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Method and circuit for decoding letterbox signals

The invention relates to a method and a circuit for decoding letterbox signals.

Prior art

The PAL-plus system standard is currently specified for the compatible transmission of the 16:9 widescreen format via terrestrial channels. In the case of this method, the 16:9 video information is represented in a compatible manner on the 4:3 receiver with black strips at the top and bottom edges of the picture. A vertical format conversion is required for matching of the geometric ratios on the conventional 4:3 receiver, in the case of which format conversion only a smaller number of active lines are displayed in the visible picture window on the 4:3 receiver (letterbox display). The remaining areas of the 4:3 receiver appear as black strips of 72 lines each at the top and bottom edges of the picture.

However, all the lines from the source image are required for a display which fills the format on the future 16:9 receiver. The information which is required for this purpose is transmitted as a so-called helper signal in the black strips at the top and bottom edges of the picture. The ultrablack area is used for the transmission of the additional information in the amplitude domain. In consequence, the additional information which has been introduced is only slightly visible on the 4:3 receiver.

The compatible transmission of 16:9 frames provided in the current television standard has a number of disadvantages, however. On the one hand, the first line of the video frame (line 23) is only half filled with video information. Normally, this line disappears in the overscan area of the receiver and is thus not visible. In the case of the format conversion which is required for a 16:9 frame, this line is, however, moved

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into the first visible line of the letterbox picture and is thus moved into the visible part of the television picture. The visible, compatible PAL-plus frame would accordingly start with half a line.

On the other hand, there is a time delay of 313 lines between the corresponding lines of the first field and of the second field. This is undesirable for the intended colour encoding using the PAL-plus standard, time averaging being provided for lines which have a delay time of exactly 312 lines. As a consequence of this, the first line in the first field and the last line in the second field would in each case have no corresponding line as a partner.

Invention

The invention is based on the object of specifying an improved method for letterbox decodering [sic]. This object is achieved by the method according to the invention specified in Claim 1.

In principle, the method according to the invention consists in that, for decoding letterbox signals, the first line (23) of the first field and the last line (623) of the second field are set to a fixed value, in particular black, before the letterbox format conversion at the transmission end of the lines containing the video content and, after the format conversion, the helper lines (23-58) of the first field are shifted by one line in the direction of higher line numbers, and the helper lines (588-623) of the second field are shifted by one line in the direction of lower line numbers, the last transmitted or recorded helper line being used for the reconstruction (45) at the receiver end of the original lines (23-623) in each case instead of the missing first letterbox line (59) of the first field, and the first transmitted or recorded helper line (587) being used instead of the missing last letterbox line (587) of the second field.

The invention is based on the further object of specifying a device for the method according to the

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invention. This object is achieved by the device according to the invention specified in Claim 2.

In principle, the device according to the invention is provided with storage means for helper signals (42) and storage means (43) for letterbox signals, to which the corresponding lines are in each case supplied controlled by a reading-in and reading-out controller (44), and from which the corresponding lines are read out into a downstream recontruction matrix (45) in order to form the original line number at the transmitter end, the reading in and reading out in each case being carried out continually for the helper lines and for the letterbox lines, in that the helper line which is arranged at this point in time is in each case read in for the missing letterbox line.

It is intended to carry out a new assignment between the lines of the two fields for the letterbox picture. In principle, the first field is offset by one line with respect to the second field. In addition, the number of active letterbox lines per field must be reduced by one line, so that, of the originally provided 216 lines per field, only 215 active lines still remain for the transmission of the letterbox picture.

First of all, care is taken at the studio to ensure that, before the format conversion, the source material in each case has one black line in the first place in the first field (line No. 23) and in last place in the second field (line No. 623), as is illustrated in Fig. 1. After the format conversion (three letterbox lines are in each case interpolated from four lines), these black lines would once again lead to approximately black lines in the letterbox picture as a result of the interpolation used (line No. 59 and No. 587 in Fig. 2). It has been agreed that these lines should not be transmitted, because their information content is only low.

The gap which results in consequence is compensated for in that, according to Fig. 3, the transmission of the first 36 helper lines for the first field does not start until line No. 24, and the transmission of the last

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36 helper lines from the second field starts from line No. 587. A total of 430 active lines thus remain for the letterbox picture and 144 lines for the helper signal. The desired time difference of 312 lines now exists between the corresponding active lines of the first field and of the second field.

