



Method and apparatus for the decoding of image signals including additional items of information

The invention relates to a method and an apparatus for the decoding of image signals including additional items of information.

State of the art

For the compatible introduction of a 16:9 wide image format into the existing television standards (e.g. PAL, NTSC, SECAM) which operate with a 4:3 format, the letterbox process is under discussion. With this, the 4:3 receivers depict the 16:9 image information in a compatible manner with black strips at the upper and lower edges of the picture. For the format filling display on a 16:9 receiver, additional items of information, which permit of an improved image quality, are transmitted in the black strips of the compatible 4:3 transmission. The additional items of information can be transmitted in the ultra-black region as an invisible image content for the 4:3 receiver. For the application to the PAL standard, the letterbox process is described in "Die neuen Wege des alten PAL", A. Ziemer, E. Matzel, Funkschau 18/1989 and in "PAL-Plus - Innovation fürs Fernsehen", Funkschau Spezial 12/1991.

A method for a PAL-Plus processing in which the letterbox format is also used, and a corresponding decoder, are given in WO91/04637. A method for the recording of PAL-Plus signals in conventional SVHS recorders is described in the PCT/EP91/00676.

Invention

The object of the invention is to provide a method for the decoding of PAL-Plus signals, in particular for PAL-Plus signals that have been recorded on SVHS recorders. This object is achieved by the method in accordance with the invention defined in claim 1.

Basically, the method in accordance with the invention consists in that, in the decoders for these image signals, the decoding is distributed over a first partial decoding device 38 and a second partial decoding device with the help of switch means 33, 34, 36 and that it is determined 32 whether the image signals contain additional items of information that are to be decoded, wherein:

- in the case of FBAS or Y/C image signals without additional items of information, a standard processing of these signals is carried out;
- in the case of FBAS image signals having additional items of information, these additional items of information are supplied



via the switch means 33, 36 to the first partial decoding device 38 and thereafter to the second partial decoding device whereby the chrominance signals are supplied to a demodulator 35 before going to the second partial decoding device;

- in the case of Y/C image signals having additional items of information, which are reproduced by an image signal recording device S-VHS in which the additional items of information are recorded in partially decoded form, the additional items of information are supplied via the switch means 34, 36 only to the second partial decoding device whereby the C signal is processed in standard manner.

Advantageous developments of the method in accordance with the invention are apparent from the appertaining dependent claims.

The further object of the invention is to provide an apparatus for the method in accordance with the invention. This object is achieved by the apparatus in accordance with the invention defined in claim 6.

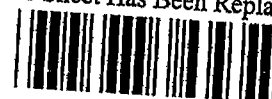
Basically, the apparatus in accordance with the invention is provided with a detector circuit 32 for detecting the type of image signals, with a first partial decoding device 38 which contains a Nyquist filter 381, a V-T demodulator 382 and a low pass filter 383, with a chrominance demodulator 35 and with switch means 33, 34, 36 which are controlled by the detector circuit and which:

- in the case of FBAS or Y/C image signals without additional items of information, supply the image signals to a standard processing device FBAS_{ST}, Y_{ST}, C;

- in the case of FBAS image signals having additional items of information, supply these additional items of information via a first switch 33 to the first partial decoding device 38 and thereafter via an A/D converter 37 to a second partial decoding device whereby the chrominance signals are supplied via the first switch 33 to a demodulator 35 before going to the second partial decoding device;

- in the case of Y/C image signals having additional items of information, which are reproduced by an image signal recording device S-VHS in which the additional items of information are recorded in partially decoded form, the additional items of information are supplied via the switch means 34, 36 and the A/D converter 37 only to the second partial decoding device whereby the C image signal is supplied directly to a standard processing device C.

