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Method for the transmission of a digital additional information item in a line of a television signal

The invention relates to a method for the compatible transmission of a digital additional information item in a line of a television signal.

Prior art

For the compatible transmission of a colour television signal in the wide-screen format 16:9 with a conventional number of lines and field frequency (future PALplus standard), it is known to use interpolation to obtain three lines in each case from four successive lines, which three lines are reproduced in conventional television receivers with the picture format 4:3 as a so-called letterbox signal.

Invention

The invention is based on the object of specifying an option for the transmission of signal type additional information items, without changing or impairing the previous occupancy of the vertical blanking interval. This object is achieved by means of the method specified in Claim 1.

In order that a wide-screen receiver can regenerate the original colour television signal from the received letterbox signal, it is necessary to transmit for the said receiver digital additional information items in the letterbox strips, which additional information items refer to the original picture content. Since both conventional signals and letterbox signals are transmitted at least in a transition period on existing television channels, each signal type must be able to be identified by a suitable identifier. Further identifiers relate to the origin of the source signal (video camera or film scanner) and to evidence concerning the presence of movements in the picture content. Corresponding identification signals (status bits) must be transmitted as signal type additional information items.

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Since all of the said signal type additional information items (PALplus additional information items) are correlated exactly with the associated picture content, they must be transmitted in a manner rigidly coupled with the picture signal. However, there are no free lines available for this in the vertical blanking interval in the present PAL standard. For example, in Germany line No. 16 (data line) is occupied by VPS signals and other control signals specific to broadcasting. Line Nos. 17, 18 and 19 are occupied by test signals. Teletext is transmitted in line Nos. 11 to 15 and Nos. 20 to 21. Line No. 22 is reserved for signal-to-noise ratio measurements. Different allocations are used in other European countries. Out of consideration for the synchronization properties of older television receivers, line Nos. 1 to 10 cannot (yet) be occupied by additional signals.

A 16:9 receiver for letterbox signals (PALplus receiver) should advantageously be able to distinguish between the following compatible television signal types:

a) standard signals;
b) letterbox signals not having any additional information items;
c) letterbox signals having additional information items;
d) source signal of interlaced scanning (camera);
e) source signal of film scanning ("progressive" original);
f) static or dynamic picture content.

In order to be able to make this decision reliably and select decoding and reproduction accordingly, it is advantageous if a corresponding identifier is transmitted at the transmitter end. This signal type identifier should be standard throughout Europe. Such a signal type identifier can advantageously be transmitted in a compatible manner at locations in the composite colour video signal which are used equally irrespective of the respective standard.

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In principle, the purpose of the method according to the invention is to transmit a signal type additional information item in a compatible manner in lines of a television signal; in the said method according to the invention, this signal type additional information item is formed by a data packet having initial incoming information data, start information data and useful information data, at the receiving end the initial incoming information data serving for the recovery, in the correct phase, of the data clock of the useful information data and the start information data serving for the addressing of the useful information data and for the selective detection of the beginning of the useful information data, and the data packet is transmitted in that half of the first or last active picture line of the television signal which is free from picture signals, the line half which is occupied by data being selected in improved 16:9 receivers and the signal type additional information item which is contained in the said line half being evaluated.

Advantageous developments of the method according to the invention emerge from the associated dependent claims.

Drawings

Exemplary embodiments of the invention are described with reference to the drawings, in which:

Figure 1 shows a diagram of the signal occupancy in the vertical blanking interval of a PAL colour television signal;

Figure 2 shows a block diagram of a signal limiter stage of a 16:9 receiver for the digital signal type additional information items transmitted according to the invention;

Figure 3 shows a detail of the occupancy of a picture-content-free television line having a conventional data signal;

Figure 4 shows a detail of the occupancy of a picture-content-free television half-line having a data

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signal constructed according to the invention;

Figure 5 shows a block diagram of a circuit detail at the receiver end for error detection within the received digital signal type additional information item transmitted according to the invention.

Exemplary embodiments

The diagram according to Figure 1 illustrates the present signal occupancy of the vertical blanking interval of the first field of a PAL colour television signal in Germany, the numbers of the relevant television lines being plotted along the abscissa of the diagram. As is evident from this, the first half of line No. 23 is provided for occupancy by the PALplus signal type data. A reflection measurement signal 101 is transmitted in line No. 10 and source data 102 are transmitted in line No. 16. Line No. 17 is a source test line and line Nos. 18 and 19 are section test lines 104. Line No. 22 serves for section noise measurement 105 and the lines marked with FT can transmit television text.

