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(71) Applicant: **RAI RADIOTELEVISIONE ITALIANA**
Corso Giambone, 68
I-10135 Torino(IT)

(72) Inventor: **Pastero, Natale, P.i.**
Via Mollar, 1
I-10040 Almese (TO)(IT)
Inventor: **Cominetti, Mario, Dr.**
Via Trento 6A
I-10099 San Mauro Torinese (TO)(IT)

(74) Representative: **Forattini, Amelia et al**
c/o Internazionale Brevetti Ingg. ZINI, MARANESI & C. S.r.l. Piazza Castello 1
I-20121 Milano(IT)

(54) Method for broadcasting text messages on a sub-carrier associated with a radiophonic carrier frequency.

(57) Message elements are formed, consisting of 64 characters, and a succession of groups of information bits is modulated on the supplementary subcarrier, each group comprising a code adapted to identify it as a text-containing group, a preset number of characters constituting a segment of the message element and a four-bit address adapted to locate said segment within the complete element, according to the RDS system of the European Broadcasting Union. According to the invention, for the transmission of a message longer than 64 characters the complete message is segmented into portions of no more than 60 characters and message elements are formed, to be transmitted in successive groups, associating with each successive portion a prefix of four control characters thus composed:

a) a message identifier character, susceptible of assuming one of two configurations and adapted to maintain the same configuration in the successive groups of bits for the duration of a same message, and of assuming the other configuration when a different message begins;

b) a language identifier character, designating the language in which the message is written;

c) a continuity index character, identifying the message element contained in the group being transmitted;

d) a message length character, identifying the number of message elements which compose the complete message.

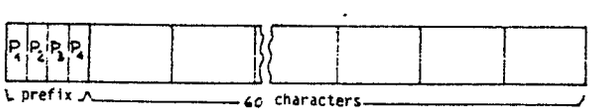

Fig. 2

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METHOD FOR BROADCASTING TEXT MESSAGES ON A SUB-CARRIER ASSOCIATED WITH A RADIOPHONIC CARRIER FREQUENCY

The present invention relates to a method for transmitting text messages on a subcarrier associated with a radiophonic carrier frequency, and more in particular for transmitting messages longer than the length normally allowed within the RDS system (EBU Tech. 3244-E).

Sound radio-broadcasting systems for additional services have been proposed and produced on an international level wherein a digital signal, which is detectable and decodable by auxiliary devices built into user radio receivers, is associated with the audio signal of a given station, to visualize on a display of the receiver alphanumeric information such as the broadcasting station or network, the programme identification, the time of the day, road traffic information, or others.

This service, parallel to the broadcasting of the audio programme, is allowed by the use of a subcarrier modulated at low speed by the data stream. According to the specification of the European Broadcasting Union (ref. EBU Tech. 3244-E, "Specifications of the radio data system RDS for VHF/FM sound broadcasting", March 1984), known as "RDS" and adopted by the CCIR (International Radio-broadcasting Advisory Committee), a subcarrier shifted by 57 KHz with respect to the carrier frequency, modulated with a data streaming rate of 1187.5 baud, is used. With this low transmission rate the occupied bandwidth is very narrow, and it is thus possible to place the subcarrier next to the main carrier without unduly compromising the quality of the audio programme and without appreciable extension in the overall occupied bandwidth.

In order to allow an adequately error-protected reception even in the very variable reception conditions which occur in practice, in particular in the case of moving receivers, for example aboard automotive vehicles, the RDS specification provides the transmission of a succession of groups of 104 bits divided into four blocks of 26 bits each, ten whereof constitute a checkword for the detection and correction of any errors occurring in the reception of that block, while the other 16 bits are useful information. Since the RDS system adopts extended coding with 8 bits per character, each block therefore contains 2 characters.

According to the RDS system, various types of groups can be transmitted, and are differentiated according to the type of information they contain and the coding convention which governs them. The first block of each group always contains a programme identification, while the three successive blocks may contain various information, such as the time of the day, traffic broadcasts, etc., as described above, and every type of information is supplied according to a preset format. In order to allow the receiver to distinguish the various types of groups from one another, so as to be able to use appropriately the information contained therein, the second block of each group includes a four-bit code which identifies the type of group.

The transmission of text messages (Radiotext) is provided among the various types of information. Radiotext messages are intended to be displayed on an alphanumeric display, for example a liquid-crystal display built into the receiver, or can be used, for example on receivers on board automotive vehicles, by a voice synthesizer adapted to provide the user, on demand, with a synthesized verbal communication of the message or can be sent to a printer associated with the receiver. Radiotext messages, however, could also be symbolic instructions intended for a digital computer or the like.