For the recording of PAL-Plus signals in conventional SVHS recorders, a method was described in the PCT/EP91/00676 which provides for a partial decoding of the additional items of information. Hereby, additional items of information which were



modulated on a carrier in accordance with PCT/EP91/00397 for example, are demodulated before the recording and then recorded as base band signals. For the reproduction in a PAL-Plus receiver, the recorded additional items of information may run backwardly through the decoding process which was carried out before the recording i.e. are converted by coding into a luminance signal Y having additional items of information and a chrominance signal C or into an FBAS signal. In the 16:9 receiver, a fresh decoding then takes place in accordance with WO91/04637. In addition to the disadvantage of the additional expenditure in the recorder for the fresh coding of the signal, the signal to noise ratio of the signal is made worse by the cascaded coding/decoding. A clear improvement results, if PAL-Plus signals including partially decoded additional items of information that have been recorded in SVHS recorders are fed into the 16:9 receiver as a luminance and chrominance signal.

In accordance with the invention, PAL-Plus signals recorded in SVHS recorders are recognised as such in a 16:9 television receiver and are supplied directly by switch means to the Analogue/Digital conversion for further PAL-Plus decoding.

Drawings

Embodiments of the invention will be explained with the help of the drawings. In the drawings

Fig. 1 shows a known decoder for letterbox signals including additional items of information;

Fig. 2 a known SVHS recorder including a prior connected demodulator and switches;

Fig. 3 apparatus in accordance with the invention for the decoding of letterbox signals including additional items of information recorded in SVHS recorders.

Embodiments

Fig. 1 shows a decoder for letterbox signals including additional items of information. The additional items of information (helper signal) are modulated onto the colour carrier and are transmitted using a residual side band technique. The input signal 80 having a 4:3 picture format, 625 lines, 50 Hz frame repetition frequency and field display is supplied to both a Nyquist filter 811 for the shaping of the residual side band and to a PAL demodulator 821. The output signal of the Nyquist filter 811 reaches a first demodulator 812 with which the helper signal modulated onto the colour carrier is demodulated. The helper signal is filtered in a



subsequent first low pass filter 813 having a limit frequency of 4.43 MHz before it is supplied to an A/D converter 814. The respective components of the helper signal are associated once more with the original lines in a subsequent store and demultiplexer circuit 815 and are interpolated or expanded horizontally in a succeeding first interpolation circuit 816 and associated with the picture points of the 432 active lines of the letterbox format.

A helper signal for a progressive image format is formed in a subsequent first interlace-progressive-interpolator 817 from the interlace-helper signal. The helper signal is transposed into the correct spectral location within the $f_y - f_t$ region with the aid of a line and frame ± 1 weighting in a subsequent second demodulator 818 and thereafter supplied to a third adder 852. The Y^- , U^+ , V^- components from the PAL demodulator 821 are supplied to an A/D converter circuit 822. The digital Y^- signal reaches a first delay circuit 830 and a first "intraframe average" circuit 831. The output signal of this circuit is supplied to a second delay circuit 836 and subtracted from the output signal of the first delay circuit 830 in a subtractor 834. The output signal of this subtractor is supplied via a second low pass filter 835 to a first adder 837. The output signal of the second delay circuit 836 is likewise supplied to the first adder 837. The output signal of the first adder 837 consists of the luminance components Y_l and Y_{bp} and reaches a second adder 838.

The signal U^+ from the second A/D converter 822 reaches a second "intraframe average" circuit 832 and, from there, a first vertical separator 841.

The signal V^- reaches a second vertical separator 842 via a third "intraframe average" circuit 833. The first vertical separator 841 delivers the signals U and Y_{h1} at its outputs, the second vertical separator 842 delivers the signals V and Y_{h2} at its outputs.

The U signal is supplied to a first vertical interpolater 843 and the V signal to a second vertical interpolater 844. The missing U^- and V^- picture points are formed in these interpolaters and, together with those already available, are supplied to the second interlace-progressive-interpolator 851. The signal components Y_{h1} and Y_{h2} are higher frequency horizontal spectral components and are combined in a line multiplexer 845 and supplied as the signal Y_h to a third demodulator 846. There, they are transposed back into the correct spectral location by means of a picture point ± 1 weighting. The output signal of the third demodulator 846 is likewise supplied to the second adder 838. The output signal of the second adder 838 likewise reaches the second interlace-progressive-interpolator 851 as the combined Y^- component.



