The invention relates to a method for digital signal transmission in accordance with the first part of claim 1. Such a method is known from EP-A-0 144 801. There, the number of channels in an existing frame format can be increased by means of a coding or transmission method which, in essence, produces a reduction of the number of bits with a simultaneous worsening of the sound quality.

A digital signal transmission system especially for satellite radio is described in the DE-A-33 39 382.6 in which information bits for programme identification and companding are transmitted in addition to the items of programme information (signal information) and the synchronisation words of the main frame. A portion of the information bits for the programmes as well as those for the companding are securely transmitted with the help of block codes, so-called BCH codes.

The make up of a programme identification frame is described in the DE-A-34 21 686.3. Bits for the synchronisation as well as a bit for the programme identification or special services are transmitted at the beginning of a main frame. The programme identification bit of the main frame is used for the building up of a programme identification sub frame. The remaining bits of the main frame contain information bits for the programmes with or without error protection as well as for a scaling factor.

The programme identification frame is synchronised by a synchronisation word and contains items of information concerning the type of programme in the transmitted stereo or mono programmes as well as free data words. Each two stereo, four mono programmes or a combination are combined together and separated from the remainder by a further synchronisation word. The synchronisation words simultaneously serve for the synchronising of a scaling factor frame.

Meanwhile, as is known from the subsequently published DE-A-35 06 912, data reduction methods have been developed which enable a significant reduction in the number of bits to be transmitted e.g. from 14 to 4 bits per channel, without any cut back in the sound quality amenable to the human ear.

Therewith for example, one stereo programme can be transmitted in each mono channel.

The object of the invention is to provide a transmission format for programme identification and for increasing the number of programmes.

This object is achieved by the features given in claim 1. Advantageous developments of the invention are specified in the appendant claims.

In accordance with the invention, in a digital signal transmission system, a flag byte (DI, DIII, DV, ...) is set especially then, when one or more programmes being transmitted have been data reduced for their transmission. If the relevant flag byte (DI, DIII, DV, ...) has been set then a decoder for data expansion is switched on in the receiver. If such a decoder is not available then the channel or block concerned is muted.

An embodiment will be explained hereinafter with the help of the drawing. Therein

Fig. 1a shows sub frames for programme identification of the blocks PA 1/2, ... PA 15/16

Fig. 1b sub frames for programme identification (section)

Figs. 1c-1e temporally successive sub frames for programme identification (each in section)

Fig. 1a shows an entire sub frame for programme identification of eight blocks PA 1/2, ... PA 15/16, corresponding to 16 stereo or 32 mono channels, which has been gradually built up from a data stream using the time slot process. The sub frame begins with a synchronisation word S1 followed by the blocks PA 1/2 to PA 15/16 which are each separated from one another by a second synchronisation word S2. There then follows a further sub frame again beginning with the synchronisation word S1 and so on.

Figs. 1b to 1e show a section from the sub frame for programme identification for the block PA 1/2 which, insofar as a special mode is not present, denotes the programmes 1 and 2. The synchronisation word S1 is transmitted at the beginning of a sub frame transmission. Insofar as a special mode is not present, the items of programme identification information PA-LI, PA-RI, PA-LII, PA-RII, which are each 8 bits long and each represent a mono channel or when combined in pairs, a stereo channel, follow this synchronisation word S1. A flag byte DI-L or DI-R (or, in the blocks PA 3/4, PA 5/6, ..., correspondingly, DIII-L or DIII-R, DV-L or DV-R, ...) contains items of information regarding the type of coding in the channels. One data word DII (or correspondingly, DIV, DVI, ...) is free for future use and, at present, is filled by "00000000". There then follows the synchronisation word S2 which differs from the synchronisation word S1.

A case is illustrated in Figs. 1b to 1e, in which a stereo programme is transmitted in the (former) mono channel which is represented by the programme identification byte PA-LIII with the help of a data reduction process. Thereby, alternating in time, a respective data reduced left or right channel is transmitted at the time points which are provided for the original mono channel. The programme identification bytes PA-LII1 or PA-RII1 then appear, alternating with each other in time, in place of the programme identification byte PA-LII. This position is specially highlighted by "*" in Figs. 1b to 1e; here, the original programme identification byte referenced PA-RII is replaced by the reference PA-(R)II2 to avoid it being confused with the said data reduced right channel. Consequently, by the use of the flag byte DI, two identification places are also made available in the programme identification transmission.

By means of data reduction, it is thus possible for example to occupy one mono channel with a stereo programme or else with two data reduced mono channels as illustrated above by an example. In accordance with the invention, the appertaining flag byte DI, DIII, DV, ..., is used for the identification as to which channel has which coding. This will be more fully described hereinafter using the example of the flag byte DI for the block PA 1/2.

In each complete programme identification frame, wherein these are arranged relative to each other in time in a 16 ms repetition period for example, data words DI-L or DI-R are transmitted alternately in the position provided for the flag byte DI. Herein, the letters L or R indicate the left or right data reduced channel. If the channel is not data reduced, the two flag bytes DI-L or DI-R are identical e.g. "00000000". The exact make up of the flag byte is more fully described below.

