

Specification of the

Radio data system (RDS)

This European Standard EN 50067 : 1990 has the status of a
British Standard

Spécifications du système de radiodiffusion de
données (RDS)

Spezifikation des Radio-Daten-Systems (RDS)

Cooperating organizations

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Contents

	Page
Cooperating organizations	Inside front cover
National foreword	i
Foreword of EN 50067	2
Text of EN 50067	3
National appendix NA (informative)	Inside back cover
National appendix NB (informative)	Inside back cover

National foreword

This British Standard has been prepared under the direction of the Electronic Equipment Standards Policy Committee and is the English language version of EN 50067 : 1990 'Specification of the radio data system (RDS)', published by the European Committee for Electrotechnical Standardization (CENELEC).

It has been derived from the European Broadcasting Union (EBU) Technical document 3244 (1986) and its Supplements 1 and 2, plus additional text. It has also been the subject of CCIR Recommendation 643 (1986).

For later information than is given in this standard, manufacturers are strongly advised to consult EBU document SPB 482 : 'Proposed enhancements of the EBU on CENELEC EN 50067 : Radio data system' (June 1990). (This publication is available from the EBU in Geneva.)

Cross-references. Details of international standards quoted in this British Standard for which there are identical or technically equivalent British Standards are given in national appendix NA.

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Specification of the radio data system (RDS)

Spécifications du système de radiodiffusion de données (RDS) Spezifikation des Radio-Daten-Systems (RDS)

This European Standard was approved by CENELEC on 1 February 1990. 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.

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Foreword

The Radio Data System RDS was developed by the European Broadcasting Union (EBU) Member countries who collaborated towards an internationally agreed standard for such a system. The Specification of the RDS System was published by the EBU in 1984 as doc. Tech 3244 [8] and is also the subject of CCIR Recommendation 643 (1986).

This revised text, which is published by the European Committee for Electrotechnical Standardization (CENELEC), was produced by members of Technical Committee 107 of CENELEC, who worked in collaboration with experts from the EBU. It incorporates minor editorial changes which were needed to clarify certain parts of the EBU Specification. It also embodies enhancements to the Specification which were originally published by the EBU as Supplements 1 and 2 to the RDS Specification. In addition, certain elements of text have been revised to accord with experience gained with the RDS System and changes in broadcasting practice since the Specification was published. It is, nevertheless, expected that receivers produced to accord with this Specification will be compatible with RDS broadcasts which conform with the original EBU Specification.

This document was approved by CENELEC as EN 50067 on 1 February 1990.

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an identical national
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CONTENTS

0. Scope	6
1. Modulation characteristics of the data channel (physical layer)	6
1.1 Subcarrier frequency	6
1.2 Subcarrier phase	6
1.3 Subcarrier level	8
1.4 Method of modulation	8
1.5 Clock-frequency and data-rate	8
1.6 Differential coding	8
1.7 Data-channel spectrum shaping	9
2. Baseband coding (data-link layer)	12
2.1 Baseband coding structure	12
2.2 Order of bit transmission	12
2.3 Error protection	13
2.4 Synchronisation of blocks and groups	14
3. Message format (session and presentation layers)	15
3.1 Addressing	15
3.1.1 Design principles	15
3.1.2 Principal features	15
3.1.3 Group types	17
3.1.3.1 Type 0 groups: Basic tuning and switching information	18
3.1.3.2 Type 1 groups: Programme-item number	19
3.1.3.3 Type 2 groups: Radiotext	20
3.1.3.4 Type 4A groups: Clock-time and date	22
3.1.3.5 Type 5 groups: Transparent data channels	22
3.1.3.6 Type 6 groups: In-house applications	23
3.1.3.7 Type 7A groups: Radio Paging	24
3.1.3.8 Type 14 groups: Enhanced Other Networks information	24
3.1.3.9 Type 15B groups: Fast basic tuning and switching information	25

3.2 Coding of information	26
3.2.1 Coding of information for control	26
3.2.1.1 Programme-identification (PI) codes	26
3.2.1.2 Programme-type (PTY) codes	26
3.2.1.3 Traffic-programme (TP) and traffic-announcement (TA) codes	26
3.2.1.4 Music/speech (M/S) switch code	27
3.2.1.5 Decoder-identification (DI) codes	27
3.2.1.6 Coding of alternative frequencies (AFs) in group OA	28
3.2.1.6.1 Assignment of AF codes	28
3.2.1.6.2 Protocols for the transmission of AFs	29
3.2.1.6.3 Convention for identification of the methods used	31
3.2.1.7 Programme-item number (PIN) codes	31
3.2.1.8 Coding of Enhanced Other Networks information (EON)	31
3.2.1.8.1 Coding of frequencies for cross-referenced programme services	31
3.2.1.8.2 Use of the TP and TA features (Group types 0, 15B and 14)	32
3.2.2 Coding of information for display	32
3.2.3 Coding of clock-time and date	32
3.2.4 Coding of information for transparent data channels	33
3.2.5 Coding of information for in-house applications	33
3.2.6 Coding of Radio paging (RP)	33
3.2.6.1 Introduction	33
3.2.6.2 Coding characteristics for paging	33
3.2.6.2.1 General	33
3.2.6.2.2 Transmitter network group designation	34
3.2.6.2.3 Transmission sequence (battery saving)	34
3.2.6.2.4 Locking to a channel	36
3.2.6.2.5 Loss of synchronization	36
3.2.6.2.6 Group type 7A message format	37
3.2.6.2.6.1 General	37
3.2.6.2.6.2 Paging without additional message	38
3.2.6.2.6.3 Paging with additional numeric message	38
3.2.6.2.6.4 Paging with additional alphanumeric message	39
3.2.6.2.6.5 International paging with	
additional numeric 15 digit message	41
3.2.6.2.6.6 Functions message in international paging	42
3.2.6.3 Examples of the traffic handling capacity of the specified RP system	44

4. Glossary of terms for the applications	46
4.1 Programme identification (PI)	46
4.2 Programme service (PS) name	46
4.3 Programme type (PTY)	46
4.4 Traffic-programme identification (TP)	47
4.5 List of alternative frequencies (AF)	47
4.6 Traffic-announcement identification (TA)	47
4.7 Decoder identification (DI)	47
4.8 Music/speech switch (M/S)	47
4.9 Programme-item number (PIN)	47
4.10 Radiotext (RT)	48
4.11 Enhanced other networks information (EON)	48
4.12 Transparent data channel (TDC)	48
4.13 In-house application (IH)	48
4.14 Clock-time and date (CT)	48
4.15 Radio paging (RP)	48
5. Marking	49

ANNEXES

Annex A (normative)	Offset words to be used for group and block synchronisation	51
Annex B (informative)	Theory and implementation of the modified shortened cyclic code	52
Annex C (informative)	Implementation of group and block synchronisation using the modified shortened cyclic code	58
Annex D (normative)	Programme-identification codes	61
Annex E (normative)	Character repertoires for Programme Service name and Radiotext	67
Annex F (normative)	Programme-type codes	71
Annex G (informative)	Conversion between time and date conventions	74
Annex H (normative)	Specification of the ARI system	76
Annex J (normative)	Index of abbreviations	77
Annex K (informative)	RDS logo	78
Annex L (informative)	Bibliography	79

0. Scope

The Radio Data System RDS is 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.