The helper signal is added to the Y- output signal of this interlace-progressive-interpolator 851 in a third adder 852. This combined Y- component and the U- and V- components from the second interlace-progressive-interpolator 851 are then D/A converted again (not illustrated). A television signal, having a 16:9 image format, 432 active lines, 50 Hz frame repetition frequency, progressive display and an increased luminance bandwidth in relation to the 5 MHz PAL transmission channel, is available at the output of the decoder.

For the recording with a video recorder S-VHS, the input signal 80 from Fig. 1 is fed into the circuit in accordance with Fig. 2, for example via a tuner or a SCART socket, as the input signal FBAS. The additional items of information contained in the letterbox strips are only partially decoded. The input signal FBAS is passed on to a Nyquist filter 41, to a separating stage 45 and to a bandpass filter 47. The frequency range located around the colour carrier is filtered out in the bandpass filter 47 and the chrominance signal C obtained. The time-matching to the luminance signal processing, or, to the processing time for the additional items of information, is undertaken in a second delay line circuit 48. This chrominance signal then reaches a fourth input 2' of a video switching device 49 that is switchable line by line. During the letterbox lines (switch position 1 or 1'), there is no chrominance signal representing a chrominance picture content present. In this case, the third input 1' of the video switching device 49 is at a constant value. The luminance signal Y is obtained from the FBAS signal in the separating stage 45 and subsequently matched to the processing time for the additional items of information in a first delay line circuit 46 and supplied to a second input 2 of the video switching device 49.

The video switching device is controlled by a control signal sw1. The two switches in the video switching device are located in the position 2 and 2' respectively during the lines of the main signal. The colour carrier modulated additional items of information from the lines of the letterbox strips of the FBAS signal are initially residual-sideband demodulated in the Nyquist filter 41. The latter's output signal is demodulated in a demodulator 42 whereby the colour carrier frequency f_{sc}' is likewise supplied to this demodulator with a suitable phase angle. The necessary phase angle of f_{sc}' , which must correspond to the modulation phase of the additional items of information, is produced by a phase shifter 44 for the colour carrier frequency f_{sc} . The undesired modulation products of the upper sidebands arising from the demodulation process are separated out in a following low pass filter 43. This low pass filter limits the thus obtained base band of the additional items of information to frequencies up to the colour carrier frequency.



The output signal of the low pass filter is supplied to a first input 1 of the video switching device 49.

If a standard FBAS signal is present i.e. not a letterbox signal or a letterbox signal without additional items of information, the two switches in the video switching device 49 advantageously remain in the position 2 and 2' respectively.

For the processing of letterbox signals recorded in this manner, i.e. for the decoding and display by means of a decoder in accordance with Fig. 1, the partial decoding has to be reversed. In this case, this means a renewed modulation. In addition to the increased cost in the recorder S-VHS, a worsening of the signal to noise ratio as well as an accumulation of jitter are to be expected whereby the derivation of the additional items of information is disadvantageously affected.

This disadvantage can be avoided if the decoder is constructed such that the recorded letterbox signals having additional items of information are recognised as such. Fig. 3 shows the apparatus in accordance with the invention for recognising and decoding letterbox signals having additional items of information that have been recorded on SVHS recorders. FBAS or luminance/chrominance (Y/C) letterbox signals are fed into the decoder part of a 16:9 television receiver via a SCART socket 31 for example. The FBAS or Y/C signals may carry an identification code which identifies these signals as letterbox signals having additional items of information. This identification code may be produced for example in accordance with DE 4114605. It is also conceivable to transmit an identification code in the vertical blanking interval or during the first half of the line 23. The identification signal is evaluated in a following detector circuit 32 and, in dependence thereon, control signals SW1, SW2 and SW3 are produced. It is also possible to replace the detector circuit 32 by an independent letterbox detector which manages without identification signals.

The purpose of the detector circuit 32 is to distinguish standard FBAS and standard Y/C signals from letterbox FBAS and Y/C signals having additional items of information. If a standard FBAS signal is recognised, this detector circuit delivers a switching pulse SW1 which supplies the signal via a first switch 33 to the standard FBAS decoding means having the switch position FBAS_{ST}. If it is a letterbox FBAS signal, the signal is supplied to a decoding means in accordance with Fig. 1.