The useful information data of the PALplus signal type data 106 are structured in the form of a plurality of data packets. Initial incoming information data and start information data precede the first data packet. The initial incoming information data serve for the recovery, in the correct phase, of the data clock of the useful information data in the receiver. Eight sinusoidal oscillations are considered, for example, as initial incoming information data of conventional data signals, only three of which sinusoidal oscillations are illustrated in Figure 3. The sinusoidal oscillations synchronize, in particular, a PLL circuit (Phase Locked Loop) in the 16:9 receiver. A more detailed description of the initial incoming information data of the PALplus signal type data according to the invention will be given later.

The start information data serve for the addressing of the useful information data and for the selective detection of the beginning of the useful

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information data in the receiver. The 16:9 receiver detects the appearance of a defined identifier, which is represented by the start information data. As soon as the receiver ascertains the sought-after identifier in the received signal, it can take up and process the following useful information data in the correct phase.

The useful information data are biphase-coded, for example, which affords the advantage of a simple code-inherent error protection. Furthermore, the signal is free from DC voltage, which is favourable for magnetic recording. In order to increase the error protection, the useful information data can be transmitted with increased redundancy, for example in such a way that the non-inverted signal waveform and the inverted signal waveform of each data packet are transmitted sequentially, as will be explained with reference to Figure 5.

Figure 2 shows the diagrammatic structure of the signal limiter stage of a receiver for the PALplus signal type data. At its analog input, the limiter 23 receives a video signal 201, which receives PALplus signal type data signals in the time intervals provided therefor. The arriving video signal is compared in the limiter 23 with a reference voltage Uref, which is present at a second input of the limiter 23. From the picture signal component of the arriving video signal, the limiter generates a "digital" random signal, which is suppressed during the following evaluation. Only the data signal component in the arriving video signal, which data signal component is processed by the limiter 23, is of interest for the evaluation. If the amplitude of the data signal contained in the video signal is greater than the reference voltage Uref, then the output voltage of the digital signal output 202 corresponds to the logic state "high". On the other hand, if the amplitude of the data signal is smaller than the reference voltage Uref, then the output voltage of the digital signal output 202 corresponds to the logic state "low". Since error-free limiting of the data signal depends exclusively on the reference voltage Uref, careful rating of the appropriate assemblies is

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particularly important. For this purpose, the video signal is likewise fed to a first peak voltmeter 21, which supplies the maximum signal amplitude Umax of the video signal 201 at its output with a time delay. A second peak voltmeter 22, to which the video signal 201 is likewise fed, operates in a similar manner. The minimum signal amplitude Umin of the video signal 201 is present at the output of the second peak voltmeter 22 with a corresponding time delay. The best possible limiting of the data signal contained in the video signal exists when the reference voltage Uref is 50% of the sum of the maximum and minimum amplitudes of the video signal. The reference voltage Uref is generated by a generator 24, to whose inputs the maximum signal amplitude Umax and the minimum signal amplitude Umin are fed. The reference voltage Uref is provided at the output of the generator 24 and it has a level of (Umax + Umin)/2 for a data signal in the steady-state condition.

Every time the amplitude of the video signal 201 changes, transient processes take place in the peak voltmeters 21 and 22, which transient processes are illustrated in Figure 3 and Figure 4 for data signals having different initial incoming information data.

Figure 3 shows the profile of the initial incoming information data which are usually used in data signals. The voltage profile of the maximum signal amplitude Umax is illustrated in curve A, while curve B illustrates the profile of the minimum signal amplitude Umin. Curve C shows the profile of the reference voltage which is obtained from the maximum and minimum signal voltages. It is evident that an optimum reference voltage is not available until after the time interval T1. Since the reference voltage determines the cut-off threshold of the limiter 23, it is not possible, in the event of signal type data signals subject to interference, to attain error-free conversion into digital signals during the interval T1. In contrast to this, in Figure 4, the initial incoming information data are preceded by a pulse which has a duration T2, whose level corresponds to the

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maximum amplitude Umax of the data and whose width encompasses a multiple of the clock period of the data. The function of the first peak voltmeter 21 is influenced by this pulse in such a way that the optimum reference voltage Uref is already reached after a significantly shorter time interval T2. In this way, the limiter 23 of the data receiver already operates in an optimum manner right at the beginning of the transmission of the actual initial incoming information data.

