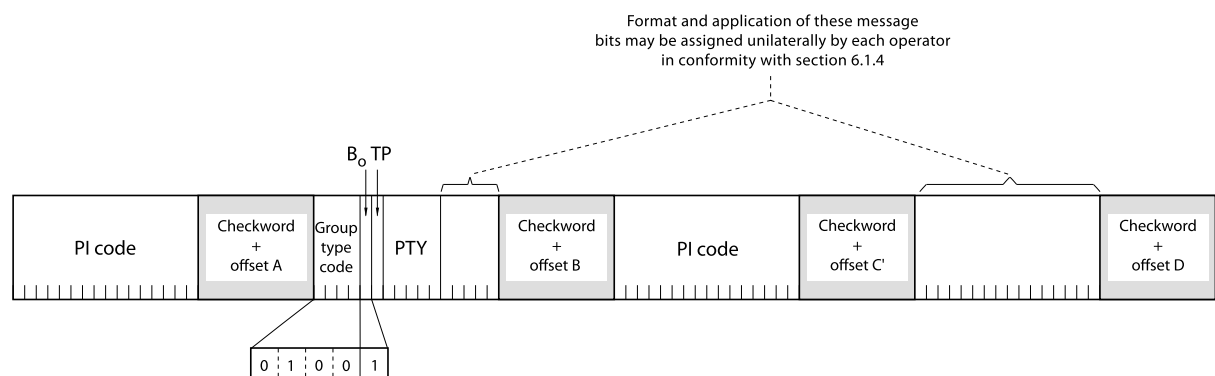


Figure 21 – Open data – Type 4B group

6.1.5.8 Type 5 groups: Transparent data channels or ODA

Figure 22 shows the format of type 5A groups and Figure 23 the format of type 5B groups, where used for TDC; if used for ODA, see 6.1.4.2.

The 5-bit address-code in the second block identifies the 'channel-number' (out of 32) to which the data contained in blocks 3 (version A only) and 4 are addressed. Unlike the fixed-format RadioText of type 2 groups, messages of any length and format can be sent using these channels. Display control characters (such as line-feed and carriage-return) will, of course, be sent along with the data.

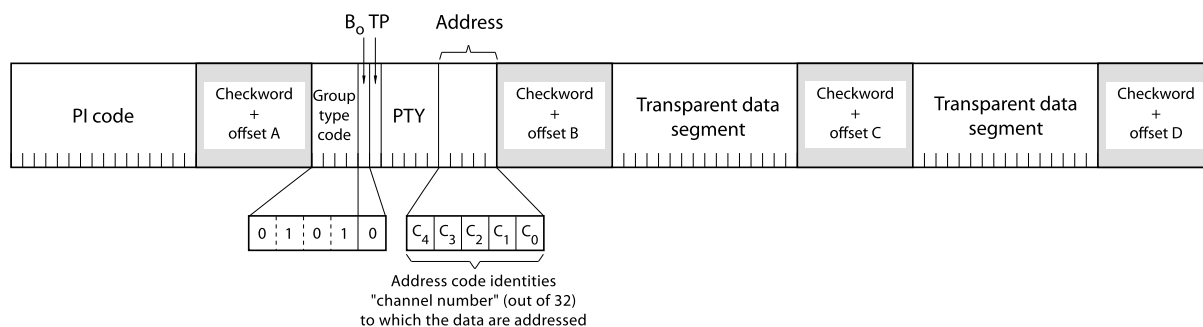


Figure 22 – Transparent data channels – Type 5A group

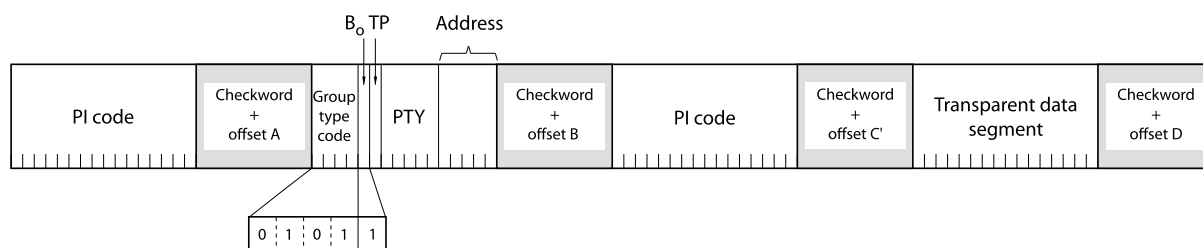


Figure 23 – Transparent data channels – Type 5B group

These channels may be used to send alphanumeric characters, or other text (including mosaic graphics), or for transmission of computer programmes and similar data not for display. Details of implementation of these last options are to be specified separately.

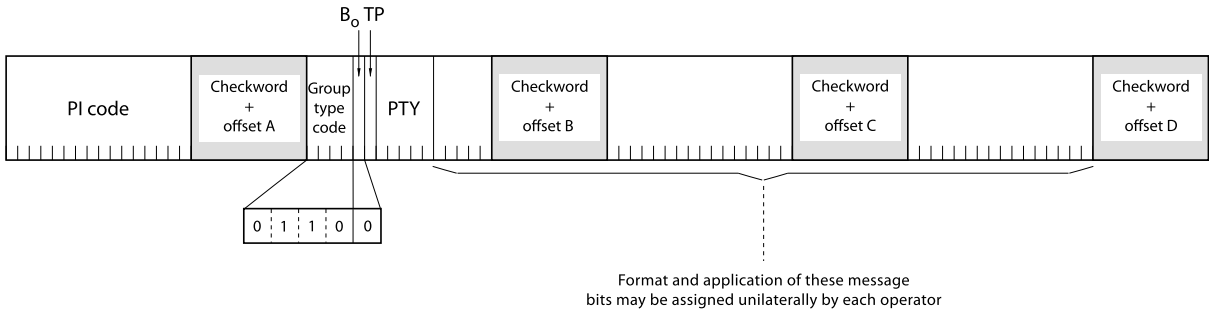
The repetition rate of these group types may be chosen to suit the application and the available channel capacity at the time.