1. Modulation characteristics of the data channel (physical layer)

The Radio Data System is intended for application to VHF/FM sound broadcasting transmitters in the range 87.5-108.0 MHz, which carry stereophonic (pilot-tone system) or monophonic sound broadcasts (see CCIR Recommendation 450-1).

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

The system can be used simultaneously with the ARI system (see annex J and CCIR Report 463-4, § 4.3), even when both systems are broadcast from the same transmitter. However, certain constraints on the phase and injection levels of the radio-data and ARI signals must be observed in this case (see 1.2 and 1.3).

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.

1.1 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 (see CCIR Recommendation 450-1), the tolerance on the frequency of the subcarrier during stereo broadcasts is ± 6 Hz.

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

1.2 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.

In the case when ARI and radio-data signals are transmitted simultaneously, the phase angle between the two subcarriers shall be $90^\circ \pm 10^\circ$.

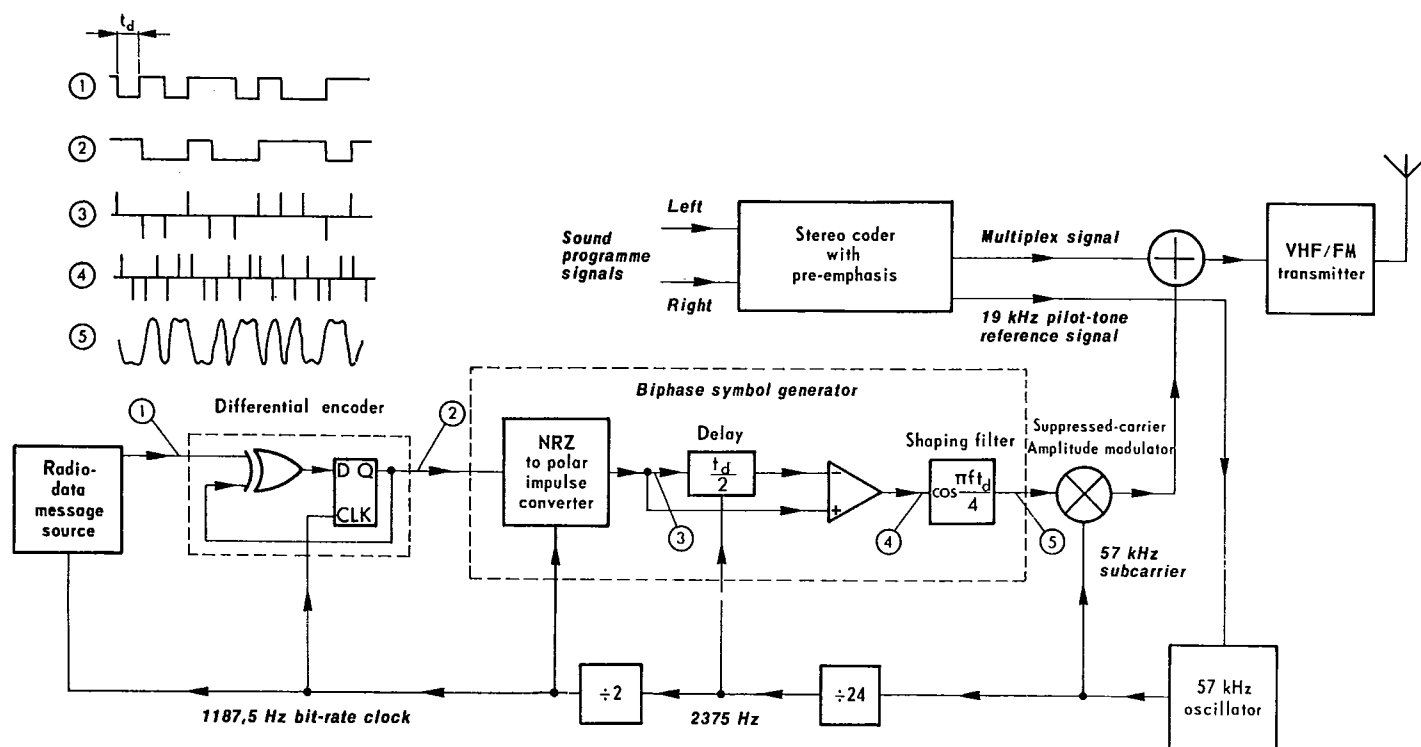
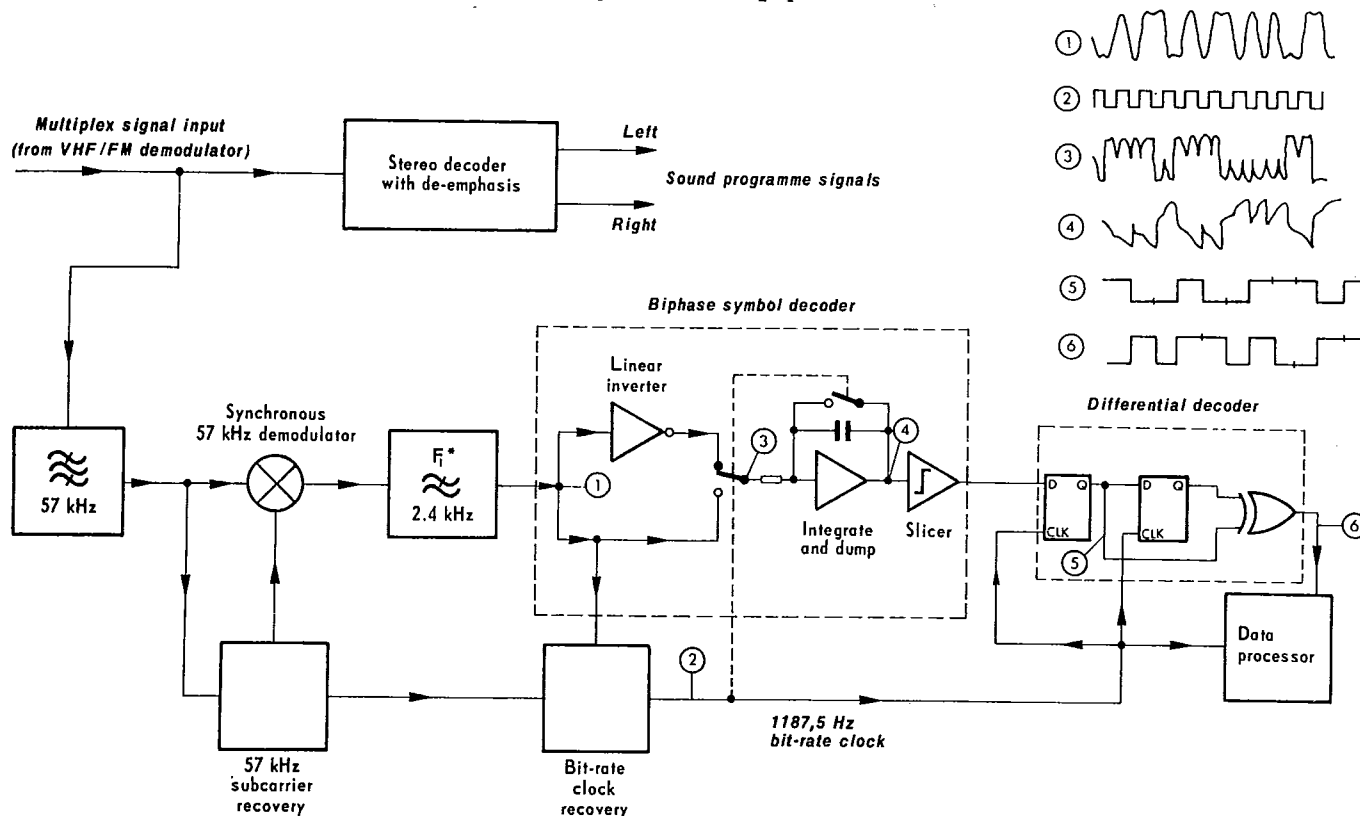


