Television programmes from private suppliers which are financed by viewers' subscriptions can be displayed in coded form in order to exclude viewers who are not entitled to view them. For reception special decoders are necessary which are made available by the programme supplier for a corresponding fee. These decoders can for example evaluate an identification sign present in the video signal and only when this identification sign is recognised is the decoder released so that the received television picture is displayed in decoded form. In practice there is a problem in recognising the identification sign clearly in the event of interference in order to enable decoding of the programme for those entitled to view but to lock out the decoder in the absence of the identification sign.

In US-A 4 319 273, instead of the synchronous pulse signal portions inserted into a video signal are detected on the part of the receiver by means of correlation with stored reference values. Then the standard synchronous pulses are re-inserted in the receiver.

In DE-C-3 432 653 those picture portions which have not altered with time are determined by means of correlation. Substitute data are then transmitted for these picture portions.

EP-A-0 106 534 describes a pattern recognition, but in this case transmission channel disturbances play no part.

The object of the invention is to provide a method and device which facilitate the recognition of the identification sign even in the case of disturbed signals.

This object is achieved by the method according to Claim 1 and by the device according to Claim 5.

The method and the device according to the invention allow disturbances within certain limits, such as can occur with poor transmission paths or due to disturbances infiltrating into the transmission path. The recognition is negative only when the disturbances reach a level at which a reliable statement is no longer possible as to whether the identification sign or a similar signal is present.

Further developments and advantageous embodiments are revealed in the further description and the drawings.

The invention will be explained in greater detail with the aid of the drawings.

Figures 1a, b show as an example an identification sign as well as the area which this occupies on a display screen,

Figure 2 shows a block diagram for calculation of a

correlation function,

Figure 3 shows an embodiment for a logic circuit from the block diagram of Figure 2,

Figures 4a, b show a complete block diagram for evaluation of an identification sign,

Figure 5 shows the curve resulting from the correlation function in the undisturbed case and in the disturbed case,

Figure 6 shows a table of the values calculated with the correlation function and

Figure 7 shows a flow diagram for evaluation of the tables.

The identification sign shown in Figure 1a is a letter "C" with a "+" sign. The size of the identification sign in Figure 1b takes approximately 40 lines with in each case sixty picture points. That gives 2400 picture points. During recognition only the luminance signal is evaluated. The principle consists of comparing the picture content with the content of a store.

Correct recognition of the identification sign can be disrupted by the following influences:

- variations in the amplitude
- spurious signals
- variations in the phase.

Protection against amplitude disturbances can be effected by transmission of one or two white lines per field for controlling a gain control. Another possibility consists of detecting a signal in a window, in which case for example a total of four windows can be provided. A third possibility consists of offering a high-contrast luminance signal.

Protection against disturbances can be effected by analogue low-pass filters and/or by awaiting an event in a window, or by calculation of a correlation function of the received signal in comparison to a reference signal.

Protection against alterations of phase consists of allowing few alterations in the video signal, a clock could then be used for synchronisation or - as in the aforementioned case - the calculation of the correlation function of the signal could be carried out with a reference signal.

A correlation function suitable for the correlation of two different signals is represented by the following mathematical expression:

$$f_{xy}(k) = \lim_{K \to \infty} \frac{1}{2K} \sum_{-K}^{K} x(i)\ y(i+k)$$

This formula shows that each point of the correlation function represents the sum of the product of a pair of picture points at a given phase value between the different signals. The maximum value is obtained when both signals have the same phase.

A suitable correlation circuit is shown in Figure 2. Digital signals quantised with n bits which are to be combined with reference values stored in a store 2 are supplied to the correlation circuit by way of an input terminal 1. The circuit includes a shift register 3 which contains a number of D-type flipflop stages D0-D14 into which the signals, that is to say the 15 points to be examined, are entered serially. Therefore the number of D-type flipflop stages corresponds to the number of points per picture line. The number of reference values stored in the store 2 for each line also amounts to 15.

From the input of each D-type flipflop stage D0-D15 and from the outputs of the store 2 conductors lead to a logic connection circuit arrangement 4 with logic circuits M0-M14. The number n of conductors corresponds to the number n of bits with which each picture point is quantised. The logic circuits M0-M14 can be multiplication circuits and indeed in the simplest case can be antivalence circuits. From the output of the logic circuits M0-M14 further conductors lead to a storage arrangement 5 of D-type flipflops and from there to a summation circuit 6. The correlated values are added up in the summation circuit 6. In the absence of conformity of the signals the value 0 is produced, in the event of complete conformity the value is 15 per bit and picture point.

The output of the summation circuit 6 is connected to an intermediate store 7 in which the sums for each line to be examined can be stored temporarily. According to the number n of bits which are used for determining each picture point, 4 x 2 x n conductors are necessary at the output of the summation circuit 6.

Figure 3 shows an embodiment of the logic circuits M0-M14 in which the three bits per picture point are correlated. The logic circuit here is formed by an antivalence circuit with three exclusive OR gates 8 as well as one AND gate 9.

Figure 5 shows a complete block diagram for evaluation of an identification sign. The analogue video signal, particularly the luminance signal LS, is passed through a low-pass filter 10 the limiting frequency of which is such that four picture points and two succeeding lines result in one point of a line to be evaluated. Then, using a comparator 11 to which a reference voltage Ref1 is supplied, the video signal is quantised so that a point is described by one bit. The comparator 11 is followed by a shift register 3 of 15 D-type

flipflops D0-D14, and in contrast to Figure 2 the signals are tapped at the outputs. The correlation is carried out with reference values which are stored in the store 2. In the connection circuit arrangement 4 equivalence elements are provided in the form of exclusive OR gates M0-M14 to which both the output signals of the D-type flipflops D0-D14 of the shift register 3 and also the outputs of the store 2 are supplied. The outputs of the exclusive OR gates M0-M14 lead to a summation circuit 6 and from there to a store 12.