Figure 5 shows a simple arrangement for identifying transmission errors during the evaluation of serial data signals whose data packets are transmitted, in the manner mentioned above, in each case in the form of the non-inverted signal waveform and the inverted signal waveform. The arrangement shown contains a delay circuit 51, whose signal delay T corresponds to the time interval which is required to transmit a data packet. A non-inverted signal and an inverted signal of a data packet 501 are in each case present at the same time and in the correct phase at the inputs of an adding stage 52 downstream of the delay circuit 51. During the time interval for the transmission of associated data packets, it is consequently possible to carry out simple error checking in each case during the second half of the transmission period, since no signal appears at the output 502 of the adding stage 52 during this period in the event of error-free data signals being transmitted. If additional error protection measures, for example biphase coding, are also implemented in the data packets, appropriate correction mechanisms can be employed in the event of error signals appearing at the output 502 of the adding stage 52.

The signal type identifier must satisfy a number of criteria in order to ensure compatibility with conventional receivers. There must be no adverse effect on the synchronization, the colour demodulation or the clamping of conventional receivers. These boundary conditions are satisfied if the identification signal is embodied as a digital data signal with coding which is

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free from a DC voltage value, and if the data rate is less than the colour subcarrier frequency, for example 1 Mbit/s.

On account of the narrow-band nature of the colour PLL of conventional receivers, the colour demodulation and reproduction are not adversely affected in this case.

If a standard PAL signal with letterbox strips is received by a 16:9 receiver, the signal type identifier permits the actuation of a format changeover, which results in a full-format display without letterbox strips.

A differentiation of letterbox signals having additional information items is advantageous since, depending on the source (film or camera), different processing algorithms are envisaged for the chrominance in future 16:9 receivers (PALplus). These processing types can then be addressed directly via the signal type identifier.

Cinema films transmitted by television systems can have different source picture formats. The letterbox strips accordingly have different widths. It is now likewise possible to include different letterbox formats in the signal type identifier and to transmit an identifier signal as a format helper. In the event of the transmission of standard PAL signals with letterbox according to b), this format helper then results in a full-format display on the 16:9 receiver by means of a corresponding change in the vertical deflection amplitude or corresponding digital processing.

For recording letterbox PAL signals of type d) or e) on S-VHS or Hi8 recorders according to PCT/EP91/00676 and DE 41 11 979, it is expedient to use an additional signal type identifier to indicate that a previously recorded letterbox PAL signal is being passed to the 16:9 receiver for display. This signal type identifier can advantageously be keyed into the composite colour video signal following reproduction by the tape. It is thereby indicated to the receiver that the partial decoding, carried out for the recording, of the letterbox PAL signals having additional information according to

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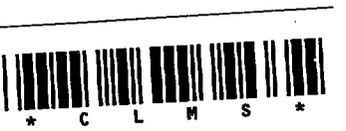
PCT/EP91/00676 and DE 41 11 979 has already been carried out.

The solutions according to the invention for the transmission of identifier signals are equally applicable in NTSC and SECAM systems.

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Patent Claims

1. Method for the compatible transmission of an additional information item (16) [sic] in lines of a television signal which do not belong to the vertical flyback, the additional information item being evaluated in improved receivers, characterized in that a data packet containing initial incoming information data, start information data and useful information data is transmitted as additional information item in that half of the first or last active picture line of television pictures which is free from picture signals, at the receiving end the initial incoming information data serving for the recovery, in the correct phase, of the data clock of the useful information data and the start information data serving for the addressing of the useful information data and for the selective detection of the beginning of the useful information data, and the additional information item indicating at least two of the following television signal types:

- standard signal (no letterbox, no additional picture information items);
- letterbox signal not having any additional picture information items;
- letterbox signal from a film source having additional picture information items;
- letterbox signal from a camera source having additional picture information items, in particular with a differentiation between field or frame picture contents which are regarded as static and as moving.

2. Method according to Claim 1, characterized in that the initial incoming information data are preceded by a pulse whose amplitude corresponds to the maximum level (Umax) of the data and whose width encompasses a multiple of the clock period of the data.

3. Method according to Claim 1 or 2, characterized in that the useful information data are transmitted in such a way that the non-inverted signal waveform and the

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inverted signal waveform of each data packet (501) are transmitted sequentially, and in that the associated non-inverted signal waveform is added (52) to each inverted signal waveform at the receiving end in order to determine transmission errors, a resultant signal sum that is not equal to zero indicating a transmission error.

4. Method according to one or more of Claims 1 to 3, characterized in that the coding which is selected for the additional information item is one which is free from a DC voltage value and has a data rate which is less than that of the colour subcarrier frequency.

5. Method according to one or more of Claims 1 to 4, characterized in that the additional information item indicates different letterbox formats.

6. Method according to one or more of Claims 1 to 5, characterized in that, during the reproduction of letterbox television signals stored on picture recording devices, an additional information item is keyed into the television signal and is such that it indicates that the letterbox additional information items have already been partially decoded during storage of the television signals.

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