Figure 1: Block diagram of radio-data equipment at the transmitter



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 3a.

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

1.3 Subcarrier level

The deviation range of the FM carrier due to the unmodulated subcarrier is from ± 1.0 kHz to ± 7.5 kHz. The recommended best compromise is ± 2.0 kHz¹⁾. The decoder/demodulator should also operate properly when the deviation of the subcarrier is varied within these limits during periods not less than 10 ms.

In the case when ARI (see annex H) and radio-data signals are transmitted simultaneously, the recommended maximum deviation due to the radio-data subcarrier is ± 1.2 kHz and that due to the unmodulated ARI subcarrier should be reduced to ± 3.5 kHz.

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

1.4 Method of modulation

The subcarrier is amplitude-modulated by the shaped and biphase coded data signal (see 1.7). 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 $\pm 90^\circ$.

1.5 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 ± 0.125 bit/s.

1.6 Differential coding

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

Table 1

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 1187,5 Hz.

¹⁾ 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).

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

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.

1.7 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, and to achieve compatibility with the ARI system. 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, $e(t)$, such 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 3a, and the overall data-channel spectrum shaping is shown in figure 3b.

The spectrum of the transmitted biphas-coded radio-data signal is shown in figure 4a and the time-function of a single biphas-coded symbol (as transmitted) in figure 4b.

The 57 kHz radio-data signal waveform at the output of the radio-data source equipment may be seen in the photograph of figure 4c.

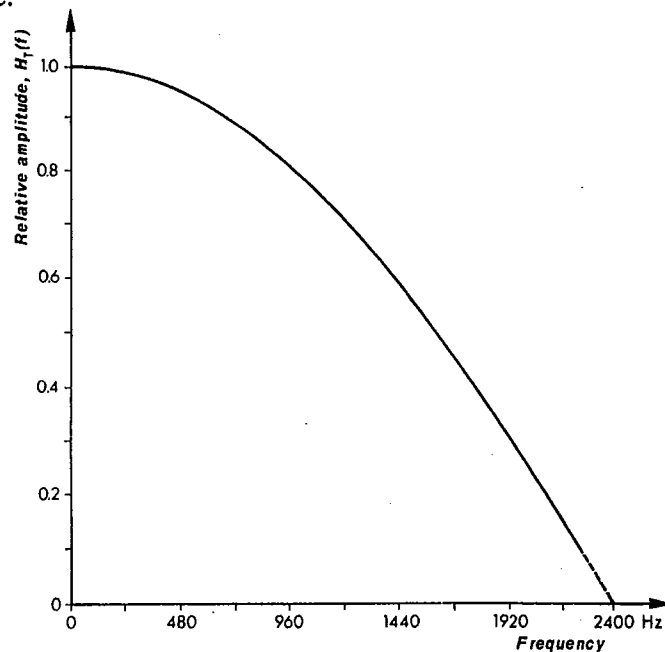


Figure 3a: Amplitude response of the specified transmitter or receiver data-shaping filter

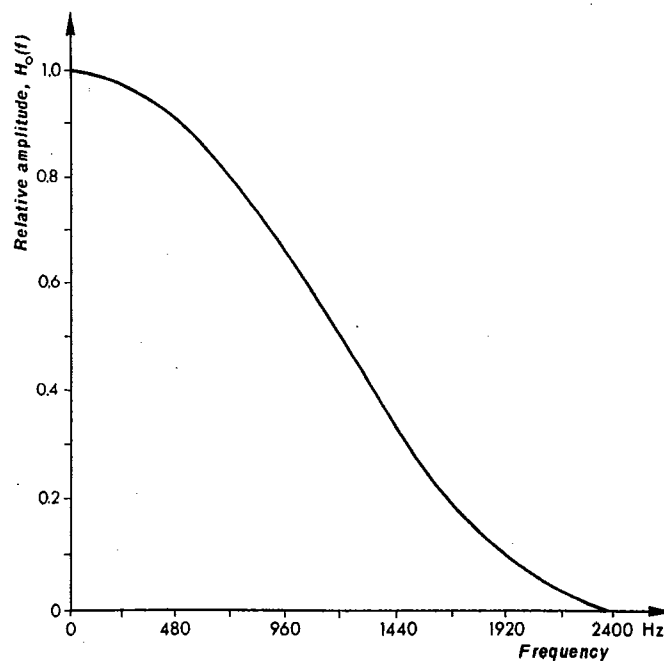


Figure 3b: Amplitude response of the combined transmitter and receiver data-shaping filters