Within the store 12 the storage locations form a matrix in which the correlated values of 15 points extending horizontally and 20 lines extending vertically are stored in the form of four-bit words in each case. In the event of in-phase conformity between the digital input signal LS and the virtual reference signal formed by the sequence of reference values a maximum is produced for each line in the centre. The analogue representation of a line in the event of freedom from disturbance is represented in Figure 4a by the narrow curve. When disturbances are present the bell-shaped curve shown in Figure 4b is produced.

In order to be able to distinguish a correct but disturbed identification sign from an incorrect identification sign, a threshold can be entered as a distinguishing criterion into the bell-shaped curve, the value 1 being assigned to the values of the bell-shaped curve above this threshold and the value 0 to those below it. This occurs for each horizontal line of the matrix by means of a comparator 13. This comparator is supplied in succession with the correlated values from the store 12 by way of a first input and with the threshold as Ref2 by way of a second input.

By means of the threshold the matrix is graphically divided into three zones Z1, Z2, Z3, as shown in Figure 6. In this matrix with the threshold in the correct position there would have to be only zeros in the two outer zones Z1 and Z3 and only ones in the central zone Z1. However, in practice this is not always the case, for example if due to phase and/or amplitude disturbances of the signal reproducing the identification sign it deviates greatly from the reference signal. In this case ones can also occur in the outer zones Z1 and Z3, whilst zeros can be present in the central zone Z1.

At an error rate of for example 20% of the values present in the zones Z1, Z2 and Z3 the identification sign should still be regarded as correctly recognised. The following summation circuit 14 with the connected retarding circuit 15 and the comparator 16 serves for evaluation of this error rate. From the output of the retarding circuit 14 there is a feedback to the summation circuit 14. The values of the correlated values, which are quantised as "1" or "0" taking account of the bell-shaped curve, are added up for each line

in succession and the result is supplied to the further comparator 16. Allowing a 20% error rate the reference value Ref3, which is supplied to the comparator 16, is then fixed 20% below the maximum value which would be produced in an error-free video signal of the identification sign. Then finally, the state at the output of the comparator 16 is crucial for recognition or non-recognition of the identification sign. Thus with the output signal of the comparator 16 a subsequent decoder (not shown) can be controlled which upon recognition of the identification sign releases the decoder and locks the decoder out if the identification sign is not recognised. Thus the decoder makes it possible to decode the remaining encoded video signal so that the viewer can follow the programme satisfactorily.

In Figure 7 the evaluation operation carried out by the last mentioned circuit parts of the summation circuit 14, the retarding circuit 15 and the comparator 16 is illustrated in the form of a flow diagram. Here the zones Z1, Z2 and Z3 are checked in three steps, the identification sign being evaluated as recognised when the sum conditions are met and as not recognised when these conditions are not met.

Claims

1. Method of recognition by a receiver of a fixed signal portion (Figure 1) included at source in a video signal by means of a line-by-line correlation (4) of this fixed signal portion with reference values stored in the receiver, characterised in that:

- the fixed signal portion consists of a group of line sections of the part of the video signal which is visible on a screen, the said line sections being arranged one below the other;

- the luminance portion (LS) of the line sections of this fixed signal portion is quantised in picture point values (11);

- these picture point values are correlated (3, 4, 6) with the stored (2) reference values, wherein the individual results of correlation within each line section and for all line sections of the group in each case form a matrix (Figure 6) and are compared (13) with a threshold value (Ref2) in order to divide the matrix into three column groups (Z1, Z2, Z3);

- the values within each of these column groups are added up (14, 15);

- the three resulting values are each compared (16) with a further threshold value (Ref3) to form error rates;

- when the error rate for each of the column groups resulting from the comparison with the further threshold value meets a particular criterion the presence of the fixed signal portion (Figure 1) is assumed.

2. Method according to Claim 1, characterised in that the quantisation is a 1-bit quantisation (11, Ref1).

3. Method according to Claim 1 or 2, characterised in that the fixed signal portion is a transmitter identification sign (Figure 1a), particularly with 60 picture points in the line sections and 40 line sections.

4. Method according to one or several of Claims 1 to 3, characterised in that the fixed signal portion is low-pass filtered (10) before the quantisation so that a picture point for the quantisation is formed from each four successive picture points of each two successive line sections.

5. Device for recognition by the receiver of a fixed signal portion (Figure 1) included at source in a video signal by means of a line-by-line correlation (4) of this

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fixed signal portion with reference values stored (2) in the receiver, characterised by:

- quantising means (11) for producing picture point values from the luminance portion (LS) of line sections of this fixed signal portion, the fixed signal portion consisting of a group of line sections of the part of the video signal which is visible on the screen, the said line sections being arranged one below the other;

- correlation means (3, 4, 6) which correlate these picture point values with the reference values stored in the storage means (2), wherein the individual results of correlation within each line section and for all line sections of the group form a matrix (Figure 6) which is stored temporarily, and wherein the results of correlation read out of the intermediate store are compared in each case in comparator means (13) with a threshold value (Ref2) in order to divide the matrix into three column groups;

- summation means (14, 15) which add up the values in this matrix within the three column groups (Z1, Z2, Z3);

- further comparator means (16) which compare each of the three results of the summation with a threshold value (Ref3) in order to form error rates.

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