Advantageously however, the circuit for the decoding of the additional items of information in accordance with Fig. 1 is divided into a first partial decoding device 38, a PAL demodulator 35 and a second partial decoding device. This second



partial decoding device corresponds to the circuit section located to the right of the A/D converters 814 and 822 in Fig. 1. The first switch 33 is in the position $FBAS_{LB}$ and the triple switch 36 is placed in the positions 1, 2, 3 by the switching pulse SW3.

Upon feeding in separate luminance and chrominance signals (Y/C), only a difference in the luminance signal Y is affected. The chrominance is always processed in a standard manner in the PAL demodulator 35 and then reproduced after its transit time has been matched with the decoded Y signal. A processing of the chrominance corresponding to the WO91/04637, wherein disturbances due to cross-talk are eliminated by an "intraframe process" (Fig. 1; 832, 833), is not worthwhile since, for this, use is made of the phase relationships between the colour carrier and the image signal which are no longer available with the necessary precision after an SVHS recording.

If the detector circuit 32 recognises a standard luminance signal Y, a second switch 34 is placed in the position Y_{ST} by the switching pulse SW2 and the luminance signal is then processed in the standard manner. Upon the recognition of a luminance letterbox signal Y, the second switch 34 goes into the position Y_{LB} . The luminance letterbox signal Y is then fed directly via the triple switch 36, which is switched into the position 1' or 2' and 3' by means of the switching pulse SW3, to the Analogue/Digital conversion means and then further to the second partial decoding device (not illustrated in Fig. 3). An A/D converter 37 does not receive any chrominance signals via the positions 2' and 3' since the chrominance signal C is processed in the standard manner. The luminance letterbox signal Y has thus been led past the first partial decoding device 38.

In principle, the first partial decoding device 38 may be related to any form of coding if a corresponding device for the partial decoding were to be used before the SVHS recording. In Fig. 3, the first partial decoding device 38 consists of a Nyquist filter 381 (corresponding to the blocks 811 and 41), of a succeeding V-T demodulator 382 (corresponding to the blocks 821 and 42/44) and of a subsequently connected low pass filter 383 (corresponding to the blocks 813 and 43) having a limiting frequency of 4.43 MHz. The demodulator 35 corresponds to the demodulator 821.

Other equivalent recorders such as e.g. Hi8 recorders may also be used instead of an S-VHS video recorder.

The said line values and circuits may be appropriately adapted for other television signal norms.



Claims

1. Method for the decoding of image signals including additional items of information which may be used for improving the quality of the image, characterised in that, in the decoders for these image signals, the decoding is distributed over a first partial decoding device (38) and a second partial decoding device with the help of switch means (33, 34, 36) and that it is determined (32) whether the image signals contain additional items of information that are to be decoded, wherein:

- in the case of FBAS or Y/C image signals without additional items of information, a standard processing of these signals is carried out;
- in the case of FBAS image signals having additional items of information, these additional items of information are supplied via the switch means (33, 36) to the first partial decoding device (38) and thereafter to the second partial decoding device whereby the chrominance signals are supplied to a demodulator (35) before going to the second partial decoding device;
- in the case of Y/C image signals having additional items of information, which are reproduced by an image signal recording device (S-VHS) in which the additional items of information are recorded in partially decoded form, the additional items of information are supplied via the switch means (34, 36) only to the second partial decoding device whereby the C signal is processed in standard manner.

2. Method in accordance with Claim 1, characterised in that, a Nyquist filtering (381), a V-T demodulation (382) and a low pass filtering (383) are undertaken in the first partial decoding device (38).

3. Method in accordance with Claim 1 or 2, characterised in that, the FBAS and Y/C image signals are supplied through a common SCART socket.

4. Method in accordance with one or more of the Claims 1 to 3, characterised in that, upon the detection of the presence of additional items of information, a corresponding identification code in the image signals is evaluated or the image signals themselves are evaluated.

5. Method in accordance with one or more of the Claims 1 to 4, characterised in that, the image signal recording device is an S-VHS or Hi-8 video recorder.