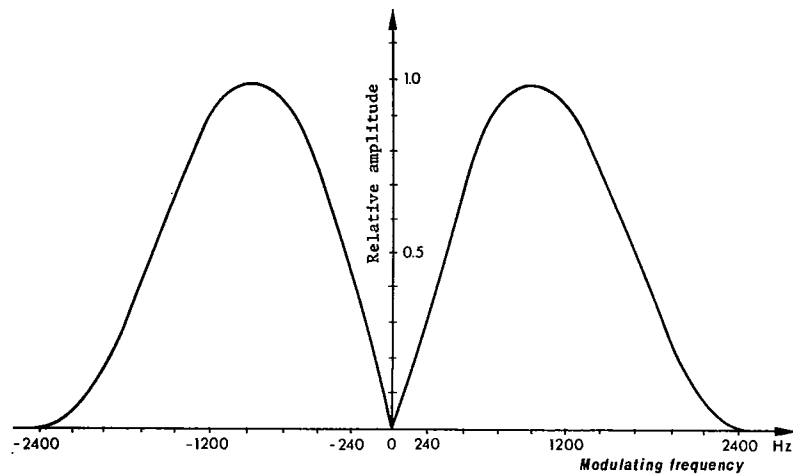


Figure 4a: Spectrum of biphase coded radio-data signals

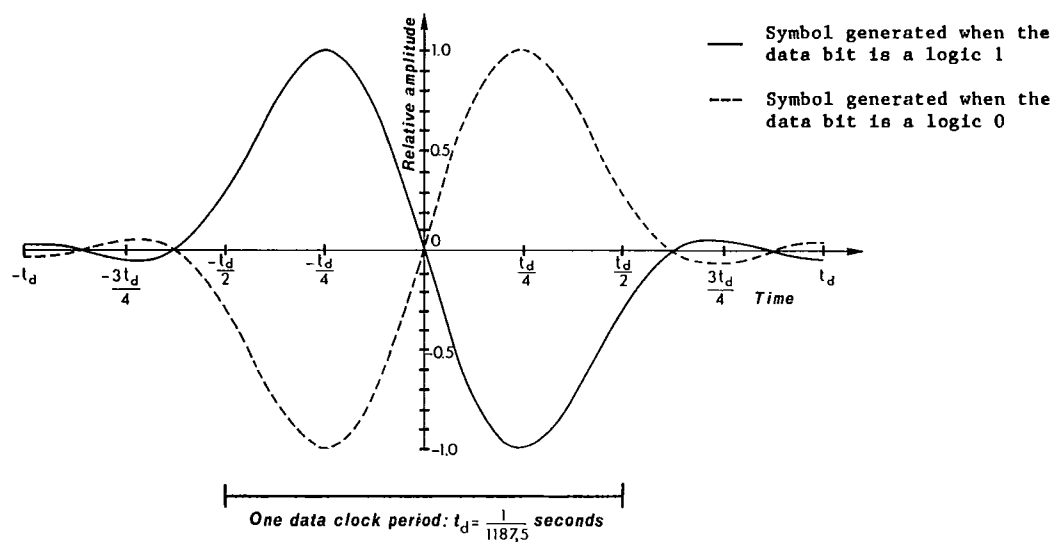


Figure 4b: Time-function of a single biphase symbol

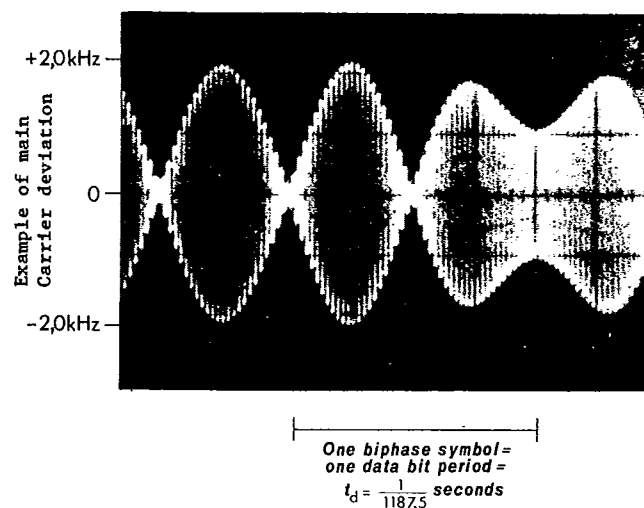


Figure 4c: 57 kHz radio-data signals

2. Baseband coding (data-link layer)

2.1 Baseband coding structure

Figure 5 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 checksum. Each information word comprises 16 bits. Each checksum comprises 10 bits (see 2.3).

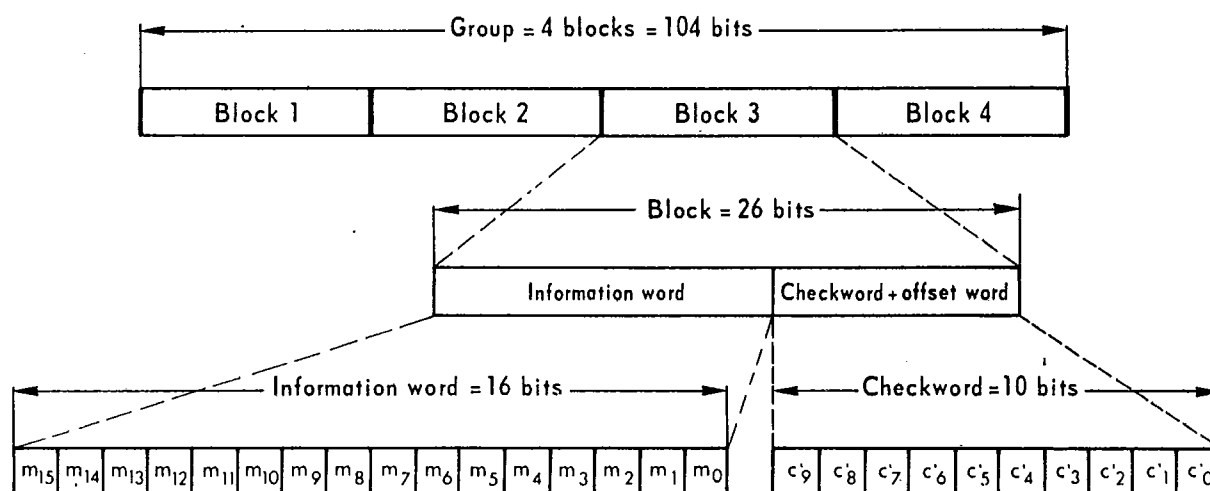


Figure 5: Structure of the baseband coding

2.2 Order of bit transmission

All information words, checksums, binary numbers or binary address values have their most significant bit (m.s.b.) transmitted first (see figure 6). 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.

