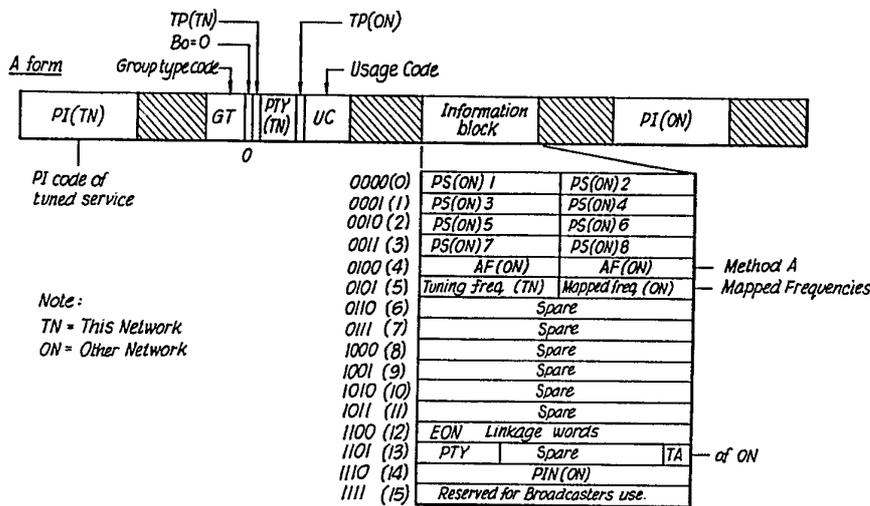




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(54) Title: METHOD FOR LINKING RDS PROGRAMME SERVICES AND RDS



(57) Abstract

The method is for transmitting radio data system signals accompanying a programme in groups of an extended other network type. The RDS data comprises first to fourth blocks, the first block carrying the programme identification code (PI(TN)) of the programme. The second block carries a group type code (GT) identifying the extended other network type as well as a multiple variant usage code (UC) identifying which of a selection of items of information is carried in the third block. These items of information pertain to the other networks programme identified in the fourth block by its programme identification code (PI(ON)). The programme identification codes comprise a country code, an area coverage code and a programme reference code. One usage code (UC) in the second block identifies a transmission of a linkage word (12) in the third block carrying information related to the programme identification code of the programme or programmes to be linked to the programme identified in the fourth block.

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Method for linking RDS programme services and RDS.

The invention relates to a method for transmitting radio data system signals accompanying a programme in groups of an extended other network type, comprising first to fourth blocks, the first block carrying the programme identification code of said programme, the second
5 block carrying a code identifying the extended other network type as well as a multiple variant usage code identifying which of a selection of items of information is carried in the third block, said items of information pertaining to the programme identified in the fourth block by its programme identification code, said programme identification
10 codes comprising a country code, an area coverage code and a programme reference code, as well as to a receiver for use in conjunction with transmissions of the radio data system (RDS) signals according to this method.

The abovementioned method and RDS receiver is known from
15 the radio data system as specified in EBU Document 3244E, 1984 entitled "Specification of the radio data system RDS for VHF/FM sound broadcasting" and supplemented in the Proposed Supplement 4 to said EBU Document, entitled "Enhanced Other Network Information" of January 1989.

The radio data system RDS according to this Proposed
20 Supplement 4 provides the possibility to transmit reliably digital information related not only to the actually received programme, i.e. the programme of the tuned network, identified with programme identification code PI(TN), but also to programmes of so-called other networks, identified with programme identification code PI(ON). To that
25 end forms A and B of a so-called type 14 or EON are specified in said Proposed Supplement 4. In the following the expression type 14 or EON group refers to form A, which is the normal form of this group, as form B is not relevant to the present invention.

The specified EON group consists of first to fourth
30 blocks, each block comprising a 16 bit information word. The first and fourth blocks carry respectively the abovementioned PI(TN) and PI(ON) codes. The second block comprises amongst other codes, a code (GT)

identifying the EON group type and a 4-bit usage code (UC) specifying the contents of the third block. This third block carries data pertaining to the programme identified in the fourth block relating to e.g. its programme service name PS(ON) identified by UC variants 0000 to 5 0011, alternative frequencies AF(ON) identified by UC variant 0100, mapped frequencies identified by UC variant 0101, etc. The EON groups provide the possibility at the receiver's side to monitor other network (ON) programmes and to build up banks of information, e.g. the AF(ON) bits of such ON programmes, while being tuned to the transmitted 10 or tuned network (TN) programme.

The availability of AF(ON) lists has the advantage that when two or more programmes are mutually linked, i.e. when these programmes have a mutually identical audio programme signal, a search for an optimum tuning frequency can be executed within the total set of 15 alternative frequencies occurring in the AF lists of all mutually linked programmes. In practice various programme linking patterns are used as many countries use various combinations of regional transmitter chains at certain times to transmit a common programme. For example, in a country with regions A, B, and C, the broadcaster may use A and C in 20 conjunction at one time in the day, and A and B together some time later. Another example is the frequent case where a local radio station transmits a national programme at night.

It has been previously proposed to identify the linked programmes by giving these programmes a mutually identical programme 25 identification (PI) code and to identify unlinking by giving said programmes their original PI-codes again. With this known programme linking method however, the receiver may not return to its original tuned programme after unlinking.

It is an object of the invention to provide a method for 30 linking RDS programmes enabling to realize an unambiguous and uniform programme tuning behaviour in a radio data receiver for use in conjunction with transmissions of the RDS signals according to this method.

It is a further object of the invention to transmit and 35 receive RDS programme linking information reliably and at a sufficiently high transmission rate, occupying a relatively small part of the RDS signal transmission capacity.

Another object of the invention is to provide a coding method for coding RDS programme linking information such that on the one hand items of the coded information can be sent within a part of each EON group and applied at the receiver's side independent from the data
5 carried in other EON groups and on the other hand great flexibility as to the number and the choice of the linked programmes is achieved.

The invention provides a method for transmitting radio data system signals accompanying a programme in groups of an extended other network type, comprising first to fourth blocks, the first block
10 carrying the programme identification code of said programme, the second block carrying a code identifying the extended other network type as well as a multiple variant usage code identifying which of a selection of items of information is carried in the third block, said items of information pertaining to the programme identified in the fourth block
15 by its programme identification code, said programme identification codes comprising a country code, an area coverage code and a programme reference code, characterized by a usage code variant in the second block identifying a transmission of a linkage word in the third block carrying information related to the programme identification code of the
20 programme or programmes to be linked to the programme identified in the fourth block, as well as a radio data receiver for use in conjunction with transmissions of radio data system signals comprising decoding means for decoding received groups of an extended network type, processing means for processing the decoded data carried by said groups
25 and storage means comprising memory banks for storing therein bits of alternative frequencies, the information thereof being carried in the third block, characterized in that the processing means are programmed to identify the transmission of a linkage word from the usage code variant, to derive from the linkage word the programme identification
30 code of the programme or programmes to be linked to the programme identified in the fourth block, to allocate a memory bank to the programme identification code of each of said programmes and to store therein the pertaining alternative frequencies.

By using the measures according to the invention the
35 programme identification codes of the programmes to be mutually linked are derivable from the linkage word and from the fourth block and do not change when these programmes are actually linked together. In the

receiver a memory bank for storing a list of AF's is allocated to each of said programmes identification codes. The linkage word occupies only one block of one out of 16 variants of the EON group therewith hardly reducing the transmissive capacity of EON groups. The transmission rate
5 of the EON groups is sufficiently high to guarantee at the receiver's side an adequately fast acquisition of the AF's of the programmes to the mutually linked. An actual link between two or more programmes authorizes the receiver to search for an optimum tuning frequency within the total set of AF's of all linked programmes, without losing the
10 individual identity of the programmes. It is therefore possible to return the receivers' tuning to the original programme after unlinking.