6.1.5.9 Type 6 groups: In-house applications or ODA

Figure 24 shows the format of type 6A groups and the format of type 6B groups, where used for IH; if used for ODA see 6.1.4.2. The contents of the unreserved bits in these groups may be defined unilaterally by the operator.

Consumer receivers shall ignore the in-house information coded in these groups. The repetition rate of these group types may be chosen to suit the application and the available channel capacity at the time.

Type 6A group:



Type 6B group:

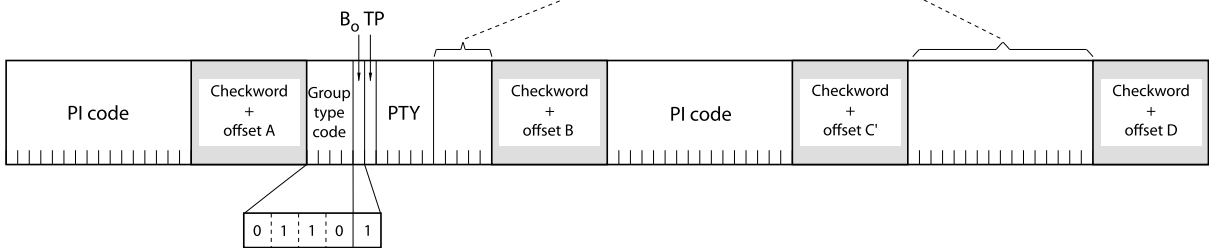


Figure 24 – In-house applications – Type 6A and 6B group

6.1.5.10 Type 7A groups: Radio Paging or ODA

Figure 25 shows the format of type 7A groups, where used for Radio Paging; if used for ODA, see 6.1.4. The specification of RP which also makes use of type 1A, 4A and 13A groups, is given in Annex M.

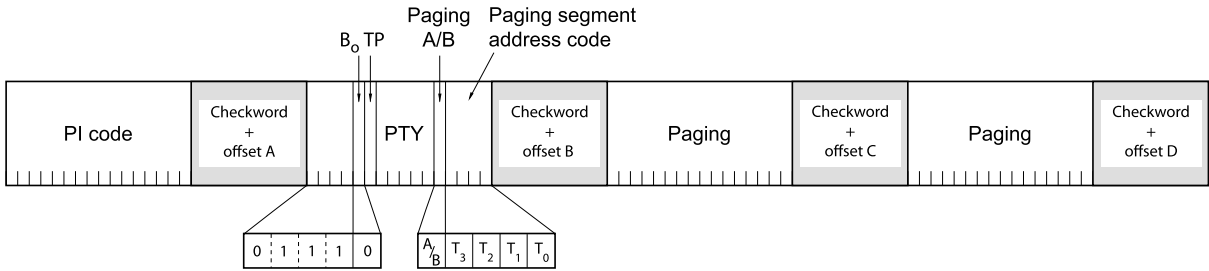


Figure 25 – Radio Paging – Type 7A group

6.1.5.11 Type 7B groups: Open Data Application

Figure 26 shows the format of type 7B groups. These groups are usable for Open data (see 6.1.4).

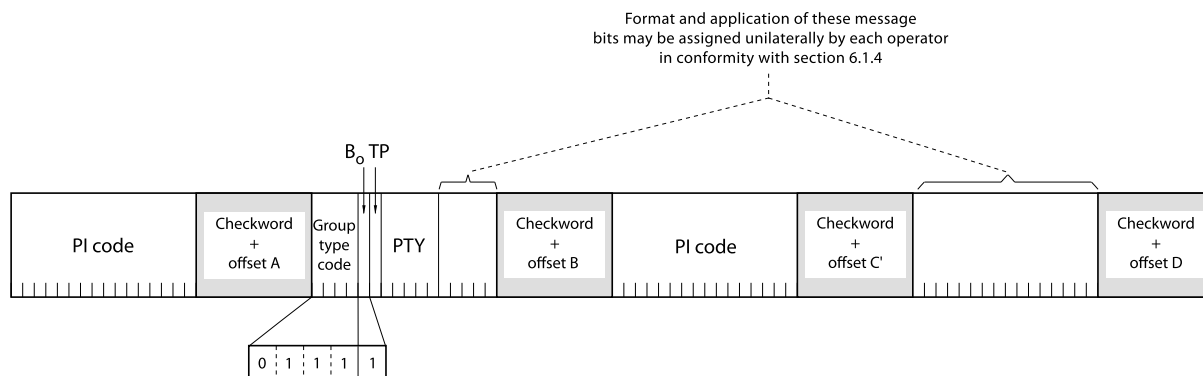


Figure 26 – Type 7B group

6.1.5.12 Type 8 groups: ODA-Traffic Message Channel (TMC) or other ODAs

Figure 27 shows the format of type 8A groups, most commonly used for the ISO-specified ODA – Traffic Message Channel (TMC). TMC has the AID 0xCD46 or 0xCD47, see 6.1.5.4. This group carries the TMC messages, and certain TMC service and administrative information. In addition to the type 3A group required by all ODAs, TMC also requires the use of type 4A groups (CT). The coding of TMC as an ODA, which uses the ALERT-C protocol, is specified in the ISO 14819 series (see Clause 2). When not used for TMC, the type 8A group may be used for any other ODA (see 6.1.4).

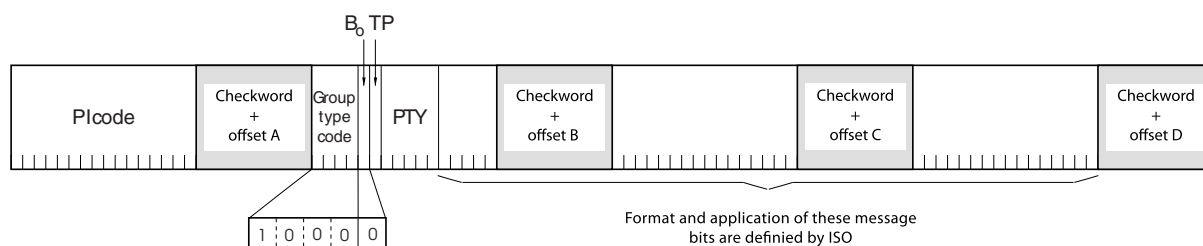


Figure 27 – Traffic Message Channel – Type 8A group

Figure 28 shows the format of type 8B groups. These groups are usable for Open data (see 6.1.4) and are not used for TMC.