Notes to figure 6:

1. Group type code = 4 bits (see 3.1)
2. B_0 = version code = 1 bit (see 3.1)
3. PI code = Programme Identification code = 16 bits (see 3.2.1.1 and annex D)
4. TP = Traffic Programme identification code = 1 bit (see 3.2.1.3)
5. PTY = Programme Type code = 5 bits (see 3.2.1.2 and annex F)
6. Checkword + offset "N" = 10 bits added to provide error protection and block and group synchronization information (see 2.3 and 2.4 and annexes A, B and C)
7. $t_1 \cdot t_2$: Block 1 of any particular group is transmitted first and block 4 last

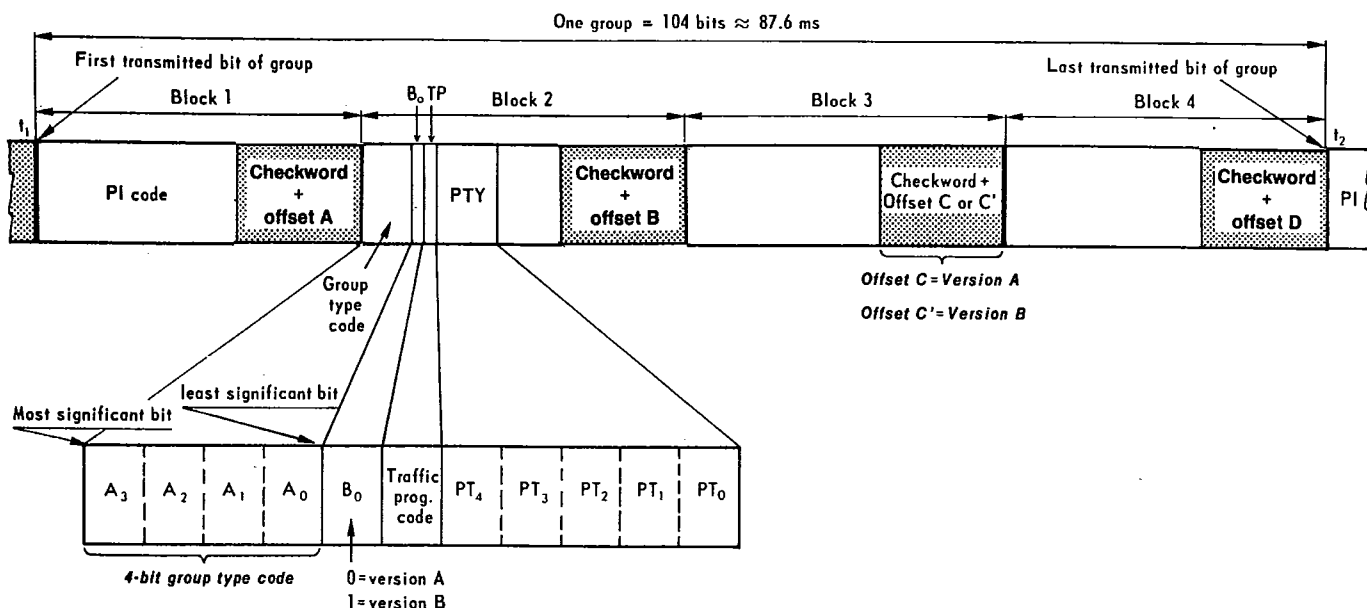


Figure 6: Message format and addressing

2.3 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 5) is the sum (modulo 2) of:

- the remainder after multiplication by x^{10} and then division (modulo 2) by the generator polynomial $g(x)$, of the 16-bit information word,
- 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 2.4) 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 2.4). 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] :

- 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.

2.4 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.

3. Message format (session and presentation layers)

3.1 Addressing

3.1.1 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 e.g. 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) This requires addressing to identify the information content of those blocks which are not dedicated to the high-repetition-rate information.
- d) Each group is, so 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, e.g. 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, one of the seven spare group types (see 3.1.3) may be assigned to future applications.

3.1.2 Principal features

The main features of the message structure have been illustrated in figure 6. These may be seen to be:

- 1) The first block in every group always contains a Programme Identification (PI) code.
- 2) 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 types 0 to 15 according to the binary weighting $A_3 = 8$, $A_2 = 4$, $A_1 = 2$, $A_0 = 1$ (see figure 6). For each type (0 to 15) two "versions" can be defined. The "version" is specified by the fifth bit (B_0) of block 2 as follows:
 - a) $B_0 = 0$: the PI code is inserted in block 1 only. This will be called version A, e.g. 0A, 1A, etc.
 - b) $B_0 = 1$: the PI code is inserted in block 1 and block 3 of all group types. This will be called version B, e.g. 0B, 1B, etc.

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

- 3) 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 reference to the value of B₀ in block 2.

3.1.3 Group types

It was described above (see also figure 6) 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 and its version.

At present nine group types have been specified and all except three (types 4, 7 and 15) are defined in version A and version B. The remaining group types will be specified at a later date when possible applications have been defined.

The applications of the nine group types defined so far are as follows:

Table 3

Group type						Applications
Decimal value	Binary code					
	A ₃	A ₂	A ₁	A ₀	B ₀	
0	0	0	0	0	X	Basic tuning and switching information (see 3.1.3.1)
1	0	0	0	1	X	Programme item number (see 3.1.3.2)
2	0	0	1	0	X	Radiotext (see 3.1.3.3)
3	0	0	1	1	X	Undefined
4	0	1	0	0	0	Clock-time and date (see 3.1.3.4)
5	0	1	0	1	X	Transparent data channels (32 channels) (see 3.1.3.5)
6	0	1	1	0	X	In-house applications (see 3.1.3.6)
7	0	1	1	1	0	Radio paging (see 3.1.3.7)
8 - 13						Undefined
14	1	1	1	0	X	Enhanced other networks information (see 3.1.3.8)
15	1	1	1	1	1	Fast basic tuning and switching information (see 3.1.3.9)

X indicates that value may be "0" (version A) or "1" (version B).