A method according to the invention is preferably characterized in that the linkage word comprises a link classification word and a link identification word, the link classification word
15 carrying data related to at least one of the area coverage and the programme reference codes of the programme or programmes to be linked to the programme identified in the fourth block, said data being coded according to one of several classes of linkage coding scheme, the link classification word identifying said one class of linkage coding scheme.

20 This measure is based on the recognition that the programme linking patterns occurring in practice may be classified in several classes of link, each class being identified by a particular variant of the link classification word.

By using the last-mentioned measure an efficient use of
25 the transmission capacity of the linkage word is achieved, while offering the possibility to identify all kinds of linking patterns, which may occur in practice.

By using the country code of the programme in the fourth block for identifying that of the programmes to be linked, the necessity
30 for transmitting this country code is avoided, so that the linkage word is completely available for identifying the rest of the hexadecimal PI-code symbols of said programmes.

A radio data receiver for use in conjunction with transmissions of RDS signals according to this method is characterized
35 in that the processing means are programmed to identify from the link classification word the linkage coding scheme applied to the link identification word and to identify on the basis of this linkage coding

scheme from the link identification word at least one of the area coverage and programme reference codes and from the country code of the programme identified in the fourth block the country code of the programme identification code of the programme or programmes for allocating a memory bank thereto.

Further preferred methods according to the invention are based on the recognition that the programme link patterns occurring in practice can be classified in the following main classes of link:

a) Generic or Regional

10 A generic or regional link is one whereby a particular programme service is linked to one or more of its generic equivalents. For example a programme service with programme identification code D525 or in short D525 may be linked (at some point in time) to D625 and D725 but not to D825. Some time later D825 may be linked to D725 but
15 not to D625 or to D525.

b) Specific

A specific link is constructed when one programme service is linked to another with an unrelated PI code. For example D3C3 carries the same programme as D201.

20 c) General

A general link applies when one programme service is linked a group of services. It has four subtypes, of which there are defined, permitting the number of linked services to be controlled in a variety of ways. In its most limited form, the general link may link
25 one service to all general equivalents of a certain specified PI code. For example D201 carries the same programme as D525, D625 etc. In its most universal form, the general link may link the programme service to all known services in the same country.

For identifying said generic or regional link the method
30 is characterized in that the link classification word carries data identifying a first class of linkage coding scheme, wherein the link identification word comprises the area code as well as the programme reference code of a specific programme to be linked to the one identified in the fourth block.

35 For identifying said specific link the method is characterized in that the link classification word carries data identifying a second class of linkage coding scheme wherein the

programme reference code in the fourth block identifies that of a regional programme or regional programmes to be linked thereto, the link identification word comprising a sequence of twelve bits said bits representing first to twelfth regional programmes for identifying by a predetermined logic value the area coverage code of the regional programme or programmes to be linked to the programme identified in the fourth block.

A radio data receiver for use in conjunction with transmission of RDS signals according to the last-mentioned method is characterized in that the processing means is programmed to identify said first and second classes of linkage coding scheme, and allocates at the identification of said first class a memory bank to the programme identification code having a country code corresponding to the country code identified in the fourth block and area coverage and programme reference codes identified by the link identification word, and at the identification of said second class a memory bank to each of the programme identification codes having a country code and programme reference code corresponding to those identified in the fourth block and an area coverage code identified by the link identification word.

For identifying said general link the method is characterized in that the link classification word carries data identifying a third class of linkage coding scheme in which the linkage word comprises data relating to at most a part of the programme identification code of the programmes to be linked to the programme identified in the fourth block.

By using this measure not all hexadecimal PI code symbols of the area coverage and programme reference codes of the programmes to be linked to the programme identified in the fourth block are transmitted. In the receiver programme identification codes are formed, having the transmitted hexadecimal PI code symbols in common and the missing PI code symbols varying within the pertaining hexadecimal value range thereof.

For identifying a first subclass of said general link a method is preferably characterized by a first subclass of linkage coding scheme in which the link identification word comprises data identifying the programme reference code of the programmes to be linked to the programme identified in the fourth block.

For identifying a second subclass of the general link, a method is preferably characterized by a second subclass of linkage coding scheme in which the link identification word comprises first and second four bit code words, the first four bit code word identifying the first hexadecimal symbol of the programme reference code and the four bits of the second code word representing respectively the national, supra regional, regional and local area code for identifying by a predetermined logic value the area codes of the programmes to be linked to the programme in the fourth block.

For identifying a third subclass of the general link, a method is preferably characterized by a third subclass of linkage coding scheme in which the link identification word comprises a sequence of five bits, said bits representing respectively the international, national, supra regional, regional and local area code for identifying by a predetermined logic value the area codes of the programmes to be linked to the programme identified in the fourth block.

A radio data receiver for identifying each of said subclasses of general link is characterized in that the processing means are programmed to identify said third class of linkage coding scheme from the link classification word, at the identification of said third class the processing means identify which of said first to third subclass of linkage coding scheme is applied to the link identification word, the processing means allocating at the identification of said first subclass a memory bank to each of the programme identification codes having a country code corresponding to the one identified in the fourth block, a programme reference code identified by the link identification word and an area coverage code within the hexadecimal value range from 2 to F, at the identification of said second subclass a memory bank to each of the programme identification codes having a country code corresponding to the one identified in the fourth block, an area coverage code and a first hexadecimal symbol of the programme reference code as identified by the link identification word and a second hexadecimal symbol of the programme reference code being within a value range from 1 to F, at an identification of said third subclass a memory bank to each of the programme identification codes having a country code corresponding to the one identified in the fourth block, an area coverage code as identified by the link identification word and a

programme reference code within the hexadecimal value range from 01 to FF.

An important extension of the number of the programmes to be linked, which can be identified by the linkage word, is achieved by a method characterized in that the linkage word comprises a first flag bit for identifying by a predetermined logic value an extended generic set of programmes to be linked to the programme identified in the fourth block, the programme identification code of said set of programmes corresponding in the country code and the first hexadecimal symbol of the programme reference code with the programme identification code in the fourth block and comprising an area code and a second hexadecimal symbol of the programme reference code within the hexadecimal value range respectively from 4 to F and from 1 to F.

A radio data receiver for use in such a system is characterized in that said processing means is programmed to identify from said first flag bit an extended generic set of programmes a memory bank being allocated to each programme thereof, the programme identification code of said programmes having a country code and a first hexadecimal symbol of the programme reference code corresponding to those identified in the fourth block, an area code and a second hexadecimal symbol of the programme reference code lying within a hexadecimal value range respectively from 4 to F and from 1 to F.

In order to avoid false programme linking a radio data system according to the invention is preferably characterized in that a first programme is identified in the fourth block and a second programme to be linked to the first programme is identified by the linkage word, characterized in that a link between said first and second programmes is preceded by a transmission of the programme identification code of the second programme in the fourth block, the first programme being identified by the linkage word.

An alert link actualisation can be achieved in a radio data system characterized in that the linkage word comprises a second flag bit for identifying by a predetermined logic value an actualisation of a programme link.

A radio data receiver utilizing both last-mentioned measures is characterized in that the processing means are programmed to set a potential link between the memory banks of said first and second

programmes after identifying at least once the first programme from the fourth block and the second programme from the link identification word and once the first programme from the link identification word and the second programme from the fourth block and in that the processing means
5 are programmed to identify an actualisation of a potential link between first and second programmes from the value of said second flag bit, for authorizing a search for an optimal alternative frequency within the alternative frequencies of the memory banks of both programmes.