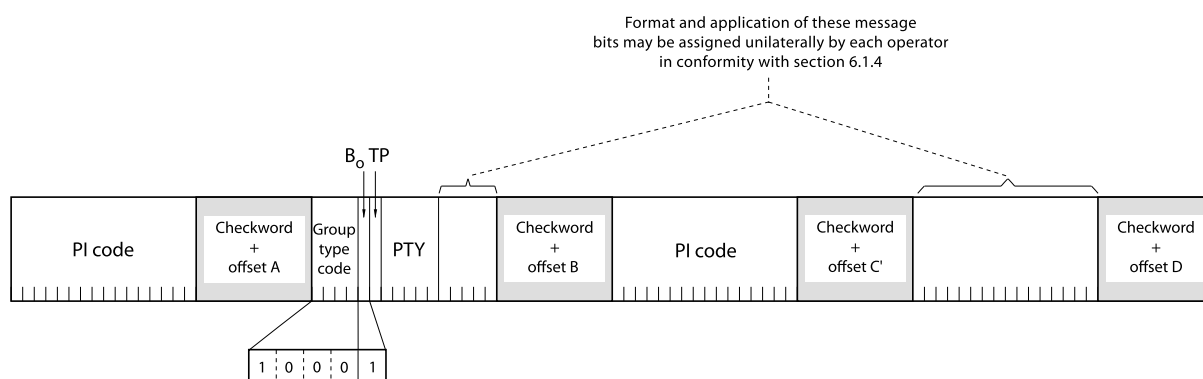


Figure 28 – Open data – Type 8B group

6.1.5.13 Type 9 groups: Emergency warning systems or ODA

These groups are transmitted very infrequently, unless an emergency occurs or test transmissions are required. Figure 29 shows the format of type 9A groups where used for EWS; if used for ODA, see 6.1.4.2.

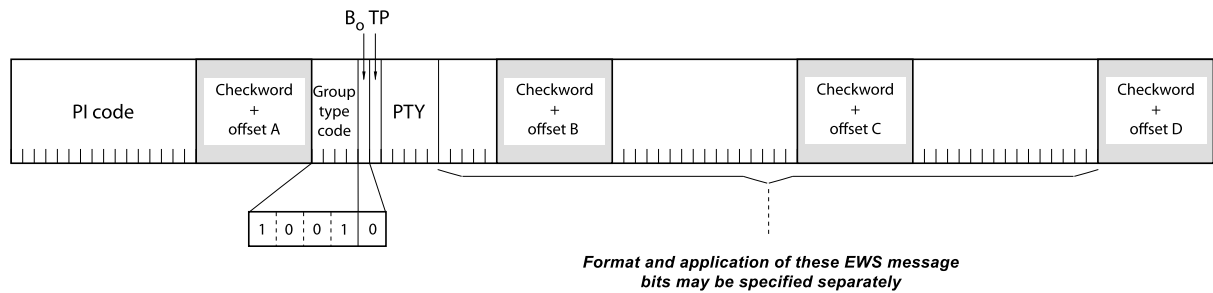


Figure 29 – Allocation of EWS message bits – Type 9A group

Format and application of the bits allocated for EWS messages may be assigned unilaterally by each country. However, the ECC feature must be transmitted in type 1A groups when EWS is implemented.

Figure 30 shows the format of type 9B groups. These groups are usable for Open data (see 6.1.4).

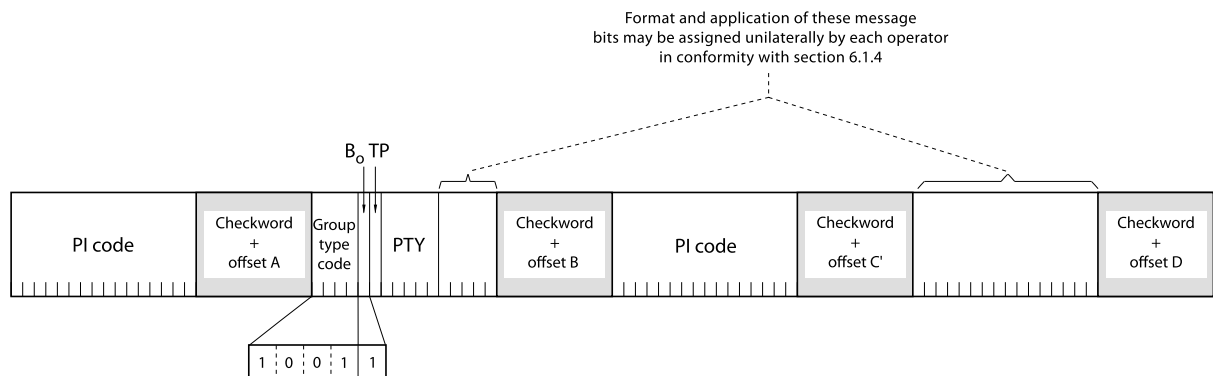
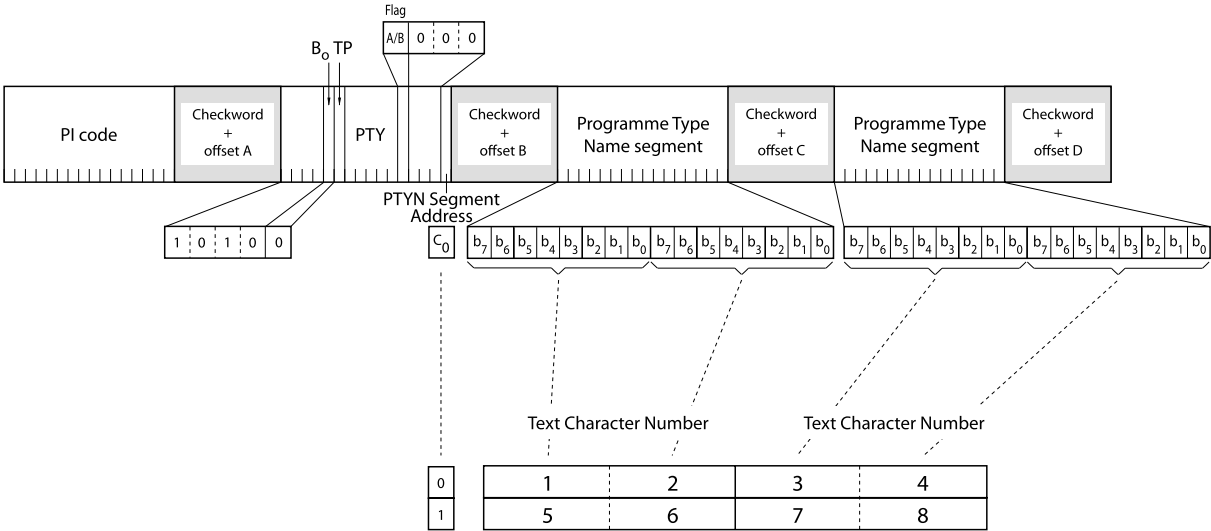