The appropriate repetition rates for some of the main applications are indicated in the table below:

Table 4

<i>Applications</i>	<i>Group types which contain this information</i>	<i>Appropriate repetition rate per sec.</i>
Programme identification (PI) code	all	11.4 ¹⁾
Programme type (PTY) code	all	11.4 ¹⁾
Traffic programme (TP) identification code	all	11.4 ¹⁾
Programme service (PS) name	0A, 0B	1 ²⁾
Alternative frequency (AF) code pairs	0A	4 ²⁾
Traffic announcement (TA) code	0A, 0B, 15B	4
Decoder identification (DI) code	0A, 0B, 15B	1
Music/speech (M/S) code	0A, 0B, 15B	4
Radiotext (RT) message	2A, 2B	0.2 ³⁾
Enhanced other networks information (EON)	14A, 14B	up to 2 ⁴⁾
¹⁾ Valid codes for this item will normally be transmitted with at least this repetition rate whenever the transmitter carries a normal broadcast programme. ²⁾ A total of four 0A groups are required to transmit the entire PS name and therefore four 0A groups will be required per second. The repetition rate of group type 0A 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. It must be noted that in this case transmission of the complete PS will take 2 seconds. However, under typical reception conditions the introduction of errors will cause the receiver to take 4 seconds or more to acquire the PS name for display. ³⁾ A total of 16 type 2A groups are required to transmit a 64 character radiotext message and therefore 3.2 type 2A groups will be required per second. ⁴⁾ The maximum cycle time for the transmission of <u>all</u> data relating to <u>all</u> cross-referenced programme services shall be less than 2 minutes.		

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

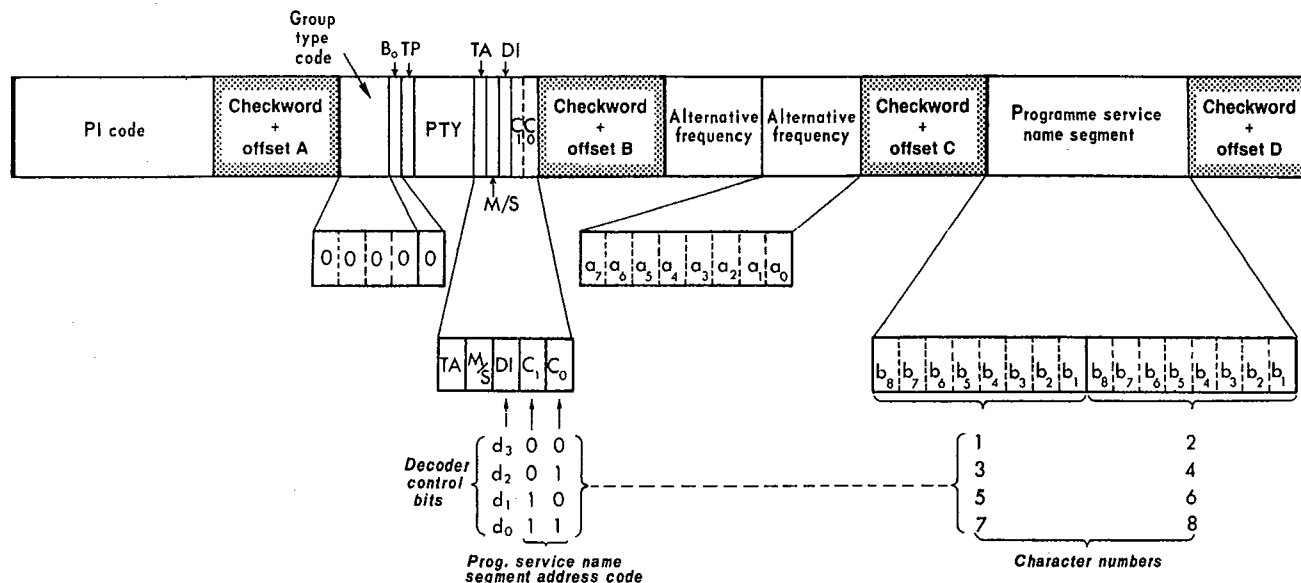
Table 5

<i>Group types</i>	<i>Applications</i>	<i>Typical proportion of groups of this type transmitted</i>
0A or 0B	PI, PS, PTY, TP, AF ¹⁾ , TA, DI, M/S	40 %
1A or 1B	PI, PTY, TP, PIN	10 %
2A or 2B	PI, PTY, TP, RT	15 % ²⁾
14A or 14B	PI, PTY, TP, EON	10 %
Any other	Other applications	25 %
¹⁾ Group type 0A only ²⁾ 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 should be avoided (see 3.1.3.3)		

3.1.3.1 Type 0 groups : Basic tuning and switching information

Figure 7a shows the format of type 0A groups and figure 7b the format of type 0B groups.

(a) Type 0A group



(b) Type 0B group

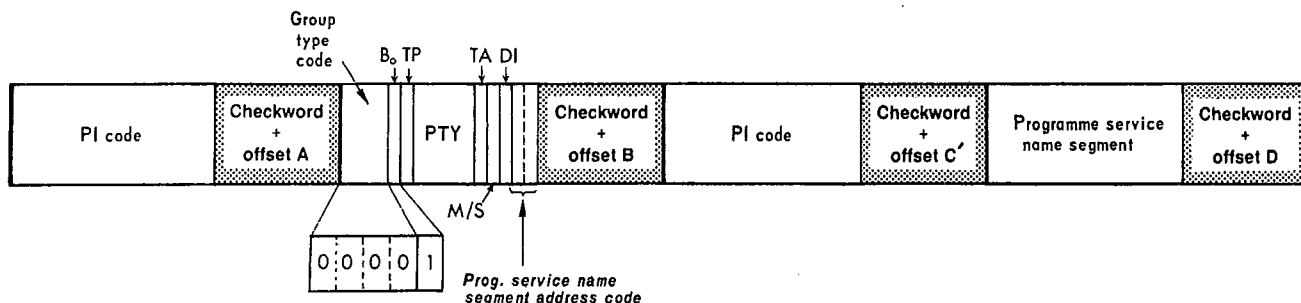


Figure 7: Basic tuning and switching information

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. These are explained in 3.2.1.6.2.