6. Apparatus for a method in accordance with one or more of the Claims 1 to 5 which is provided with a detector circuit (32) for detecting the type of image signals, with a first partial decoding device (38) which contains a Nyquist filter (381), a V-T



demodulator (382) and a low pass filter (383), with a chrominance demodulator (35) and with switch means (33, 34, 36) which are controlled by the detector circuit and which:

- in the case of FBAS or Y/C image signals without additional items of information, supply the image signals to a standard processing device (FBAS_{ST}, Y_{ST}, C);
- in the case of FBAS image signals having additional items of information, supply these additional items of information via a first switch (33) to the first partial decoding device (38) and thereafter via an A/D converter (37) to a second partial decoding device whereby the chrominance signals are supplied via the first switch (33) to a demodulator (35) before going to the second partial decoding device;
- in the case of Y/C image signals having additional items of information, which are reproduced by an image signal recording device (S-VHS) in which the additional items of information are recorded in partially decoded form, the additional items of information are supplied via the switch means (34, 36) and the A/D converter (37) only to the second partial decoding device whereby the C image signal is supplied directly to a standard processing device (C).

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Claims

1. Method for the decoding of image signals which may comprise additional items of information in the letterbox Y format for improving the quality of the image, characterised in that, in the decoders for these image signals, the decoding is distributed over a first partial decoding device (38) and a succeeding second partial decoding device with the help of switch means (33, 34, 36) and that it is determined (32) whether the image signals contain additional items of information that are to be decoded, wherein:

- in the case of FBAS image signals having additional items of information, these additional items of information are supplied by the switch means (33, 36) to the first partial decoding device (38) and from there to the second partial decoding device and the luminance component of the image signals is supplied via a demodulator (35) or via the first partial decoding device to the second partial decoding device and the chrominance component of the image signals is supplied via the demodulator (35) to the second partial decoding device;

- in the case of Y/C image signals having additional items of information, which are reproduced by an image signal recording device (S-VHS) in which the additional items of information are recorded in partially decoded form, the additional items of information together with the luminance component of the image signals is supplied via the switch means (34, 36) only to the second partial decoding device and the chrominance signals are processed in standard manner as in the case of Y/C image signals without additional items of information,

- and wherein the second partial decoding device produces a wide image luminance signal from the luminance component of the image signals and from the corresponding partially decoded additional items of information.

2. Method in accordance with Claim 1, characterised in that, inter alia, a V-T demodulation (382) and a low pass filtering (383) are undertaken in the first partial decoding device (38).

3. Method in accordance with Claim 1 or 2, characterised in that, the FBAS and Y/C image signals are supplied through a common SCART socket.

4. Method in accordance with one or more of the Claims 1 to 3, characterised in that, upon the detection of the presence of additional items of information, a corresponding identification



code in the image signals is evaluated or the image signals themselves are evaluated.

5. Method in accordance with one or more of the Claims 1 to 4, characterised in that, the image signals recording device is an S-VHS or Hi-8 video recorder.

6. Apparatus for a method in accordance with one or more of the Claims 1 to 5 which is provided with a detector circuit (32) for detecting the type of image signals, with a first partial decoding device (38) for the additional items of information, with a demodulator (35) and with switch means (33, 34, 36) which are controlled by the detector circuit and which:

- in the case of FBAS image signals having additional items of information, supply these additional items of information via a first switch (33) to the first partial decoding device (38) and from there to a second partial decoding device wherein the luminance component of the image signals is supplied via a demodulator (35) or via the first partial decoding device to the second partial decoding device and the chrominance component of the image signals is supplied via the demodulator (35) to the second partial decoding device;

- in the case of Y/C image signals having additional items of information, which are reproduced by an image signal recording device (S-VHS) in which the additional items of information are recorded in partially decoded form, the additional items of information together with the luminance component of the image signals are supplied via the switch means (34, 36) only to the second partial decoding device and the chrominance signals are processed in a standard manner as in the case of Y/C image signals without additional items of information,

- and wherein the second partial decoding device produces a wide image luminance signal from the luminance component of the image signals and from the corresponding partially decoded additional items of information.

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