Figure 30 – Open data – Type 9B group

6.1.5.14 Type 10 groups: Programme Type Name (Group type 10A) and Open data (Group type 10B)

Figure 31 shows the format of type 10A groups used for PTYN.

The type 10A group allows further description of the current Programme Type, for example, when using the PTY code 4: SPORT, a PTYN of “Football” may be indicated to give more detail about that programme. PTYN shall only be used to enhance Programme Type information and it shall not be used for sequential information.



NOTE 1 The A/B flag is toggled when a change is made in the PTYN being broadcast.

NOTE 2 Programme Type Name (PTYN) (for display) is transmitted as 8-bit characters as defined in the 8-bit code, Table E.1. Eight characters (including spaces) are allowed for each PTYN and are transmitted as four character segments in each type 10A group. These segments are located in the displayed PTYN name by the code bit C_0 in block 2. The addresses of the characters increase from left to right in the display. The most significant bit (b_7) of each character is transmitted first.

Figure 31 – Programme Type Name PTYN – Type 10A group

Figure 32 shows the format of type 10B groups used for ODA, see 6.1.4.2.

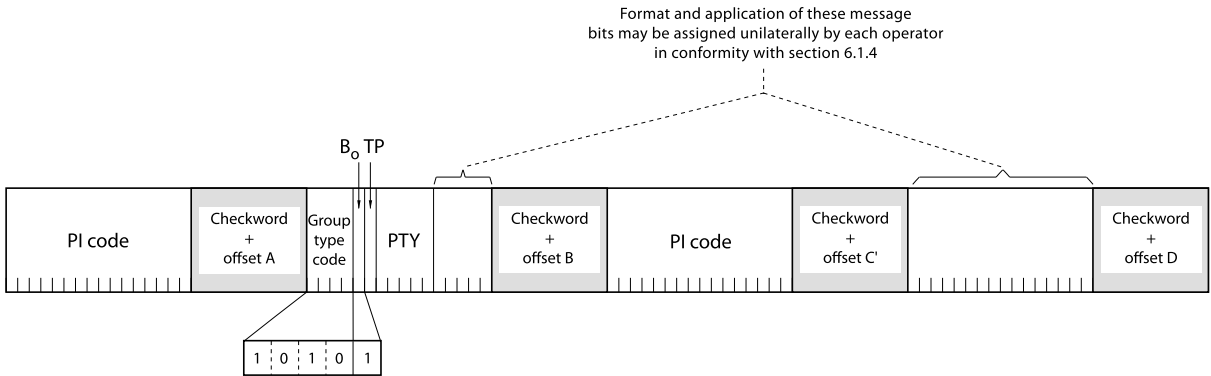
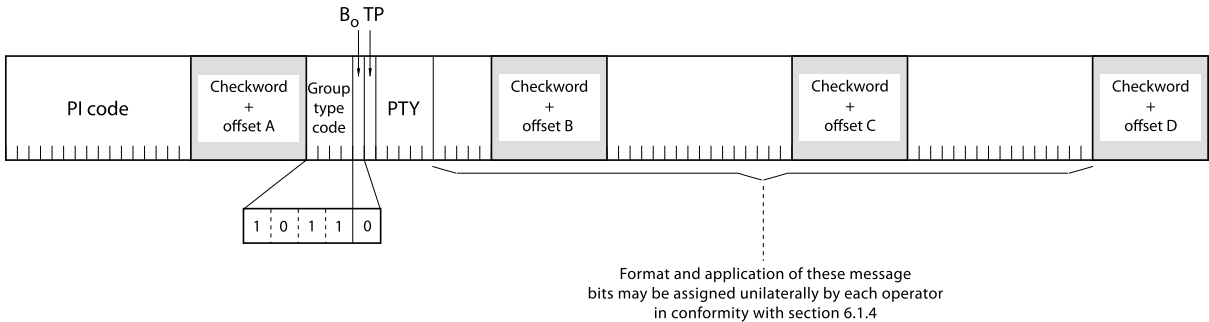


Figure 32 – Open data – Type 10B group

6.1.5.15 Type 11 groups: Open Data Application

Figure 33 shows the format of type 11A and 11B groups. These groups are usable for Open data (see 6.1.4).