In the text-containing type group, or "Radiotext group", the last two available blocks of the group, for a total of four characters, are interpreted as text, while the second block contains, besides the group type identifier code, an address composed of four bits. The message is split into four-character segments which are each transmitted on a successive group of the broadcast, associating a progressively increasing address to each. The receiver can thus reconstruct a message having a maximum length of 64 characters.

A 64-character text is less than one line of a normal typewritten page, and is therefore extremely short. It is desirable in many cases to be able to broadcast even longer messages, for example the equivalent of one or two typewritten pages. This could be done by defining a new type of group, distinct from the Radiotext group and identified by an appropriate code, with a message segment addressing criterion which allows the listing of a greater number of segments.

However, this would require the international discussion and approval of the coding of a new group, and would furthermore give rise to an undesirable duplication of service, since there would then be two distinct group types both containing messages of the same kind.

One should furthermore note that in the broadcasting of messages on Radiotext groups the language in which the message is written is not specified. Though the indication of the language of the message is irrelevant in the case of alphanumeric display, in voice synthesis this language identification is essential and though voice synthesizers

capable of handling different languages are currently available, if the receiver equipped with voice synthesizer is tuned to a station in another language it is unable to adapt automatically and generates incorrect and incomprehensible vocalizations.

The aim of the invention is therefore to provide a method to allow, in full compatibility with the convention existing on the RDS system, the transmission of messages longer than 64 characters, and more in particular of messages in the order of one or two typewritten pages.

Another object is to provide said method so that a receiver equipped with a multi-language voice synthesizer can automatically translate correctly messages written in different languages.

This aim, this object, and others which will become apparent hereinafter, are achieved by the invention with a method for the transmission of text messages on a subcarrier associated with a radiophonic carrier frequency, wherein message elements are formed consisting of 64 characters and a succession of groups of information bits is modulated on the subcarrier, each group including a code adapted to identify it as a group containing text, a preset number of characters constituting a segment of the message element and a four-bit address adapted to locate said segment within the complete element, characterized in that for the transmission of a message longer than 64 characters the complete message is split into portions no longer than 60 characters and message elements are formed, to be broadcast in successive groups, associating with each successive portion a prefix of four control characters thus composed:

a) a message identifier character, susceptible of assuming one of two configurations and adapted to maintain the same configuration in the successive groups of bits for the duration of a same message, and of assuming the other configuration when a different message begins;

b) a language identifier character, designating the language in which the message is written;

c) a continuity character, identifying the message element contained in the group being transmitted;

d) a message length character, identifying the number of message elements which compose the overall message.

A preferred embodiment of the invention is now described, and is given only by way of non-limitative example with reference to the accompanying drawings, wherein:

figure 1 is a symbolic diagram of a group of bits containing text in an RDS transmission;

figure 2 is a symbolic diagram of the structure of a message element to be transmitted on RDS groups, according to the method of the invention; and

figure 3 is a diagram of a plurality of message elements as in figure 2, adapted to constitute a complete message according to the invention.

Figure 1 symbolically illustrates a group of Radiotext-type information bits according to the convention of the abovementioned RDS system. The group comprises four blocks, BA, BB, BC, BD, each comprising a "data" portion of 16 bits consisting of useful information, and a "corr" portion of 10 bits (in broken lines in the figure) which constitutes an error detection and correction code (checkword), according to methods known in the field.

The first block BA contains a two-character information PI which identifies the network which is broadcasting. The block BA is uniform in all the types of groups of the RDS system.

The first four bits T1, T2, T3, T4 of the second block BB constitute an identification code for the group type, to allow the receiver (or, more precisely, its associated decoders) to correctly interpret the data contained in the two subsequent blocks BC and BD. In the case of the Radiotext group, the RDS specification has the four digits "0010" as identifier.

The last four bits S1, S2, S3, S4 of the block BB constitute a message segment address according to the RDS specification. The messages are split into segments of four characters each, which are broadcast in the blocks BC and BD of successive Radiotext groups, and said four address bits assume increasing values (for example "0000", "0001", "0010", etc.) in the successive groups which contain the message. It can thus be seen that 16 groups can be broadcast, giving a total of 64 characters per message.

The other bits still available in the block BB are used by the RDS specification to transmit information such as the programme type, according to methods not related to the invention.

According to the invention, the 64-character message which can be transmitted according to the RDS specification is composed of a prefix of four characters, P1, P2, P3, P4, which is followed by a sequence of 60 useful characters, that is to say, belonging to the actual message. This is illustrated in the diagram of figure 2. A long message, for example a message of a few hundred characters, is then split into 60-character portions, said prefix P1, P2, P3, P4 (which will be described in detail hereinafter) is placed before each of them,

and the resulting 64-character sequence is normally transmitted as a message element according to the RDS specification, with which the message element is absolutely compatible.