The PAL-plus decoder uses the auxiliary information which is transmitted in the black strips and has the total of 144 lines, and the letterbox picture, to reconstruct a format-filling 16:9 frame with 576 active lines. The ratio of the number of letterbox lines to auxiliary lines must therefore be 1:3. Thus, exactly 432 letterbox lines are required for a total of 144 auxiliary lines. This means that the virtually black lines of the letterbox picture which were removed before transmission must be added again. However, since the original lines are no longer available, the two missing lines must additionally be produced in the decoder.

According to the invention, two of the transmitted helper lines are used as a replacement for this line information which is not transmitted. The video information of a helper line can advantageously be regarded as being approximately "black", because the auxiliary signal, as has already been mentioned above, is transmitted in the ultrablack area.

The invention furthermore provides for the last helper line (line No. 59) to be used as the first active line of the transmitted letterbox picture of the first field. A corresponding situation applies to the last active letterbox line of the second field, which is identical to the first helper line (line No. 587), of the bottom "black" letterbox strip.

The advantage of the invention is considerable simplification for the circuitry design of the control of reading into and reading out of the storage means for the helper information and for the active lines of the letterbox format.

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Drawings

The invention is described with reference to the drawings, in which:

Fig. 1 shows the arrangement of the lines of a 16:9 frame in the studio before the format conversion;

Fig. 2 shows the arrangement of the lines of a 16:9 frame after the format conversion;

Fig. 3 shows the arrangement of letterbox lines and helper lines provided for the PAL-plus transmission;

Fig. 4 shows an outline block diagram of a PAL-plus decoder according to the invention.

Exemplary embodiment

The PAL-plus decoder in Fig. 4 receives at its input 40, for example, a composite video signal from which the corresponding helper lines are stored in a helper memory 42, and the letterbox lines are stored in a letterbox memory 43. The synchronization signal from the composite video signal is used and is supplied to the reading-in and reading-out controller 44 for the two memories. In the reconstruction matrix 45, in each case four lines of the 16:9 frame are interpolated with 576 active lines, which are then available at the output 46, from the stored data which is advantageously read out continuously, after an appropriately matched delay time of in each case three letterbox lines and one helper line.

Whether there is any auxiliary information whatsoever in the relevant helper lines 71 and 74, which information changes the frame content of the interpolated edge line, depends on the corresponding vertical spectral elements in the original picture.

Without the invention, the compensation for the letterbox lines which are not transmitted would have to be carried out by interrupting the reading and writing processes of the helper memory 42 and of the letterbox

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memory 43. However, this would lead to increased circuit complexity because additional control signals would have to be produced and would have to be supplied to the memories. It would be particularly disadvantageous that this process would have to be carried out only for a single line within a field, and that the position of the lines in the two fields would be different. Additional logic modules would be required in order to interrogate the counter readings in the reading-in and reading-out controller 44, and additional signal lines. In contrast to this, the production of the letterbox lines which are not transmitted and the additional control signal complexity linked thereto can be avoided according to the invention if the start and end times of the letterbox picture are in each case fixed to the corresponding helper lines. In consequence, a 432-line letterbox picture - comprising two fields each having 216 lines - is simulated for the PAL-plus decoder, which have [sic] been obtained using a continual reading-in and reading-out cycle.

The specified numerical values can be correspondingly adapted for other television systems, for example, NTSC.

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Patent Claims

1. Method for decoding letterbox signals, in the case of which method the first line (23) of the first field and the last line (623) of the second field are set to a fixed value, in particular black, before the letterbox format conversion at the transmission end of the lines containing the video content and, after the format conversion, the helper lines (23-58) of the first field are shifted by one line in the direction of higher line numbers, and the helper lines (588-623) of the second field are shifted by one line in the direction of lower line numbers, the last transmitted or recorded helper line being used for the reconstruction (45) at the receiver end of the original lines (23-623) in each case instead of the missing first letterbox line (59) of the first field, and the first transmitted or recorded helper line (587) being used instead of the missing last letterbox line (587) of the second field.

2. Circuit for a method according to Claim 1, provided with storage means for helper signals (42) and storage means (43) for letterbox signals, to which the corresponding lines are in each case supplied controlled by a reading-in and reading-out controller (44), and from which the corresponding lines are read out into a downstream recontruction matrix (45) in order to form the original line number at the transmitter end, the reading in and reading out in each case being carried out continually for the helper lines and for the letterbox lines, in that the helper line which is arranged at this point in time is in each case read in for the missing letterbox line.

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