The invention will be described in more detail by way of
10 example with reference to the accompanying drawings, in which

Figure 1 shows the format of a type 14 or Enhanced Other Network group for use in a method according to the invention,

Figure 2 shows a structure of linkage word for identifying first to third classes of link,

15 Figure 3 shows the contents of the memory banks of a radio data receiver in the case of a generic or regional link,

Figure 4 shows said contents in the case of a specific link,

20 Figure 5 shows geographically a generic or regional programme link,

Figure 6 shows geographically a specific programme link,

Figure 7 shows a flow chart of a process in a radio data receiver for determining from EON information the PI codes of the programmes to be linked,

25 Figure 8 shows a flow chart of a process for linking the memory banks of the programmes involved in a link.

Figure 1 shows the format of a type 14 or Enhanced Other Network group for executing the method according to the invention, which differs from the one defined in the above Proposed Supplement 4 merely
30 in the new use of usage code (UC) variant 12 (1100). With this new use of the UC variant 12 in the second block the transmission of a linkage word in the third block is identified.

Figure 2 shows the format of the EON group (type 14-A form) with UC variant 12 in block 2, carrying a 16-bit data structure in block
35 3, called the linkage word. This word defines the set of PI codes that the programme service is to be considered to be linked with. The form of the word can be defined as follows:-

Bit	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
Generic/ regional Link	X	0	0	0	R	R	R	R	R	R	R	R	R	R	R	R
5 Specific Link	X	0	0	1	<-----PI [bits 11..0]----->											
General/ regional Link	X	0	1	0	X	X	X	X	<--- PI [bits 7..0]-->							

A link is considered to be cleared if the relevant linkage bits (11..0 in Generic and Specific, 7..0 in General) are all set to zero. The country code of any linked services is always derived from the EON PI code under which this linkage word is to be loaded.

Bit 15 of the linkage word, the so-called linkage actuator (LA), is used to indicate whether the defined link is in effect at the present moment. This bit should be set at the moment that the programme services link together and cleared before the programmes resume their individual identity. The cleared condition may be used by a receiver to initiate storage of EON information about possible linked services in advance.

In order for a link to be activated, it is necessary for two complimentary linkage words to be in effect i.e. programme service A must be linked to B and programme service B must be linked to A, also indicated as forward linking and backward linking respectively. To give an example D201 is linked (using the general linkage word) to all generic variants of Dn25 (forward linking). The receiver will then begin to load information pertaining to these PI codes. This could result in D525, D625 and D725 being loaded. An individual link between any one of these services and D201 is considered to be potentially in effect if a linkage word back to D201 is detected in the EON information about the respective service.

30	PI code -	D201	D525	D625	D725
	Linked to-	Dn25	D201	0000	D201

In the above example D201 is actively linked to D525 and D725, but not to D625.

Figures 3 and 4 show by way of example the contents of the memory banks of an RDS receiver in the case of generic or regional respectively specific links. The memory banks in which preset PI's can be stored can be activated by the user through buttons 1-6. The memory

12

PI_{EON}: D532
 D632
 D732

- 5 * Linkage word on R1 and R3 (D432 and D632): X 000 0000 0000 0101
- * Linkage word on R2 and R4 (D532 and D732): X 000 0000 0000 1010

Figure 6 shows geographically the area's of 2 networks
 10 with PI codes C201 and C525 respectively. By using specific links a time
 dependent linking can be realized as follows:

If C525 is linked to C202 (6.00 - 22.00) hrs. and
 linked to C201 (22.00 - 6.00) hrs. then:

- 15 Linkage word on C201 X b₁₅001 + [525]
 b14 = 0 (6.00 and 22.00)
 = 1 (22.00 and 6.00)
- Linkage word on C202 X b₁₅001 + [525]
- 20 Linkage word on C525
- 6.00 - 22.00 : 1001 + [202] hex
 22.00 - 6.00 : 1001 + [201] hex

Figure 7 shows a flow chart of a process in an RDS
 25 receiver for determining from EON information which programs can be
 expected to be linked.

In block 1 the PI code of the tuned programme e.g. PI1 is selected and
 stored.

In block 2 a detection on the presence of EON groups occurs. If no EON
 30 groups are present in the received RDS signal, then the process returns
 to the beginning of this block 2. If such EON groups are received then
 in block 3 these EON groups are detected on the occurrence of a linkage
 word LW (UC variant 12), this LW being also selected in block 3.

If not LW is present in the received EON group then through Q in block
 35 16 (figure 8) the received EON data is stored in the preset and/or pool
 stores as e.g. shown in figures 3 and 4.

In block 4 the selected LW is detected on the presence of

a potential link. If there is a potential link then the EON data and the linkage actuator (LA) are monitored through P in block 15, which will be described later. If not then in block 5 is determined whether the LW relates to PI1.

5 If LW relates to PI1, then in block A is determined which PI code may be expected to be linked to PI1, e.g. PI code PI2 (forward linking). Block A therefore comprises block 6, which asks whether the program to be linked is known. If this program is not known, identification of this program occurs in block 7. If this program is
10 known then a flag L1 is set in block 8.

 If LW does not relate to PI1, then in block 9 is determined whether LW refers to PI2. If LW does not refer to PI2, then the process returns to block 2. If LW refers to PI2 then in block B is determined whether PI2 may be expected to be linked to PI1 (backward
15 linking). Block B therefore comprises block 10, in which the question has to be answered whether the program to be linked is known. If said program is not known then identification thereof occurs in block 12. If on the contrary the program is known, than a flag L2 is set in block 12.

 In block 14 is determined whether the flag L1 and L2 are
20 both set. If so then the process confirms that a potential link between PI1 and PI2 is present. If not then the process return to block 2.

 Figure 8 shows a flow chart of a process for utilizing the result of the process of figure 7, having blocks 1-3 in common with the flow chart of said figure 7.

25 In block 15 the LA in the LW is monitored for PI1 as well as for PI2. If both LA's are set to "one" then in block C the AF-lists of PI1 and PI2 (AF1 and AF2 respectively) are combined into one AF-list (AF1 + AF2), so that the receiver can search for the optimal AF in each of both AF-lists. Block C therefore comprises a block 17, in which is
30 determined whether the link is active. If the link is not active then no linking occurs and an eventual search for optimal AF is restricted to the AF-lists of PI1. If the link is active, then the AF-lists of PI1 and PI2 are combined as beforementioned and the process returns through R to the beginning of the flow chart in figure 7.

35 If non or only one of both LA's in the LW's of PI1 and PI2 are set to "one" (block 15) then the rest of the EON information is stored in the memory banks of the receiver as symbolized with block

16.

It will be clear, that on itself the choice which bits of the 16 bits linkage word are used for the link classification word and which for the link identification word, is arbitrary. The same applies for the meanings given to the individual or hexadecimal values of these links.

In the following some other structures of the linkage word are defined providing the possibility to extend the range of PI codes which can be transmitted through the EON groups.

10	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Bitorder
	EG	LA	0	0	<	Bits 5-16 of linked PI										>	Specific
	EG	LA	0	1	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10	R11	R12	Regional
	EG	LA	1	1	X	X	0	0	<	Bits 9-16 of linked PI's						>	General
																	/Regional
15	EG	LA	1	1	X	X	0	1	<	bits 9-12 of N S R L				>	General/		
																	Restricted
	EG	LA	1	1	X	X	1	1	X	X	X	I	N	S	R	L	General/
																	Universal

Bits 1 to 4 of the linkage word are used to give information regarding the status of the link, the class of link and the extended-generic flag (EG).