The four-character prefix according to the invention is composed only of characters related to columns 0 and 1 in the coding of the ISO 646 code-table. As is known, such characters, so-called "non-printable" characters, are used as control and protocol characters in ASCII-code transmissions. The characters of the prefix are composed as described hereinafter.

The character P1 is the message identifier, only two configurations being assignable thereto, and it keeps the same configuration in the successive groups which constitute a same message, changing its configuration when the message changes. Such configurations can be selected as desired, except for the characters known as SI, SO and ESC (hexadecimal 0/15, 0/14 and 1/11). Said two possible configurations are preferably those knonw as DLE (hexadecimal 1/0) and NAK (hexadecimal 1/5). This choice ensures a minimum Hamming distance of 2 with respect to the already-assigned control characters SI, SO and ESC.

The character P2 is a language identifier, to notify the decoding circuits of the receiver about the language in which the message is written. The characters SI and SO are excluded from the configurations which can be assigned to the character P2 for the reasons described above Thus it is possible to indicate up to 30 different languages.

Though the language identifier is mostly intended for use by possible voice synthesizers, and therefore generally refers only to natural languages, such as Italian, French, English, etc., one must not neglect the possibility that in certain applications the message may be, for example, a symbolic program which can be used by a microcomputer or the like, and therefore the term "language" must be understood also in the meaning of programming language or other artificial syntax specification.

The character P3 is a continuity index, that is to say a progressive order number of the Radiotext message element being broadcast. It can assume all the values defined above, for a total of 32 (see figure 3).

Finally, the character P4 is the message length indicator. It represents the number of message elements which compose the complete message, and keeps the same value in successive groups for the entire duration of the message.

With the method described above it is thus possible to send messages of up to 1920 characters (60 x 32). Thus there is the advantage of being able to use, for example for the generation of traffic messages or others, Teletext generation sources (U.K., level 1), the pages whereof contain up to 960 characters.

The decoder, associated with the receiver to receive messages encoded according to the invention, must contain, in addition to the devices which perform the normal decoding process provided by the conventional RDS system, a device for decoding the prefix contained in the first four characters of the blocks BC and BD of the Radiotext group, interpreting them as above. The groups of the Radiotext message element successive to the first are treated conventionally by the decoder, using the segment address provided by the RDS specification. At the end of the message element at issue, the decoder again examines the prefix, checking every time, among other things, that the message identifier is still the same.

If the receiver is provided with a voice synthesizer, the additional decoder will use the language identification character to set the synthesizer appropriately.

The use of the method according to the invention has the considerable advantage of being totally compatible with the current convention of the Radiotext groups of the RDS specification. In fact the receiver not equipped with said additional decoding device receives short messages, that is to say up to 60 characters, normally, and is not affected by the prefix, which in any case cannot be displayed.

It should be furthermore noted that in the RDS specification it is provided that the Radiotext-type group may be used in a variation wherein only the block BD is used for the message, while the block BC contains other types of information, which do not relate to the invention. In this case each group contains only two characters, and the message element can comprise a maximum of 32 characters instead of 64. An appropriate bit added to the segment address S1, S2, S3, S4 is provided by the RDS system to indicate which of the two variations is adopted on a case-by-case basis.

Naturally the invention is applicable even in this case, without any modification, the only difference residing in the fact that the maximum length of messages according to the invention will be halved.

A preferred embodiment of the invention has been described, but naturally it is susceptible to equivalent modifications and variations, for example in the order of the characters in the prefix, or in the position of the prefix itself, without thereby departing from the scope of the invention.

Claims

1. A method for the transmission of text messages on a subcarrier associated with a radiophonic carrier frequency, characterized in that message elements are formed consisting of 64 characters and the subcarrier is modulated with a succession of groups of information bits, each group including a code adapted to identify it as a group containing text, a preset number of characters constituting a segment of the message element and a four-bit address adapted to locate said segment within the complete element, characterized in that for the transmission of a message longer than 64 characters the complete message is split into portions no longer than 60 characters and message elements are formed, to be transmitted in successive groups, associating with each successive portion a prefix of four control characters thus composed:

a) a message identifier character, susceptible of assuming one of two configurations and adapted to maintain the same configuration in the successive groups of bits for the duration of a same message, and of assuming the other configuration when a different message beings;

b) a language identifier character, designating the language in which the message is written;

c) a continuity character, identifying the message element contained in the group being transmitted;

d) a message length character, identifying the number of message elements which compose the complete message.