Type 11A group:



Type 11B group:

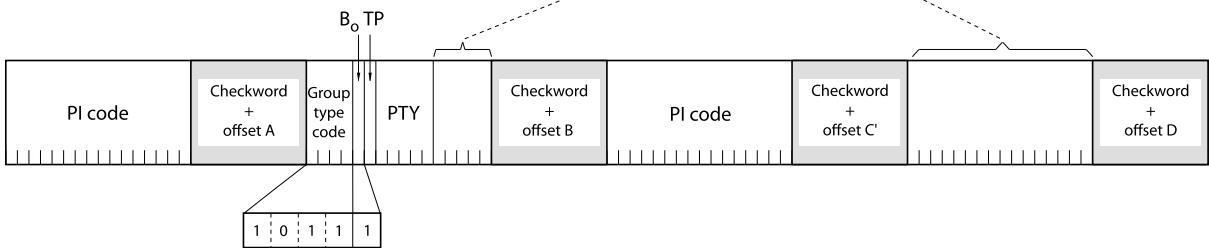
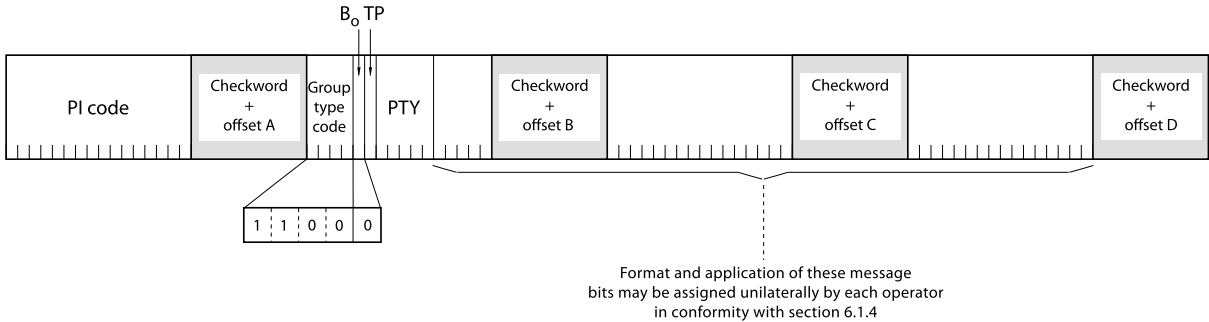


Figure 33 – Open data – Type 11A and 11B groups

6.1.5.16 Type 12 groups: Open Data Application

Figure 34 shows the format of type 12A and 12B groups. These groups are usable for Open data (see 6.1.4).

Type 12A group:



Type 12B group:

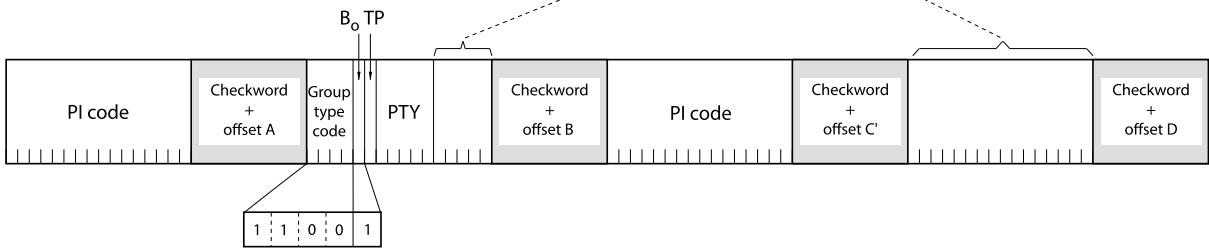


Figure 34 – Open data – Type 12A and 12B groups

6.1.5.17 Type 13A groups: Enhanced Radio Paging or ODA

The type 13A group is used to transmit the information relative to the network and the paging traffic. Its primary purpose is to provide an efficient tool for increasing the battery life time of the pager.

Figure 35 shows the format of the type 13A group. These groups are transmitted once or twice at the beginning of every interval (after the type 4A group at the beginning of each minute or after the first type 1A group at the beginning of each interval).

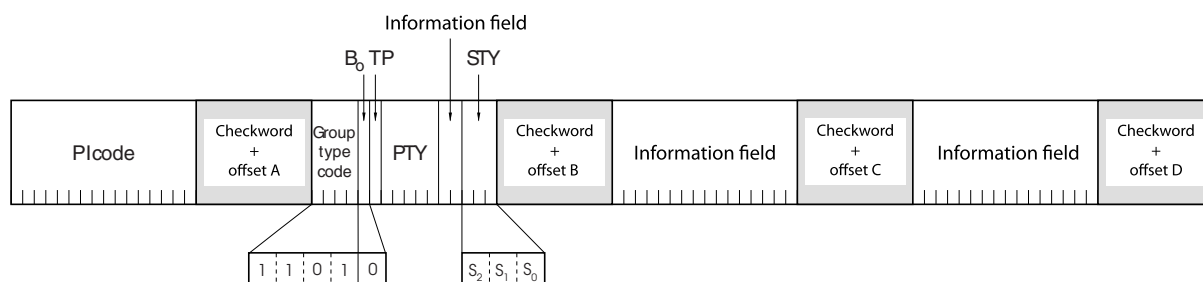


Figure 35 – Enhanced Paging information – Type 13A group

The STY code (3 bits) denotes the different type 13A group subtypes; there are 8 different subtypes:

Table 7 – STY codes

STY			Last bits of third block and fourth block of type 13A group
S ₂	S ₁	S ₀	
0	0	0	Address notification bits 24...0, when only 25 bits (one type 13A group) are used
0	0	1	Address notification bits 49...25, when 50 bits (two type13A groups) are used
0	1	0	Address notification bits 24...0, when 50 bits (two type13A groups) are used
0	1	1	Reserved for Value Added Services system information
1	0	0	Reserved for future use
...	...	...	...
1	1	1	Reserved for future use

The specification of the relevant protocol is given in Clause M.3.

The type 13A group may be used for ODA when it is not used for Radio Paging, and its group structure is then as shown in 6.1.4.2.

6.1.5.18 Type 13B groups: Open Data Application

Figure 36 shows the format of type 13B groups. These groups are usable for Open data (see 6.1.4).