Bit 1, the extended-generic indicator (EG) is set to inform the receiver that the programme service, defined in block 4, is a member of an extended-generic set. Such a set of services is characterized by PI codes of the form WXYZ, where W is the common country code, X is the area code (and must lie in the range R1 to R12), Y is common to all such related services, and Z may assume any value. This permits a generically related set of services to comprise more than twelve members, each with a unique PI code.

Bit 2, the linkage actuator (LA) is set to 1 to inform the receiver that the link is in effect at the present moment. If the bit is set to zero, a potential link is indicated, and the receiver may use the linkage data to determine those services about which EON data should be acquired.

Bits 3 and 4 determine the class of link as show below:

	Bit 3	Bit 4	Class
	0	0	Specific
	0	1	Regional
	1	0	Undefined
5	1	1	General

In each case the country code of all linked programme services determined by block 3 is always derived from the PI(ON) code carried in block 4 of the same group.

A specific link allows one programme service to be linked to another. The PI code of the linked service is derived as follows: Bits 1-4 (country code) are taken from block 4
 Bits 5-16 are taken from block 3.

For example, the service D312 (supra-regional) will later carry the same programme as service D201 (national). In the received data for service D201, the following appears in blocks 3 and 4 of EON variant 12.

```
Block 3 = 0000 0011 0001 0010 - .312
Block 4 = 1101 0010 0000 0001 - D210
Linked PI = 1101 0011 0001 0010 - D312
```

No link exists (potential or active) if bits 5 to 16 are all set to zero.

A regional link allows a regional programme service to be linked to one or more services in its generic set. The structure of bits 5 to 16 of block 3 is as follows:

```
25 Bits 5 6 7 8 9 10 11 12 13 14 15 16
      R1 R2 R3 R4 R5 R6 R7 R8 R9 R10 R11 R12
```

R1, R2, ..., R12 correspond to the regional element (bits 5-8) of the PI code of the generic set. A logic 1 in two or more elements of this structure indicates that the respective regional services are linked.

For example, the service D425 is currently carrying the same programme as D725 and DB25. In the received data for service D425 the following appears in blocks 3 and 4 of EON variant 12:

```
Block 3 = 0101 1001 0001 000 - ....
Block 4 = 1101 0100 0010 0101 - D425
```

Block 3 indicates that regional variants R1, R4 and R8 are currently carrying a common programme and thus the linked services are: D425, D725 and DB25.

No link exists (potential or active) if bits 5 to 16 are all set to zero.

A general link allows one programme service to be linked to a group of services. It has four sub-types, of which three are defined, permitting the number of linked services to be controlled in a variety of ways. In its most limited form, the general link may one service to all the generic variants of a specified PI code. In its most universal form, the general link may link one service to all known services in the same country.

Bits 5 and 6 of the general linkage word are undefined, and should be set to 0. Receivers should ignore these bits.

Bits 7 and 8 are used to indicate the scope of the link as follows.

Bit 7	Bit 8	Scope
0	0	Regional set
0	1	Restricted set
1	0	Undefined
1	1	Universal

As to the general regional link: bits 9 to 16 carry the programme reference number of a set of generically related services. For example, general regional variants from the set of PI codes 5n17 (such as 5417, 5817, 5F17), may carry the same programme as the national service 5201. In the received data for service 5201 the following appears in blocks 3 and 4 of EON variant 12:

Block 3 = 0011 0000 0001 0111 - ..17
 Block 4 = 0101 0010 0000 0001 - 5201

No link exists (potential or active) if bits 9 to 16 are all set to zero.

As to the general restricted link: bits 9 to 12 carry bits 9 to 12 of the programme reference number of a (restricted) set of services. Bits 13 to 16 carry a bit structure, shown below, which defines the restriction in terms of area coverage:

Bit	Area Coverage Codes
13	N (2 Hex)
14	S (3 Hex)
15	R (4 Hex - F Hex)
16	L (0 Hex)

For example, the national programme service 8202 carries the same programme as local services 8015, 8016, 8019 and regional services 8411, 8511 and 8719 during the night hours. When this link is in effect, in the received data for programme service 8202 the following appears in

5 blocks 3 and 4 of EON variant 12:

Block 3 = 0111 0001 0001 0011 - ..1.

Block 4 = 1000 0010 0000 0010 - 8202

No link exists (potential or active) if bits 13 to 16 are all set to zero.

10 As to the general universal link: bits 9 to 11 are undefined, and should be set to zero. Receivers should ignore these bits.

Bits 12 to 16 carry a bit structure, shown below, which impose a restriction in terms of area coverage.

15 Bit Area Coverage Codes

12 I (1 Hex)

13 N (2 Hex)

14 S (3 Hex)

15 R (4 Hex - F Hex)

20 16 L (0 Hex)

For example, the national service C213 carries the same programme as service C002 (local), C356 (supra-regional) and members of the generic set Cn42. In advance of the start of the common programme, in the received data for programme service C213 the following appears in blocks

25 3 and 4 of EON variant 12:

Block 3 = 0011 0011 0000 0111 -

Block 4 = 1100 0010 0001 0011 - C213

No link exists (potential or active) if bits 12 to 16 are all set to zero.

30 A link (potential or active) between any two services, A and B, is considered to be valid only when A links to B, and B links to A. An active link is considered to be valid only when the linkage actuators in both linkage words are set to one. This is the principle of bi-directionality.

35 It may be necessary to deliver linkage information regarding the tuned programmed service. In this case the PI code in block 4 of EON variant 12 - PI(ON), will be identical to the PI code in

block 1 of the same group - PI(TN).

No more than one linkage word (potential or active), will apply to any given programme service at the same time. Interleaving the different linkage words, relating to the same programme service, e.g. an
5 active link and a future potential link, is to be avoided.

By using properly chosen microprocessor and storage circuits the realization of a receiver for use in conjunction with the above defined transmission of RDS signals according to the invention lies on itself within the ability of the skilled man. A detailed
10 description of such receivers is therefore omitted.

Claims

1. A method for transmitting radio data system signals accompanying a programme in groups of an extended other network type, comprising first to fourth blocks, the first block carrying the programme identification code of said programme, the second block
5 carrying a code identifying the extended other network type as well as a multiple variant usage code identifying which of a selection of items of information is carried in the third block, said items of information pertaining to the programme identified in the fourth block by its programme identification code, said programme identification codes
10 comprising a country code, an area coverage code and a programme reference code, characterized by a usage code variant in the second block identifying a transmission of a linkage word in the third block carrying information related to the programme identification code of the programme or programmes to be linked to the programme identified in the
15 fourth block.
2. A method according to claim 1, characterized in that the linkage word comprises a link classification word and a link identification word, the link classification word carrying data related to at least one of the area coverage and the programme reference codes
20 of the programme or programmes to be linked to the programme identified in the fourth block, said data being coded according to one of several classes of linkage coding scheme, the link classification word identifying said one class of linkage coding scheme.
3. A method according to claim 2, characterized in that the
25 country code of the programme in the fourth block identifies that of the programme or programmes to be linked thereto.
4. A method according to claim 3, characterized in that the link classification word carries data identifying a first class of linkage coding scheme, wherein the link identification word comprises
30 the area code as well as the programme reference code of a specific programme to be linked to the one identified in the fourth block.
5. A method according to claim 3, characterized in that the

link classification word carries data identifying a second class of linkage coding scheme wherein the programme reference code in the fourth block identifies that of a regional programme or regional programmes to be linked thereto, the link identification word comprising a sequence of
5 twelve bits said bits representing first to twelfth regional programmes for identifying by a predetermined logic value the area coverage code of the regional programme or programmes to be linked to the programme identified in the fourth block.

