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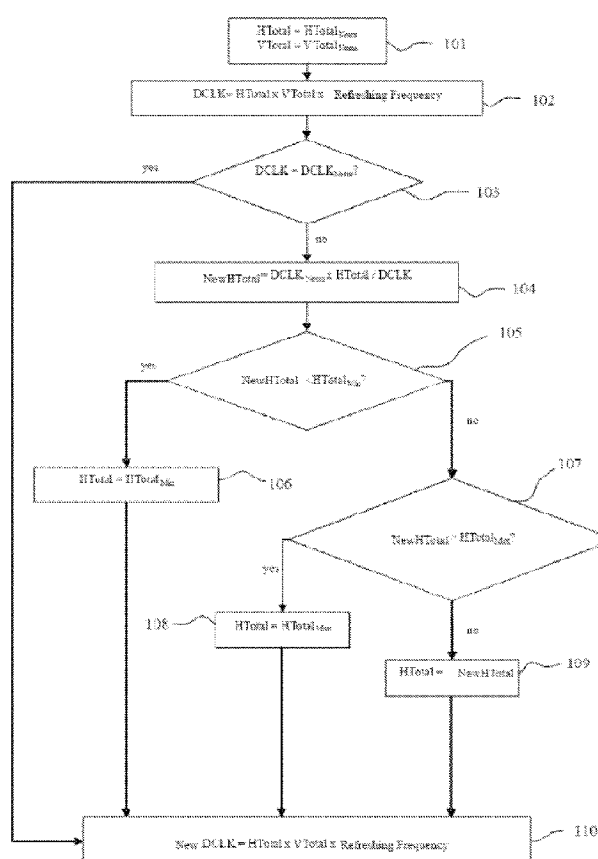
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(54) Title: A RECEIVER AND A CONTROL METHOD



(57) Abstract: The present invention relates to a receiver (1) and a control method wherein DLCK signal is brought to the desired values by automatic adjustment of at least one of the horizontal and vertical pixel numbers (HTotal, VTotal) in the video signal, and thus panels with various resolutions of various manufacturers are easily used.



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Description

A RECEIVER AND A CONTROL METHOD

[1] Field of the Invention

[2] The present invention relates to a receiver and a control method, which carry out automatic adjustment of components related to a video signal.

[3] Prior Art

[4] In devices comprising new generation flat panel displays such as LCD or Plasma, video information is transmitted to the panel digitally via serial communication method. The signal used in synchronization of this communication is called Dot Clock (DCLK). Frequency of DCLK signal is obtained by multiplication of the total number of pixels (dot) sent to the panel and the refresh frequency (F). Total pixel number transmitted to the panel includes total horizontal pixel number (HTotal) and total vertical pixel number (VTotal). Accordingly, frequency of DCLK signal is calculated according to the following formula:

[5]
$$DCLK = HTotal \times VTotal \times F$$

[6] HTotal, which is one of the values used in calculating DCLK frequency, comprises synchronization information together with the horizontal pixel number. For that reason HTotal is greater than the horizontal pixel resolution of the panel. VTotal is also greater than the vertical pixel resolution of the panel, since it also comprises synchronization information together with the vertical pixel number. F denotes how many times the image on the panel is refreshed in a second. This frequency can have different values such as 50 Hz in PAL systems and 60 Hz in NTSC systems.

[7] Minimum, normal and maximum values of HTotal, VTotal and DCLK variables are supplied by panel manufacturers. The said values which are designated by the panel manufacturers also specify the DCLK range at which the device will operate in a normal manner. In cases where the broadcast is PAL or NTSC, in order not to encounter any problems, maximum and minimum values of number of horizontal and vertical pixels (HTotalmax, HTotalmin, VTotalmax, VTotalmin) are adjusted such that minimum DCLK value (DCLKmin) and maximum DCLK value (DCLKmax) are maintained within a certain range. Accordingly the following conditions should be fulfilled:

[8] $HTotalmin \leq HTotal \leq HTotalmax$

[9] $VTotalmin \leq VTotal \leq VTotalmax$

[10] $DCLKmin \leq HTotal \times VTotal \times 50$

[11] $DCLKmax \leq HTotal \times VTotal \times 60$

[12] It will be understood from the DCLK formula that DCLK values of panels with the same resolution may be different depending on the required synchronization in-

formation or use of systems (PAL, NTSC) with different refresh frequencies (F). In this case, when the panel is used in a broadcast system different from the designated system, DCLK value can exceed the specified range and this may cause occurrence of undesirable effects on the video image. For example in the case that the normal HTotal and VTotal values (HTotalNorm, VTotalNorm) supplied by the panel manufacturers are determined according to 60 Hz refresh frequency (F), DCLK, which is obtained when the panel is used with the said HTotalNorm and VTotalNorm values at 50 Hz refresh frequency (F), is smaller than DCLKMin. In other words, when watching a broadcast from a PAL source, while HTotalNorm and VTotalNorm values designated according to the NTSC system, DCLK falls below the lowest required value and noise occurs in the image.