Notes on Type 0 groups:

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.
2. For details of Programme identification (PI), Programme type (PTY) and traffic programme (TP) code, see figure 6, 3.2.1 and annexes D and F.
3. TA = Traffic announcement code (1 bit) (see 3.2.1.3).
4. M/S = Music-speech switch code (1 bit) (see 3.2.1.4).

5. *DI= Decoder-identification control code (4 bits) (see 3.2.1.5). This code is transmitted as 1 bit in each type 0 group. The Programme service name segment address code (C_1 and C_0) also 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. *Alternative frequency codes (2 x 8 bits) (see 3.2.1.6).*
7. *Programme service name (for display) is transmitted as 8-bit character as defined in the 8-bit code-tables in annex E. 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 C_1 and C_0 in block 2. The addresses of the characters increase from left to right in the display. The most significant bit (b_8) of each character is transmitted first.*

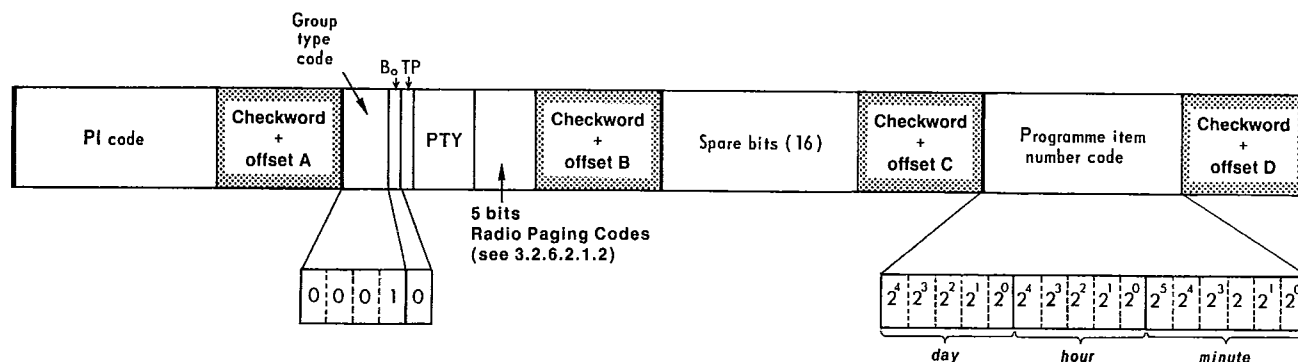
3.1.3.2 Type 1 groups : Programme-item number

Figure 8a shows the format of type 1A groups and figure 8b the format of type 1B groups.

When this application is used, Group 1 may be transmitted only once per minute. In such a case, immediately after a programme item number has been changed, Group 1 should be repeated four times with a separation of about 0.5 seconds. The unused bits in blocks 2 (type 1B only) and 3 (type 1A only) are reserved for undefined applications.

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

(a) Type 1A group



(b) Type 1B group

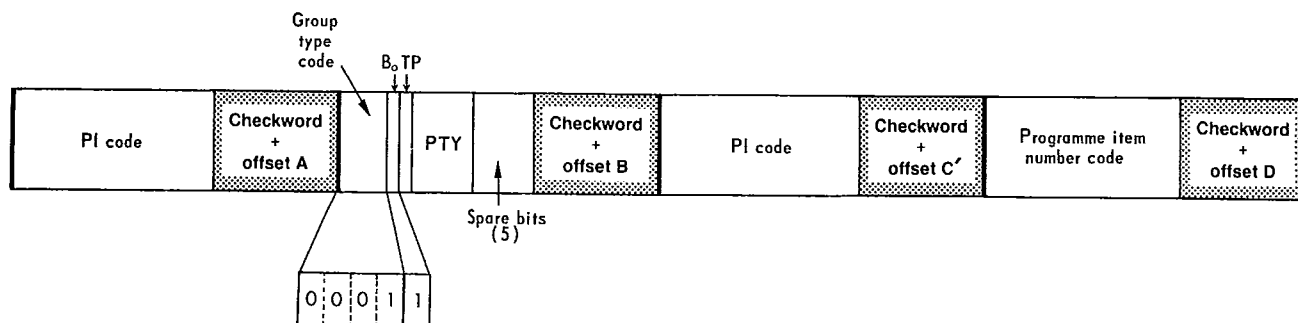


Figure 8: Programme item number

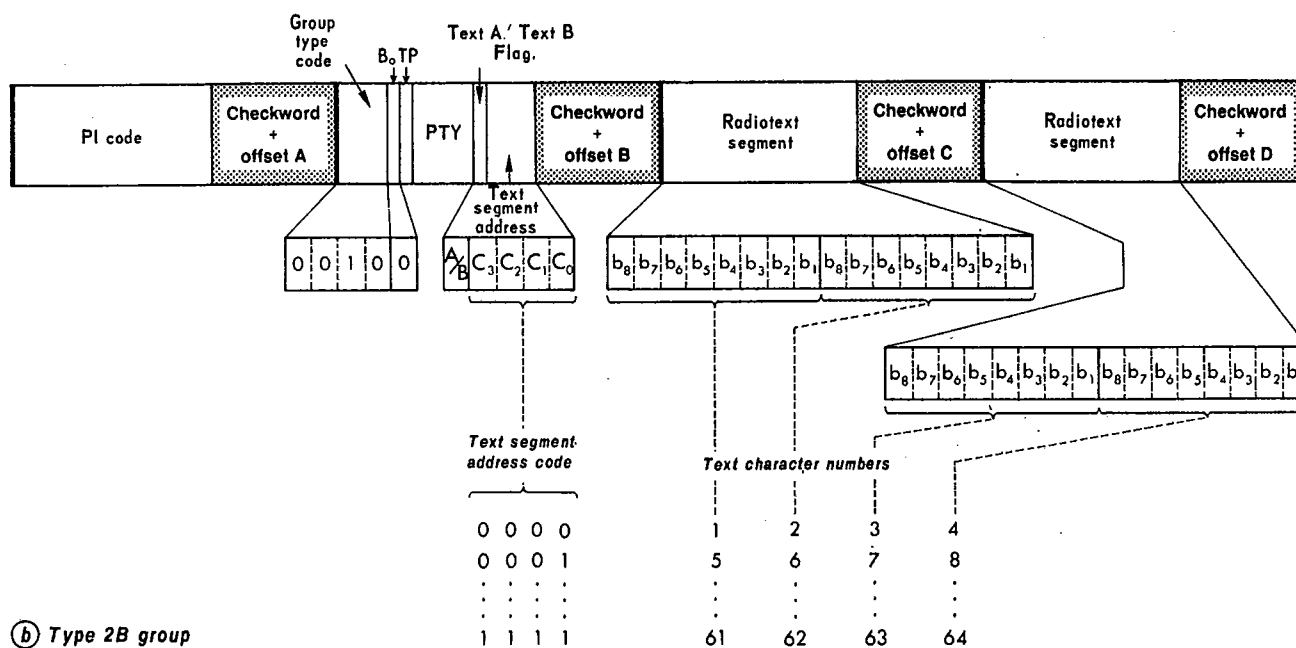
Notes on Type 1 groups:

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 .
2. The programme item number is its 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.
3. If Type 1 is transmitted without a valid PIN, the day of month shall be set to zero.