6. A method according to claim 3, characterized
10 in that the link classification word carries data identifying a third class of linkage coding scheme in which the linkage word comprises data relating to at most a part of the programme identification code of the programmes to be linked to the programme identified in the fourth block.

7. A method according to claim 6, characterized by a first
15 subclass of linkage coding scheme in which the link identification word comprises data identifying the programme reference code of the programmes to be linked to the programme identified in the fourth block.

8. A method according to claim 6, characterized by a second
20 subclass of linkage coding scheme in which the link identification word comprises first and second four bit code words, the first four bit code word identifying the first hexadecimal symbol of the programme reference code and the four bits of the second code word representing respectively the national, supra regional, regional and local area code for
25 identifying by a predetermined logic value the area codes of the programmes to be linked to the programme in the fourth block.

9. A method according to claim 6, characterized by a third
subclass of linkage coding scheme in which the link identification word
30 comprises a sequence of five bits, said bits representing respectively the international, national, supra regional, regional and local area code for identifying by a predetermined logic value the area codes of the programmes to be linked to the programme identified in the fourth
block.

10. A method according to one of claims 6 to 9, characterized
in that the linkage word comprises a two bit link subclassification word
35 identifying the subclass of linkage coding scheme.

11. A method according to claim 3, characterized in that the linkage word comprises a first flag bit for identifying by a

predetermined logic value an extended generic set of programmes to be linked to the programme identified in the fourth block, the programme identification code of said set of programmes corresponding in the country code and the first hexadecimal symbol of the programme reference code with the programme identification code in the fourth block and comprising an area code and a second hexadecimal symbol of the programme reference code within the hexadecimal value range respectively from 4 to F and from 1 to F.

12. A method according to one of the foregoing claims 1-11 characterized in that a first programme is identified in the fourth block and a second programme to be linked to the first programme is identified by the linkage word, characterized in that a link between said first and second programmes is preceded by a transmission of the programme identification code of the second programme in the fourth block, the first programme being identified by the linkage word.

13. A method according to one of the foregoing claims 1 to 12, characterized in that the linkage word comprises a second flag bit for identifying by a predetermined logic value an actualisation of a programme link.

14. A radio data receiver for use in conjunction with transmissions of radio data system signals according to claim 1, comprising decoding means for decoding received groups of an extended network type, processing means for processing the decoded data carried by said groups and storage means comprising memory banks for storing therein bits of alternative frequencies, the information thereof being carried in the third block, characterized in that the processing means are programmed to identify the transmission of a linkage word from the usage code variant, to derive from the linkage word the programme identification code of the programme or programmes to be linked to the programme identified in the fourth block, to allocate a memory bank to the programme identification code of each of said programmes and to store therein the pertaining alternative frequencies.

15. A radio data receiver according to claim 14 for use in conjunction with transmissions of radio data system signals according to the method of claim 3, characterized in that the processing means are programmed to identify from the link classification word the linkage coding scheme applied to the link identification word and to identify on

the basis of this linkage coding scheme from the link identification word at least one of the area coverage and programme reference codes and from the country code of the programme identified in the fourth block the country code of the programme identification code of the programme
5 or programmes for allocating a memory bank thereto.

16. A radio data receiver according to claim 15 for use in conjunction with transmissions of radio data system signals according to claim 4 and 5 characterized in that the processing means is programmed to identify said first and second classes of linkage coding scheme, and
10 allocates at the identification of said first class a memory bank to the programme identification code having a country code corresponding to the country code identified in the fourth block and area coverage and programme reference codes identified by the link identification word, and at the identification of said second class a memory bank to each of
15 the programme identification codes having a country code and programme reference code corresponding to those identified in the fourth block and an area coverage code identified by the link identification word.

17. A radio data receiver according to claim 15 for use in conjunction with transmission of radio data system signals according to
20 claims 6 to 9, characterized in that the processing means are programmed to identify said third class of linkage coding scheme from the link classification word, at the identification of said third class the processing means identify which of said first to third subclass of linkage coding scheme is applied to the link identification word, the
25 processing means allocating at the identification of said first subclass a memory bank to each of the programme identification codes having a country code corresponding to the one identified in the fourth block, a programme reference code identified by the link identification word and an area coverage code within the hexadecimal value range from 2 to F, at
30 the identification of said second subclass a memory bank to each of the programme identification codes having a country code corresponding the the one identified in the fourth block, an area coverage code and a first hexadecimal symbol of the programme reference code as identified by the link identification word and a second hexadecimal symbol of the
35 programme reference code being within a value range from 1 to F, at an identification of said third subclass a memory bank to each of the programme identification codes having a country code corresponding to

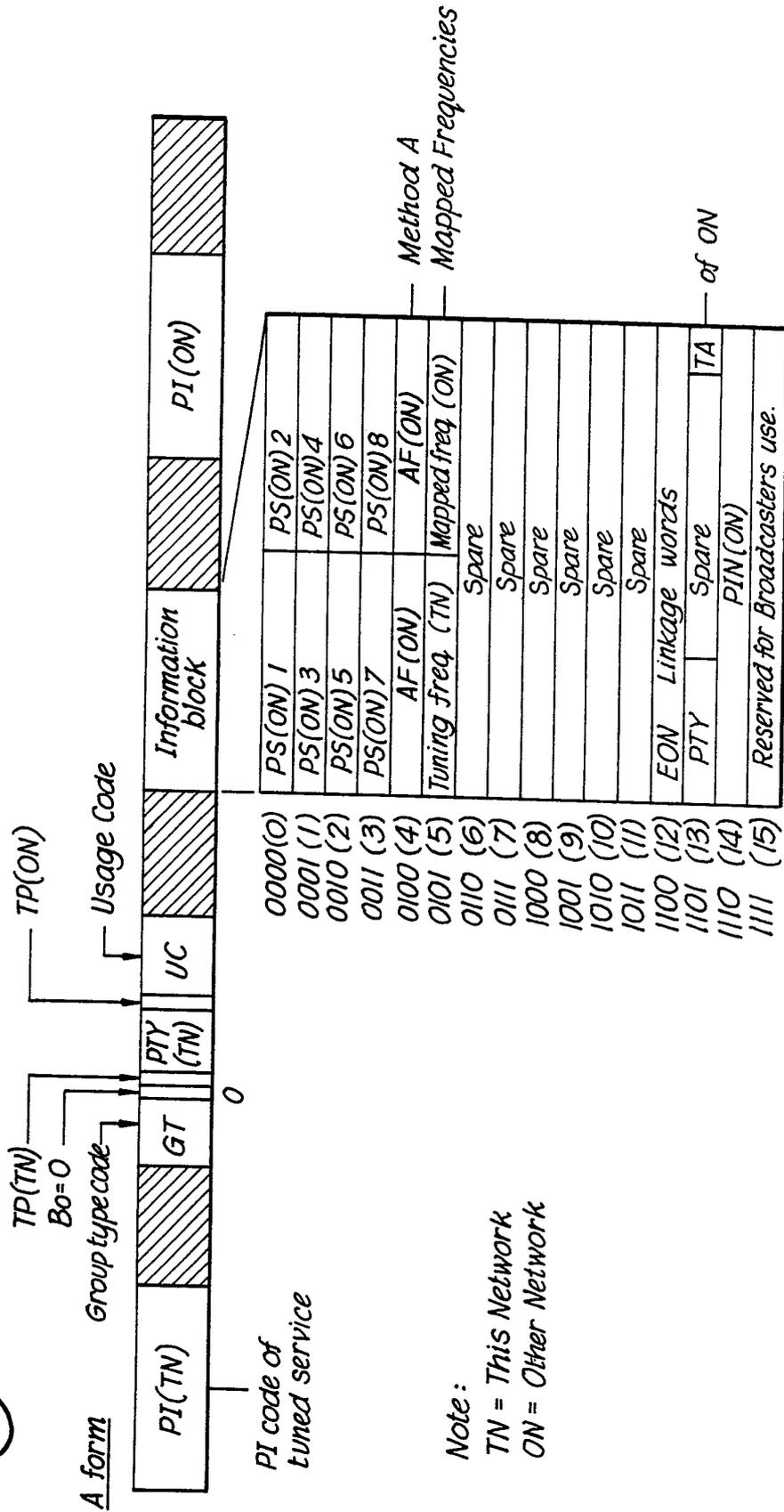
the one identified in the fourth block, an area coverage code as identified by the link identification word and a programme reference code within the hexadecimal value range from 01 to FF.