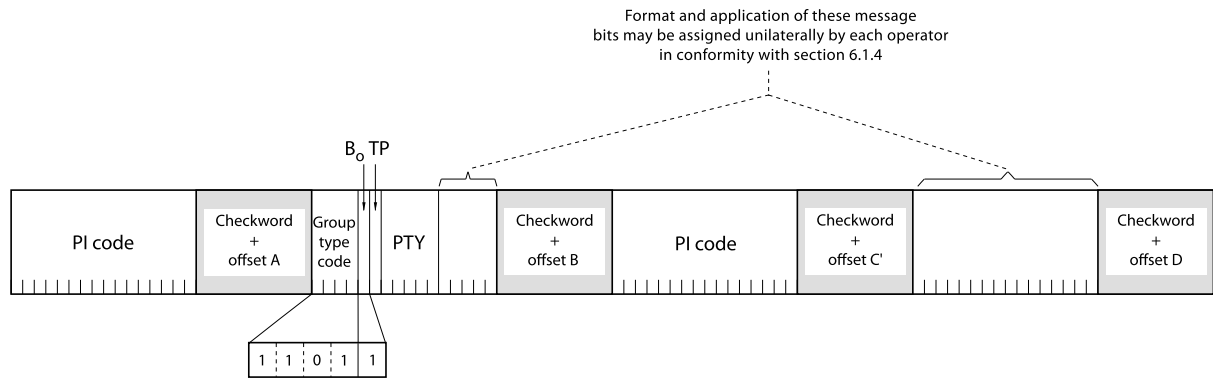


Figure 36 – Open data – Type 13B group

6.1.5.19 Type 14 groups: Enhanced Other Networks information

Figures 37 and 38 show the format of type 14A and 14B groups. These groups are transmitted if Enhanced Other Networks information (EON) is implemented. The specification of the relevant protocol is given in 6.2.1.8.

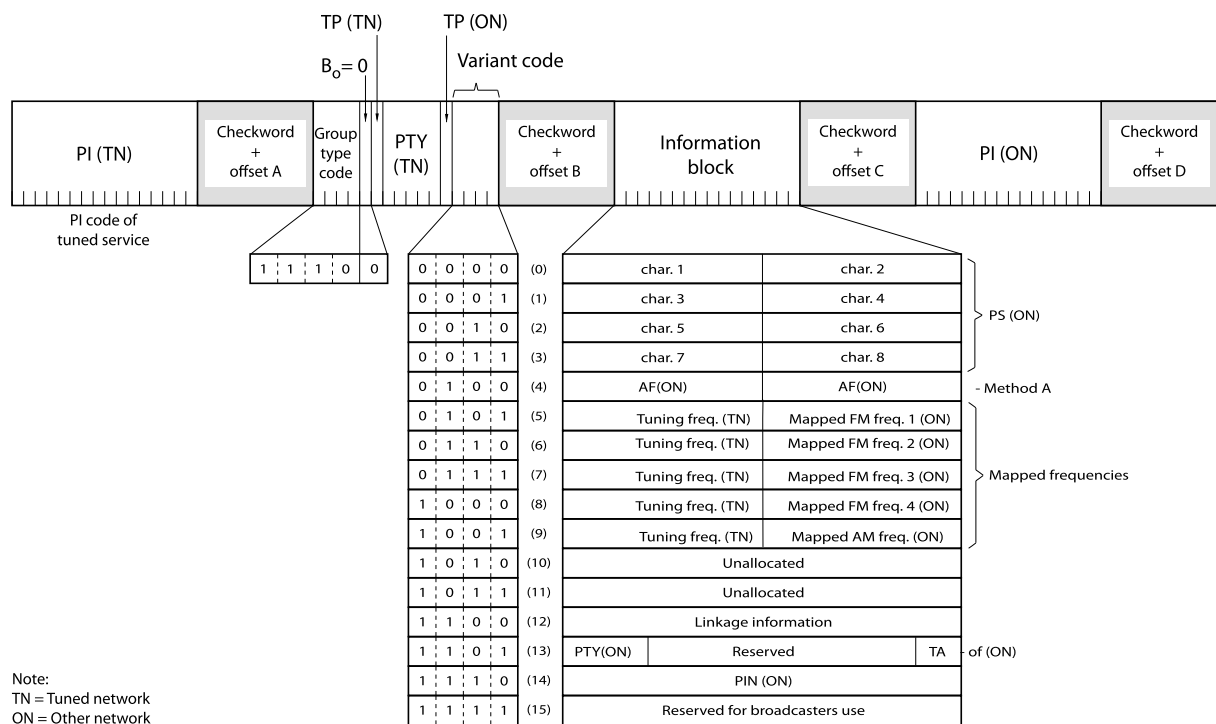


Figure 37 – Enhanced Other Networks information – Type 14A groups

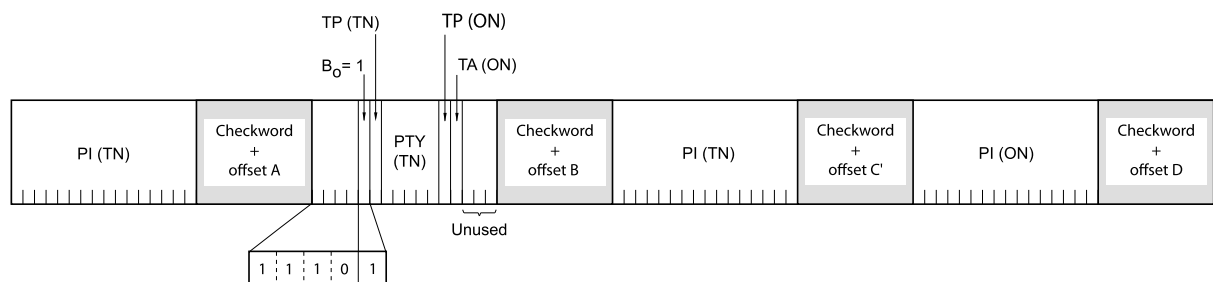


Figure 38 – Enhanced Other Networks information – Type 14B groups

6.1.5.20 Type 15A groups: Open Data Application

The type 15A group may be used for ODA and its group structure is then as shown in Figure 39.