If, in the general case, a data reduced channel for a block PA(2n-1)/2n is present, then the bits Nos. 1 to 4 of the relevant flag byte Dn have the following meaning (n = 1 ... 8):

Bit No. 1 = 1, if the audio signal channels appertaining to PA-L(2n-1) exhibit a special mode.

Bit No. 2 = 1, if the audio signal channels appertaining to PA-R(2n-1) exhibit a special mode.

Bit No. 3 = 1, if the audio signal channels appertaining to PA-L(2n) exhibit a special mode.

Bit No. 4 = 1, if the audio signal channels appertaining to PA-R(2n) exhibit a special mode.

A doubling of the programme (type) identification blocks is provided for if a special mode is present. The programme (type) identification blocks are distinguished by the bit No. 5 of the relevant flag byte DI, DIII, DV, ...(cf the bit pattern below). If the bit No. 5 is not set, then the programme identification frame is allocated to the left channel of the data reduced programme, if it is set, then the programme identification frame is allocated to the right channel of the data reduced programme. Bit No. 8 of each flag byte DI, DIII, DV, ... is a parity bit P.

The bit pattern for the relevant flag byte apppears as follows:

	Bit No:	1	2	3	4	5	6	7	8
DI-L, DIII-L, ... (left)		x	x	x	x	0	0	0	P
DI-R, DIII-R, ... (right)		x	x	x	x	1	0	0	P

For the case illustrated in the Figs. 1b to 1e, the flag byte DI thus has the coding:

DI-L: 0010 000P
DI-R: 0010 100P

If one of the bits No. 1 - 4 of the flag byte DI, DIII, DV, ... is set, then a decoder which is required for the data expansion is switched in upon selection of the appertaining programme. If such a decoder is not available, the channel is muted. A selection by the customer cannot then arise.

* C L M S *

Claims

1. Method for digital signal transmission, especially for satellite radio having 16 stereo or 32 mono channels, including a programme identification frame incorporating a plurality of sub frames (PA 1/2, PA 3/4, ..., PA 15/16) which can be built up from a programme identification bit of a main frame, wherein, in a special mode, with an increase in the number of transmitted channels by means of a coding or transmission method to be used for one or more channels, a flag byte (DI, DIII, DV, ...), which is allocated to the channel affected thereby, has a flag at a predetermined position, characterised in that, a data reduction method, which permits of a reduction of the number of bits per channel which have to be transmitted without any substantial loss of the sound quality, is used as the coding or transmission method, and that the programme identification frame is correspondingly increased in such a way (Fig. 1b, Fig. 1c) that, for an increase of the number of channels, whose items of programme information this frame carries, the programme information (PA-LII1, DI-L, PA-RII1, DI-R) of the data reduced channels is transmitted alternately in time in the sub frames (PA 1/2, PA 3/4, ..., PA 15/16).

2. Method in accordance with claim 1, characterised in that, during use of the special mode for all channels, in particular, the number of the channels that can be transmitted is doubled and at the same time the programme identification frame is substantially doubled in length.

3. Method in accordance with either of claims 1 or 2, characterised in that, a flag byte (DI, DIII, DV, ...) is allocated to each two stereo or four mono channels.

4. Method in accordance with any of claims 1 to 3, characterised in that, the flag byte (DI, DIII, DV, ...) has the value "0000 0000" when the channels allocated to it are not being operated in the special mode.

5. Method in accordance with any of claims 1 to 4, characterised in that, for identification purposes, exactly one predetermined bit (1 - 4) of the appertaining flag byte (DI, DIII, DV, ...) is allocated to each channel (PA-L(2n-1), PA-R(2n-1), PA-L(2n), PA-R(2n)) arising from use of the special mode.

6. Method in accordance with any of claims 1 to 5, characterised in that, one or more predetermined bits, in particular the fifth bit of the flag byte (DI, DIII, DV, ...) serves for the identification of the programme identification frame.

7. Method in accordance with claim 6, characterised in that, these predetermined bits together with a first synchronising word (S1) and/or a second synchronising word (S2) of the programme identification frame serve for the identification of the programme identification frame.

8. Method in accordance with claim 6 or 7, characterised in that, these predetermined bits are transmitted in the original repetition sequence using alternating code, in particular in the alternation 0/1-1 bit or 0/1/2/3-2 bits and that the frame length required for this is determined by the number of the different combinations.

9. Method in accordance with any of claims 1 to 8, characterised in that, a decoder is switched in at the receiving end upon the selection of a channel (PA-L(2n-1), PA-R(2n-1), PA-L(2n), PA-R(2n)) transmitted in the special mode.

10. Method in accordance with claim 9, characterised in that, the decoder effects an expansion of the data previously subjected to a data reduction process at the transmitting end.

11. Method in accordance with any of claims 1 to 8, characterised in that, no reproduction occurs upon the selection of a channel (PA-L(2n-1), PA-R(2n-1), PA-L(2n), PA-R(2n)) transmitted in the special mode.

12. Method in accordance with any of claims 1 to 11, characterised in that, a predetermined bit, in particular the eighth bit, of the flag byte (DI, DIII, DV, ...) is used as a parity protecting bit.

* C L M S *