18. A radio data receiver according to claim 15 for use in conjunction with transmissions of radio data system signals according to claim 11, characterized in that said processing means is programmed to identify from said first flag bit an extended generic set of programmes a memory bank being allocated to each programme thereof, the programme identification code of said programmes having a country code and a first hexadecimal symbol of the programme reference code corresponding to those identified in the fourth block, an area code and a second hexadecimal symbol of the programme reference code lying within a hexadecimal value range respectively from 4 to F and from 1 to F.

19. A radio data receiver according to one of the foregoing claims 15 to 18 for use in conjunction with transmissions of radio data system signals according to claim 12, characterized in that the processing means are programmed to set a potential link between the memory banks of said first and second programmes after identifying at least once the first programme from the fourth block and the second programme from the link identification word and once the first programme from the link identification word and the second programme from the fourth block.

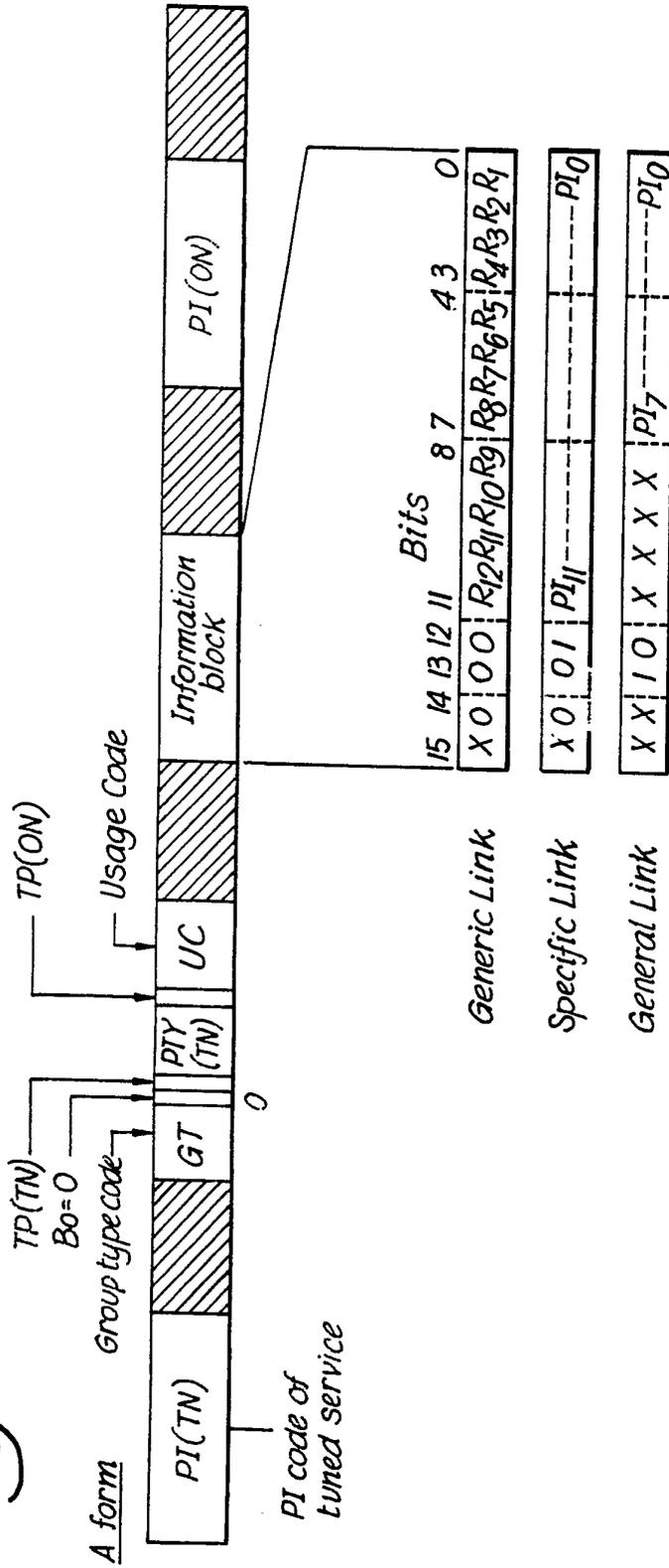
20. A radio data receiver according to claim 19 for use in conjunction with transmissions of radio data system signals according to claim 13, characterized in that the processing means are programmed to identify an actualisation of a potential link between first and second programmes from the value of said second flag bit, for authorizing a search for an optimal alternative frequency within the alternative frequencies of the memory banks of both programmes.

Fig. 1.



Note:
 TN = This Network
 ON = Other Network

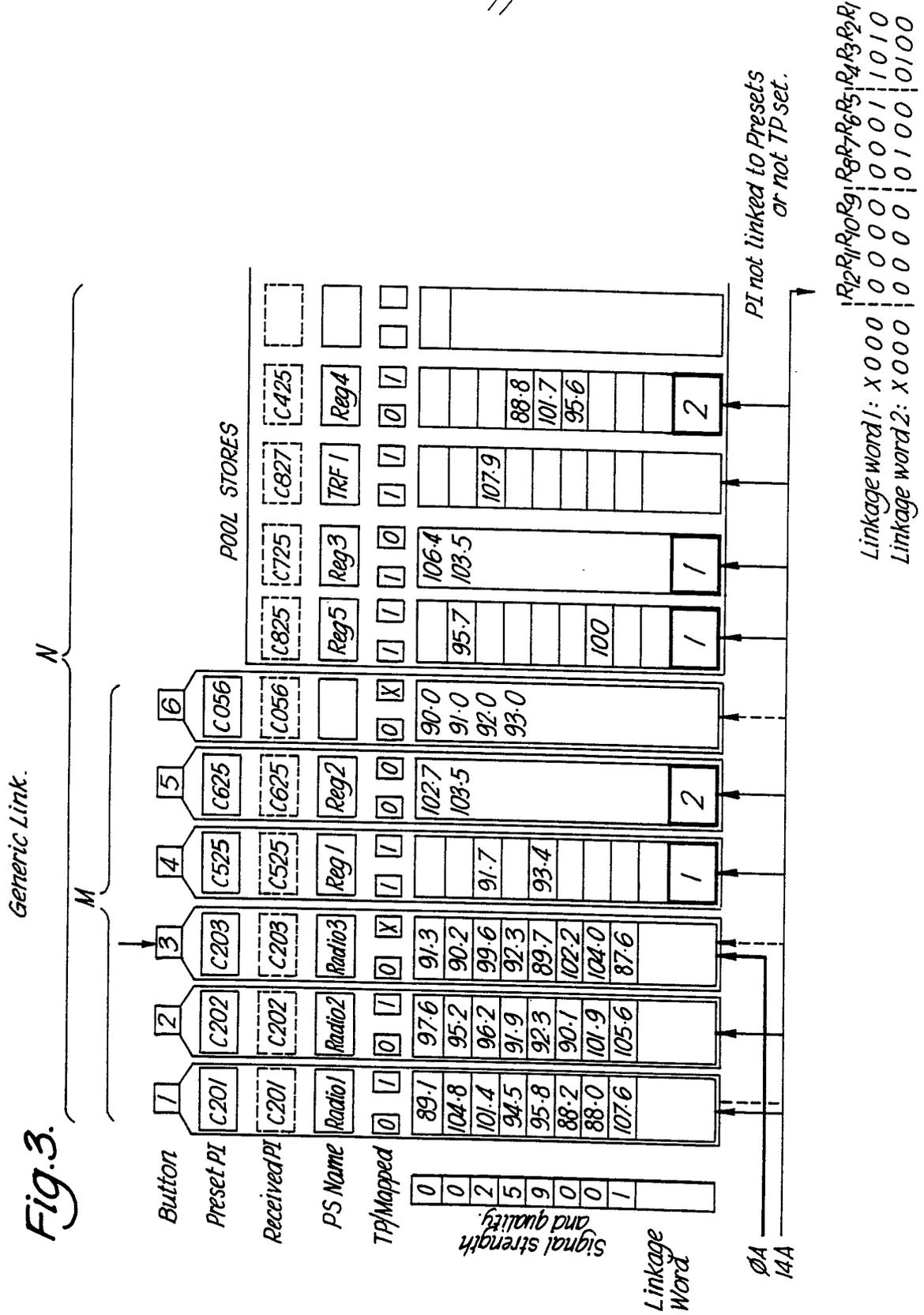
Fig. 2.