Type 15A group:

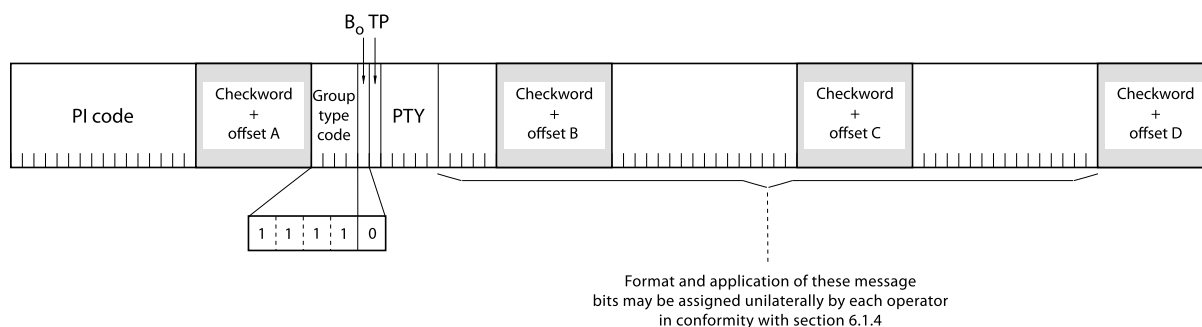


Figure 39 – Open data – Type 15A group

6.1.5.21 Type 15B groups: Fast basic tuning and switching information

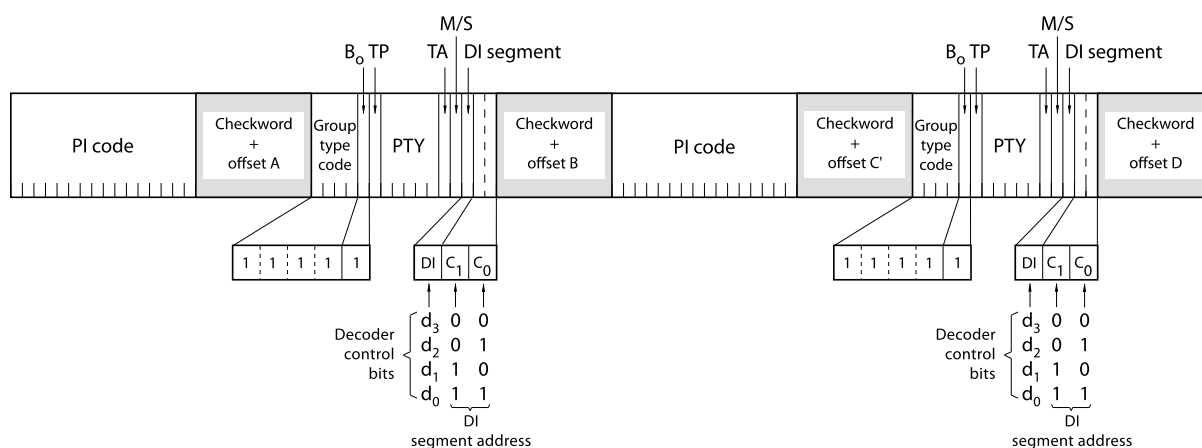


Figure 40 – Fast basic tuning and switching information – Type 15B group

When groups of this type are transmitted, the repetition rate may be chosen to suit the application and the available channel capacity at the time.

NOTE 1 For details Programme Identification (PI), Programme Type (PTY) and Traffic Programme (TP) code, see 6.2.1 and Annexes D and F.

NOTE 2 TA = Traffic Announcement code (1 bit) (see 6.2.1.3).

NOTE 3 MS = Music Speech switch code (1 bit) (see 6.2.1.4).

NOTE 4 DI = Decoder-Identification control code (4 bits) (see 6.2.1.5). This code is transmitted as 1 bit in each type 15B group. The DI segment address code (C_1 and C_0) serves to locate these bits in the DI codeword. Thus in a group with $C_1C_0 = '00'$ the DI bit in that group is d_3 . These code bits are transmitted most significant bit (d_3) first.

6.2 Coding of information

A glossary of terms used in RDS applications is given in Clause 7, which also explains the expected responses of a consumer receiver to the various codes.

6.2.1 Coding of information for control

6.2.1.1 Programme Identification (PI) codes and Extended Country Codes (ECC)

The coding model for Programme Identification information and Extended Country Codes is given in Annex D.

6.2.1.2 Programme Type (PTY) codes

The applications of the 5-bit Programme type codes are specified in Annex F. PTY codes 30 and 31 are control functions for a consumer receiver (see Annex F).

6.2.1.3 Traffic Programme (TP) and Traffic Announcement (TA) codes

The coding to be used is as follows:

Table 8 – Codes for TP and TA

Traffic Programme code (TP)	Traffic Announcement code (TA)	Applications
0	0	This programme does not carry traffic announcements nor does it refer, via EON, to a programme that does
0	1	This programme carries EON information about another programme which gives traffic information
1	0	This programme carries traffic announcements but none are being broadcast at present and may also carry EON information about other traffic announcements
1	1	A traffic announcement is being broadcast on this programme at present

6.2.1.4 Music Speech (MS) switch code

This is a 1-bit code. A '0' indicates that speech, at present, is being broadcast and a '1' indicates that music, at present, is being broadcast. When the broadcaster is not using this facility the bit value will be set at '1'.

6.2.1.5 Decoder Identification (DI) and Dynamic PTY Indicator (PTYI) codes

These 4 bits are used to indicate different operating modes to switch individual decoders on or off and to indicate if PTY codes in the transmission are dynamically switched.

Table 9 – Bit d₀ to d₃ meanings

Settings	Meaning
Bit d ₀ , set to 0:	Mono
Bit d ₀ , set to 1:	Stereo
Bit d ₁ , set to 0:	Not Artificial Head
Bit d ₁ , set to 1:	Artificial Head
Bit d ₂ , set to 0:	Not compressed
Bit d ₂ , set to 1:	Compressed
Bit d ₃ , set to 0:	Static PTY
Bit d ₃ , set to 1:	Indicates that the PTY code on the tuned service, or referenced in EON variant 13, is dynamically switched

6.2.1.6 Coding of Alternative Frequencies (AFs)

6.2.1.6.1 AF code tables

In the following code tables, each 8-bit binary code represents a carrier frequency, or it represents a special meaning as shown in Tables 10, 11 and 12.