3.1.3.3 Type 2 groups : Radiotext

Figure 9a shows the format of type 2A groups and figure 9b the format of type 2B groups.

(a) Type 2A group



(b) Type 2B group

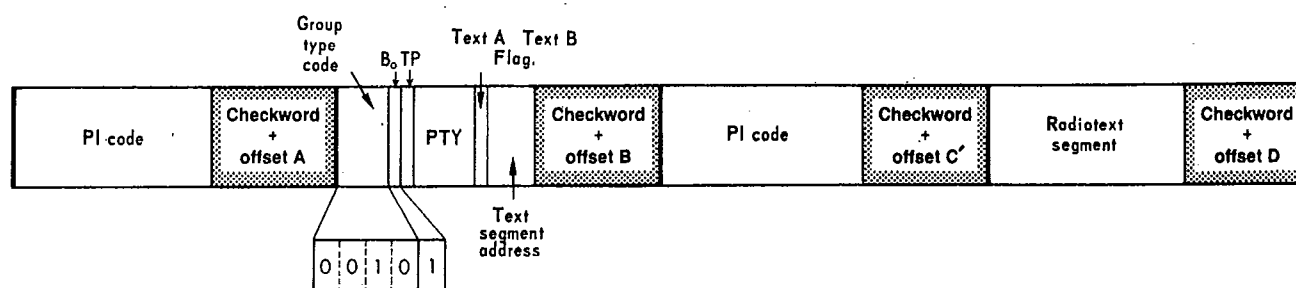


Figure 9: Radiotext

The 4-bit address-code in the last four bits of the second block serves to locate in the displayed message the segment of text contained in the third (version A only) and fourth blocks. Since each text segment in version 2A groups comprises four characters, messages of up to 64 characters in length can be sent using this version. In version 2B groups, each text segment comprises only two characters and therefore when using this version the maximum message length is 32 characters.

If a display which has fewer than 64 characters is used to display the radiotext message then memory should 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 (of length to fit the available display) one at a time in sequence, or, alternatively by scrolling the displayed characters of the message from right to left.

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 it is recommended to avoid a mixture of version 2A and 2B groups when transmitting any one given message.

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

- If the receiver detects a change in the flag for a given segment (from binary "0" to binary "1" or vice-versa), then the whole radiotext display should be cleared and the newly received radiotext message segments should be written into the display with blanks left for those segments or characters for which no update is received.
- If the receiver detects no change in the flag, then the received text segments or characters should be written into the existing displayed message and those segments or characters for which no update is received should 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 should 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.

Notes on Type 2 groups:

1. Radiotext is transmitted as 8-bit characters as defined in the 8-bit code-tables in annex E. The most significant bit (b_8) of each character is transmitted first.
2. The addresses of the characters increase from left to right in the display.
3. The text of up to 64 characters is transmitted in four (version A) or two (version B) character segments. These segments are located by the text segment address code.

3.1.3.4 Type 4A groups : Clock-time and date

The transmitted clock-time and date shall be accurate; otherwise the transmitted CT codes shall all be set to zero.

Figure 10 shows the format of type 4A groups. Type 4B groups are not yet defined.

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

(a) Type 4A group

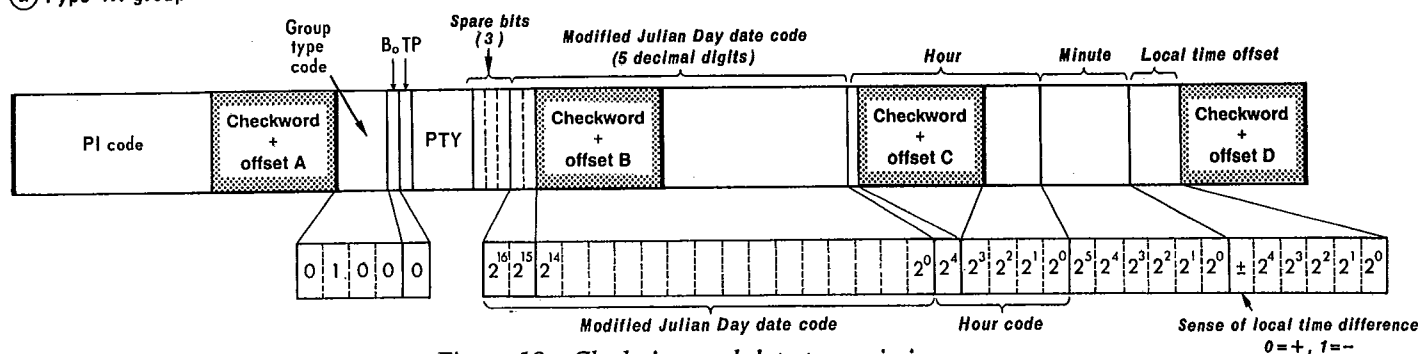


Figure 10: Clock-time and date transmission

Notes on Type 4A groups:

1. Time of day is expressed in terms of Coordinated Universal Time (UTC).
2. The information relates to the epoch immediately following the start of the next group.
3. The clock-time group is inserted so that the minute edge will occur within ± 0.1 seconds of the end of the clock-time group.
4. Minutes are coded as a six-bit binary number in the range 0-59. The spare codes are not used.
5. Hours are coded as five-bit binary number in the range 0-23. The spare codes are not used.
6. 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 local midnight.
7. The local time difference is expressed in multiples of half hours with the range -12 h to +12 h and is coded as a six-bit binary number. "0" = positive offset, and "1" = negative offset (e.g. USA).

3.1.3.5 Type 5 groups : Transparent data channels

Figure 11 shows the format of type 5A groups and the format of type 5B groups.

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.