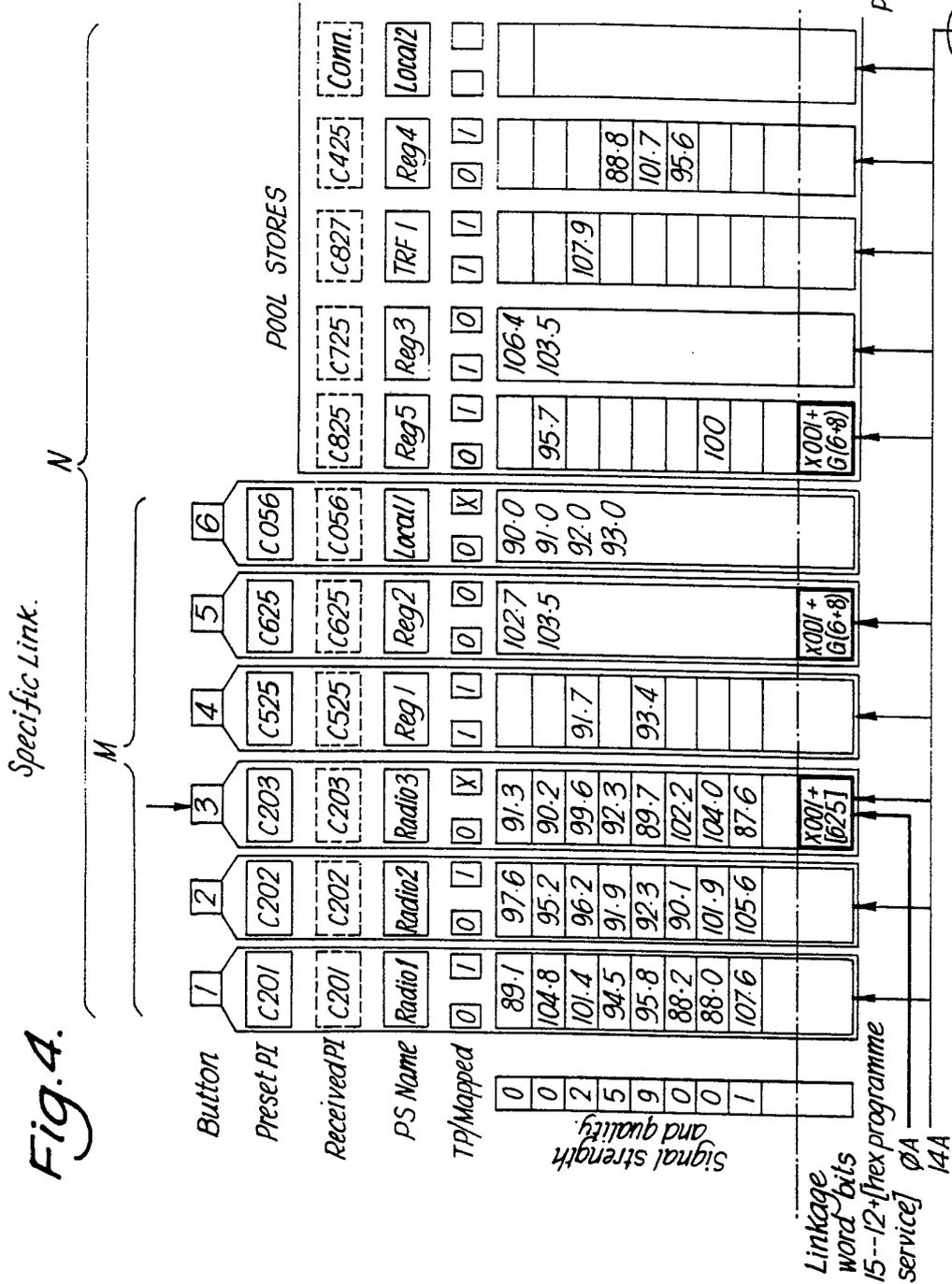
Bit 15

- 0 Link is potential, data should be loaded but not utilised.
- 1 Link is in effect now.

3/7



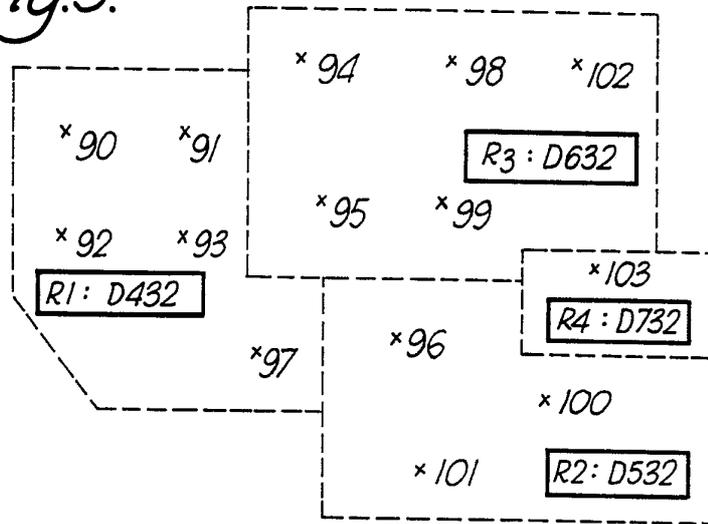
4/7



5/7

GENERIC OR REGIONAL LINK.

Fig.5.



SPECIFIC LINKS

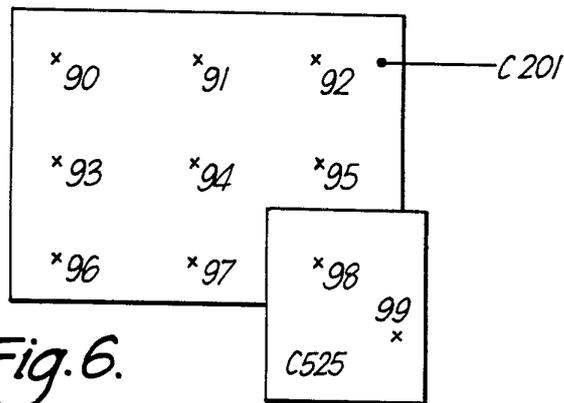


Fig.6.