Table 10 – VHF code table

Number	Binary code	Carrier frequency
0	0000 0000	Not to be used
1	0000 0001	87.6 MHz
2	0000 0010	87.7 MHz
:	:	:
:	:	:
204	1100 1100	107.9 MHz

Table 11 – Special meanings code table

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

Table 12 – Code tables according to ITU regions

Table 12a – LF/MF code table – for ITU regions 1 and 3 (9 kHz spacing)

Number	Binary code	Carrier frequency
LF 1	0000 0001	153 kHz
:	:	:
:	:	:
15	0000 1111	279 kHz
MF 16	0001 0000	531 kHz
:	:	:
:	:	:
:	:	:
:	:	:
135	1000 0111	1602 kHz

Table 12b – MF code table – for ITU region 2 (10 kHz spacing)

Number	Binary code	Carrier frequency
MF 16	0001 0000	530 kHz
:	:	:
:	:	:
:	:	:
:	:	:
124	0111 1100	1610 kHz

6.2.1.6.2 Use of Alternative Frequencies in type 0A groups

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.

6.2.1.6.3 AF method A

Two AF codes are carried in block 3 of each type 0A group. The first byte in the transmitted list (codes 224 – 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 of AF method A coding:

	Example A		Example B		Example C	
1st 0A:	#5	AF1	#4	AF1	#4	AF1
2nd 0A:	AF2	AF3	AF2	AF3	AF2	AF3
3rd 0A:	AF4	AF5	AF4	Filler	LF/MF follows	AF4

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

Example B shows: a list of 4 VHF frequencies, where Filler code is 205.

Example C shows: a list of 3 VHF frequencies and 1 LF/MF frequency, where LF/MF follows code is 250.

6.2.1.6.4 AF method B

Method B AF coding is used where the number of AFs used by a transmitter and its associated repeater stations exceed 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 alternative frequencies for the VHF/FM transmitters are individually addressed by transmitting the tuning frequency paired with one alternative frequency within one block.

NOTE If the frequency referenced is for an LF/MF transmission, it occupies 2 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 pairs² (up to 12) give the tuning frequency together with a valid AF.

- If the number of AFs of a station is larger 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 must 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 of an AF method B coding:

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
89.3	101.7	$F_2 > F_1$ hence 101.7 is an AF of tuned frequency 89.3, and is the same programme
88.8	89.3	$F_2 > F_1$ hence 88.8 is an AF of tuned frequency 89.3, and is the same programme
102.6	89.3	$F_2 < F_1$ hence 102.6 is an AF of a regional variant of tuned frequency 89.3
89.3	89.0	$F_2 < F_1$ hence 89.0 is an AF of a regional variant of tuned frequency 89.3
# 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
99.5	100.9	$F_2 > F_1$ hence 100.9 is an AF of tuned frequency 99.5, and is the same programme
104.8	99.5	$F_2 < F_1$ hence 104.8 is an AF of a regional variant of tuned frequency 99.5
99.5	89.1	$F_2 < F_1$ hence 89.1 is an AF of a regional variant of tuned frequency 99.5

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, carrying a different programme during certain hours of the day, shall be signalled by transmitting in the descending order. Their PI shall differ in the second element (bits 8 to 11) of the code and may also be static. To identify different regional networks or programmes the PI area codes R1 to R12 shall be used (see Clause D.5).

This convention will permit a receiver to use a regional on/off mode which, when a receiver is in the mode 'regional off', will lead to the acceptance of the PI with the differing second element, and thus permit switching to a different regional network. This option can be deactivated by choosing the mode 'regional on'. Then only AFs having the same second

element of the PI (i.e. the same programme) will be used. This should also be the case for receivers without regional on/off mode. The switching of the second element of the PI to I, N, or S, respectively, informs a receiver that now even AFs transmitted in descending order carry the same programme and the receiver should use this information to allow switching to these AFs.

6.2.1.6.5 Convention for identification of the AF methods 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.

6.2.1.6.6 Use of AF Codes in type 14A groups

AF codes in type 14A groups are used to refer to frequencies of other networks. There are two AF methods for transmitting this information.

Variant 4 utilises AF method A coding to transmit up to 25 frequencies; the coding method is as described above for type 0A groups. The PI code of the other network to which the AF list applies is given in block 4 of the group.

Variant 5 is used for the transmission of “Mapped frequency pairs”. This is used to specifically reference a frequency in the tuned network to a corresponding frequency in another network. This is particularly used by a broadcaster that transmits several different services from the same transmitter tower with the same coverage areas.

The first AF code in block 3 refers to the frequency of the tuned network, the second code is the corresponding frequency of the other network identified by the PI code in block 4.

Where it is necessary to map one tuning frequency to more than one VHF/FM frequency for the cross-referenced programme service (due to multiple use of the tuning frequency or because the cross-referenced programme is receivable at more than one frequency within the service area associated with the tuning frequency), then variants 6, 7 and 8 are used to indicate second, third and fourth mapped frequencies, respectively.

LF/MF mapped frequencies are implicitly signalled by using variant 9. AF Code 250 is not used with the mapped AF method.

6.2.1.7 Programme Item Number (PIN) codes

The transmitted Programme Item Number code will be the scheduled broadcast start time and day of month as published by the broadcaster. For the coding of this information see 6.1.5.2.

If a type 1 group is transmitted without a valid PIN, the day of the month shall be set to zero. In this case, a receiver which evaluates PIN shall ignore the other information in block 4.

6.2.1.8 Coding of Enhanced Other Networks information (EON)

The enhanced information about other networks consists of a collection of optional RDS features relating to other programme services, cross-referenced by means of their PI codes (see 6.2.1.1). Features which may be transmitted using EON for other programme services are: AF (see 6.2.1.6.5), PIN (see 6.2.1.7), PS (see 6.2.2), PTY (see 6.2.1.2), TA (see 6.2.1.3), TP (see 6.2.1.3) and Linkage (see 6.2.1.8.3).

The format of the type 14 groups is shown in Figures 37 and 38. It has two versions: A and B. The A version is the normal form and shall be used for the background transmission of Enhanced Other Networks information. The maximum cycle time for the transmission of all data relating to all cross-referenced programme services shall be less than two minutes. The A version has sixteen variants which may be used in any mixture and order. Attention is