2. A method for the transmission of messages according to claim 1, characterized in that said four control characters are selected among those belonging to columns 0 and 1 of the ISO 646 code-tables.

3. A method for the transmission of messages according to claims 1 or 2, characterized in that the two configurations DLE (hexadecimal 1/0) and NAK (hexadecimal 1/5) of the ASCII coding are adopted as message identifier characters.

4. A method for the transmission of messages according to claims 1 or 2 or 3, characterized in that only the fourth block of the Radiotext groups is used for the transmission of the message element, which can thus comprise a maximum of 32 characters.

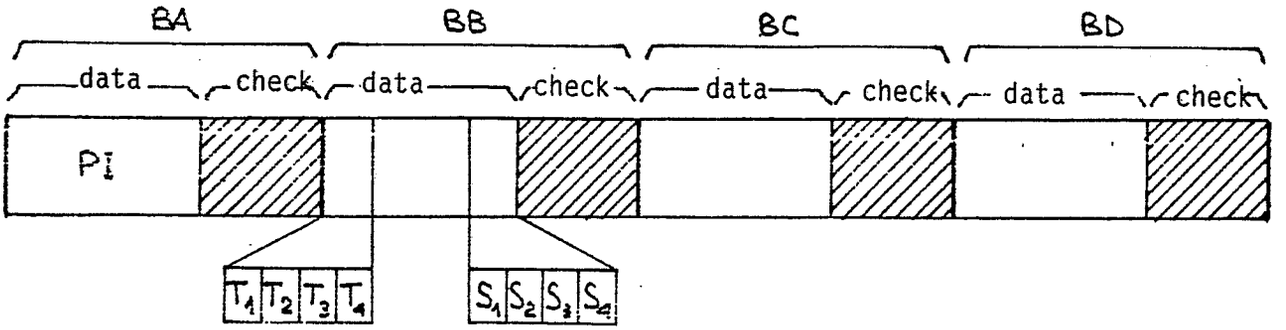

Fig. 1

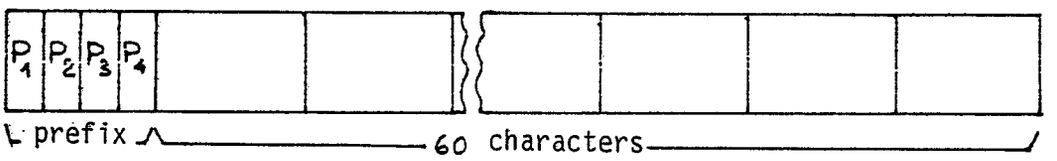

Fig. 2

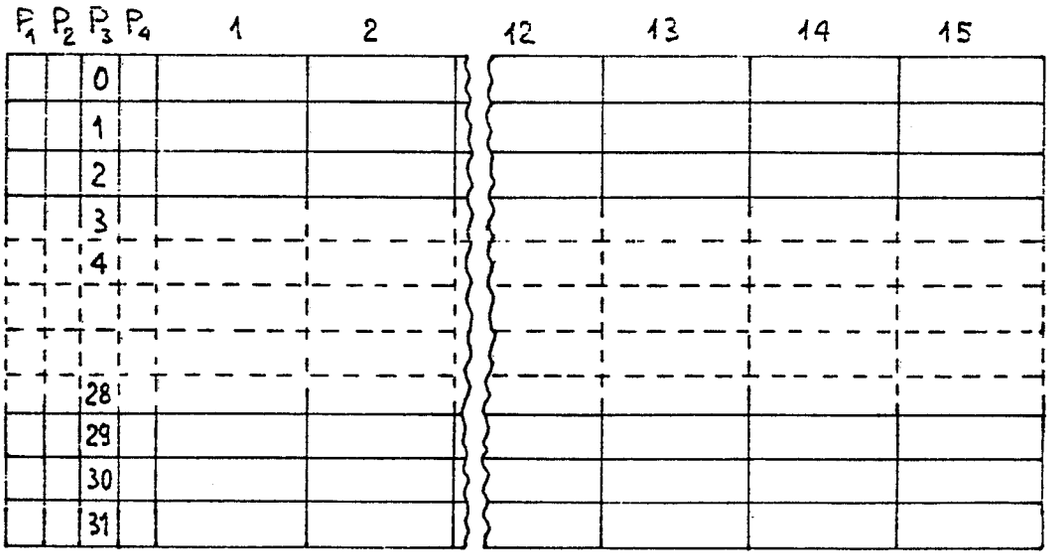

Fig. 3