Linkage word on C201: Bits Hex Digits
 $X001 + [525]$

Linkage word on C525: $X001 + [201]$

6/7

Fig. 7.

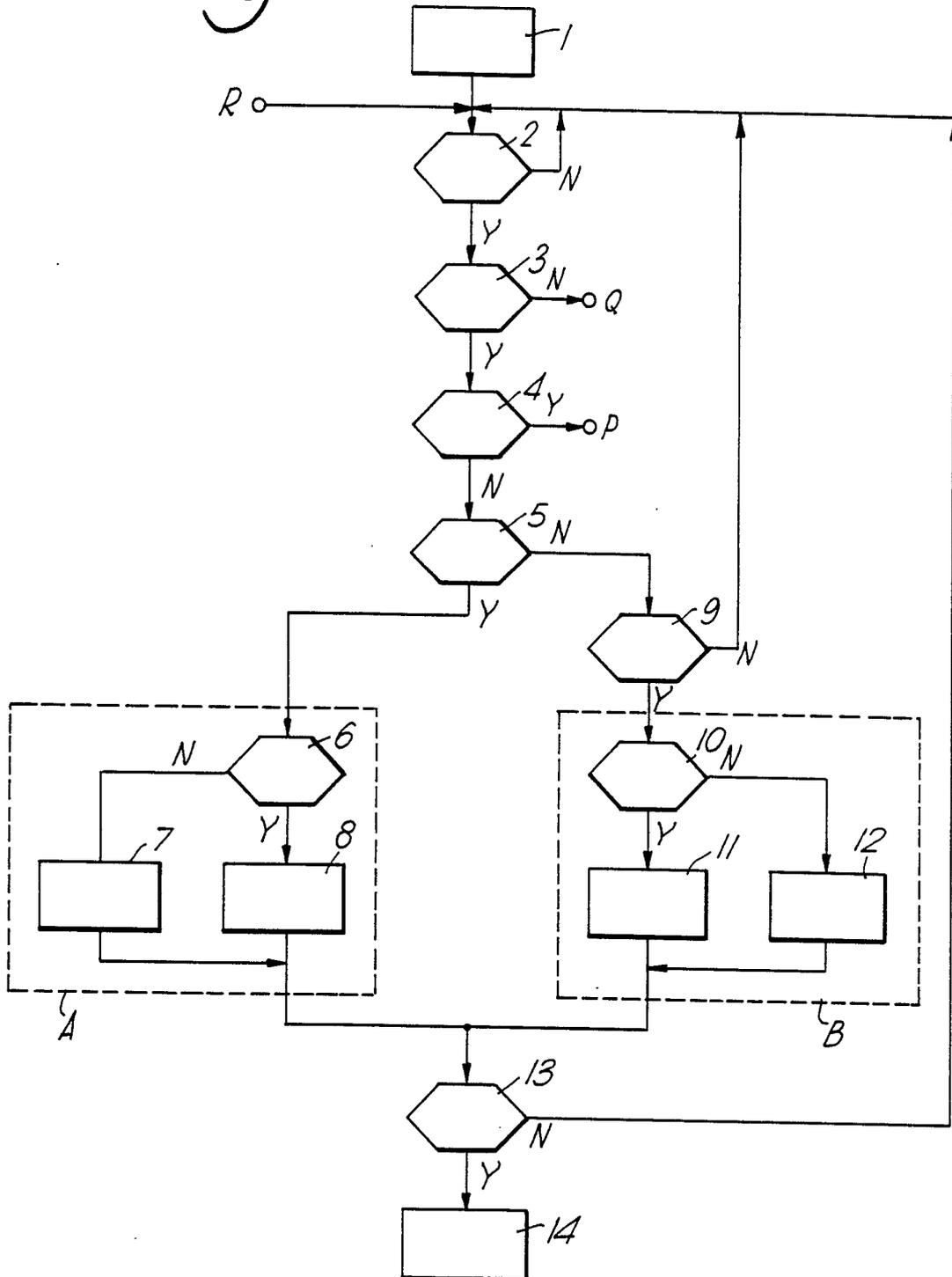
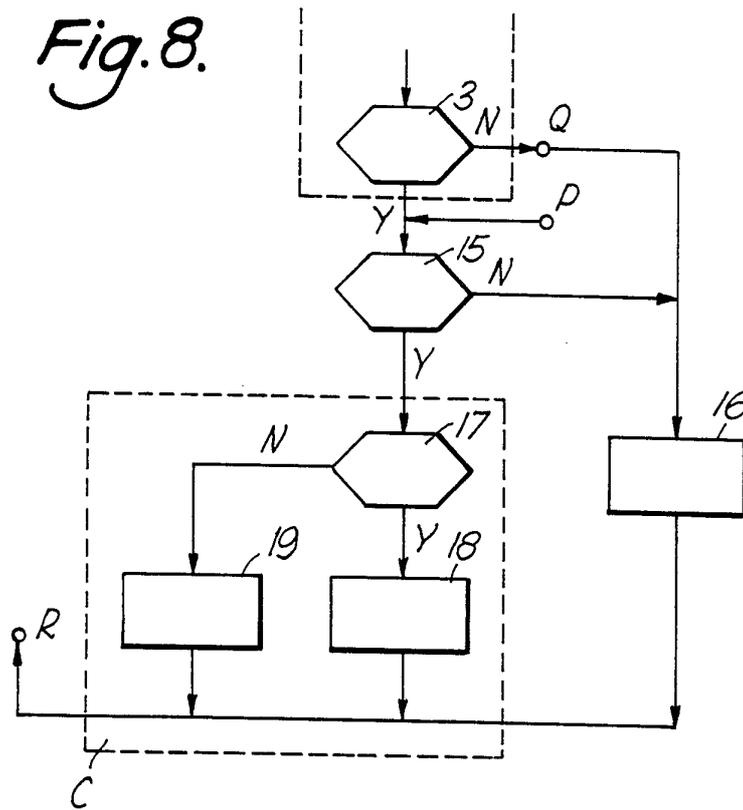


Fig. 8.



INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 90/00351

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC ⁵ : H 04 H 1/00		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC ⁵	H 04 H, H 03 J, G 08 B	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹		
Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
A	European Broadcasting Union, Tech 3244-E, March 1984, (Brussels, BE), "Specifications of the radio data system RDS for VHF/FM sound broad- casting", pages 1-60 see pages 20-21, paragraph 1.3.4; figure 10	1,14
A	EP, A, 0305172 (BBC) 1 March 1989 see page 3, line 60 - page 4, line 34	1,14
A	EP, A, 0275527 (TELEFUNKEN) 27 July 1988 see column 7, line 34 - column 8, line 43	14

<p>¹⁰ Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"Z" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
20th June 1990	- 9. 07. 90	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	M. Peiz	M. PEIS

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.**

GB 9000351
SA 35083

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report. The members are as contained in the European Patent Office EDP file on 03/07/90. The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP-A- 0305172	01-03-89	GB-A- 2209102	26-04-89
EP-A- 0275527	27-07-88	DE-A- 3718845	15-12-88
		DE-A- 3725487	09-02-89
		WO-A- 8804862	30-06-88
		EP-A- 0293464	07-12-88
		JP-T- 1501593	01-06-89