- [13] The Japanese patent document No. JP8160907, an application within the state of the art, discloses a method and a device for automatic building of DCLK. According to this method, optimum delay is produced in the DCLK signal by using a micro-processor, analog-digital converters and delay circuits, and a proper video image is acquired.
- [14] The USA patent document No. US6515708, an application within the state of the art, discloses a method which relates to obtaining DCLK by dividing the clock signal received from the oscillator.
- [15] As it is often not possible to provide the above described conditions in the panels, DCLK value may be smaller than DCLKmin in PAL broadcasts, and greater than DCLKmax in NTSC broadcasts. Furthermore, in cases where frequency propagation range is changed via SSC (spread spectrum clocking) technique which is known as spreading the energy in a certain frequency range in the frequency domain, the probability of the DCLK value exceeding the foreseen range is more. Noise and similar problems are encountered in some devices since DCLK diverges from the predefined specifications of the panel as a result of these deviations.
- [16] A possible solution for reducing these problems is to determine two different HTotal or VTotal values for PAL and NTSC broadcasts and to use these values in the panel software. However, it is also required to control during panel adaptation that these fixed values satisfy the conditions set forth above for DCLK.
- [17] The applications within the state of the art do not provide an effective solution for all of the problems stated above, against the DCLK frequency which varies according to the panel or broadcast used.
- [18] Summary of the Invention
- [19] The objective of the present invention is to realize a receiver and a control method wherein DCLK value is maintained at a level suitable for the broadcast and formation of undesirable effects on the image are prevented.

- [20] Another objective of the present invention is to realize a receiver and a control method which do not require a separate calculation in each panel for DCLK, can calculate the DCLK value suitable for all panels by means of a single algorithm and thus facilitate adaptation of new panels.
- [21] A further objective of the invention is to realize a receiver and a control method which eliminate image distortions and incompatibilities originating from the fact that refresh frequencies are different in various broadcast systems (PAL, NTSC, etc.).
- [22] The inventive video signal receiver comprises a controller which enables that the horizontal and vertical pixel numbers (HTotal and VTotal) in the video signal are automatically adjusted according to the broadcast received. When there is a deviation in the DCLK, the said controller changes the VTotal and/or HTotal in proportion to the amount of change ($DCLK_{Norm}/DCLK$) in the DCLK value in order to bring DCLK to its normal value ($DCLK_{Norm}$) or to its normal value range ($DCLK_{min}$ - $DCLK_{max}$); makes DCLK equal to $DCLK_{Norm}$ if the NewVTotal and NewHTotal values obtained as a result of the change are within the minimum and maximum limits determined for VTotal and HTotal; and if NewVTotal and NewHTotal values are not within the said limits, pulls these values within the limits and brings DCLK to the normal value range ($DCLK_{min}$ - $DCLK_{max}$) and thus minimizes the image distortion.
- [23] With the inventive receiver and method, it is ensured that the receiver operates in the DCLK range ($DCLK_{min}$ - $DCLK_{max}$) defined according to the panel specifications or in the most suitable DCLK value ($DCLK_{Norm}$) and that a high quality image is attained by performing the required adjustments on one or both of the horizontal total pixel number (HTotal) and vertical total pixel number (VTotal) values of the video signal. After deviations from the normal value are determined in DCLK, the required adjustments are performed on the HTotal and/or VTotal pixel numbers in order to bring this signal value to its normal level ($DCLK_{Norm}$) or to the normal value range ($DCLK_{min}$ - $DCLK_{max}$).
- [24] In an embodiment of the invention where adjustments are made on the horizontal total pixel number (HTotal), the video signal receiver calculates a new value for the horizontal pixel number (HTotal) and uses maximum ($HTotal_{max}$) and minimum ($HTotal_{min}$) values of the horizontal pixel number as the maximum and minimum values of the pixel number.
- [25] In an embodiment of the invention where adjustments are made on the vertical total pixel number (VTotal), the video signal receiver calculates a new value for the vertical pixel number (VTotal) and uses maximum ($VTotal_{max}$) and minimum ($VTotal_{min}$) values of the vertical pixel number as the maximum and minimum values of the pixel number.
- [26] In the case that both pixel numbers (HTotal and VTotal) are controlled together and

that new values (NewHTotal and NewVTotal) are calculated for each of them and these values are used in determining DCLK, the DCLK signal is brought to the value of DCLKNorm.

- [27] In an embodiment where both horizontal and vertical pixel numbers (HTotal and VTotal) are used as the pixel number, the video signal receiver calculates a new value (NewHTotal and NewVTotal) for each of these pixel numbers, and uses the maximum (HTotalmax) and minimum (HTotalmin) values of horizontal pixel number for the maximum and minimum values of horizontal pixel number and the maximum (VTotalmax) and minimum (VTotalmin) values of vertical pixel number for the maximum and minimum values of vertical pixel number.
- [28] In the case that DCLK is calculated upon controlling only one of the values of HTotal or VTotal or that both of the pixel numbers are out of the ranges (HTotalmin-HTotalmax and VTotalmin-VTotalmax) predetermined for these numbers; the DCLK signal is brought to the normal value range (DCLKmin-DCLKmax) even if not to the DCLKNorm value, and thus the image distortion is minimized.
- [29] Detailed Description of the Invention
- [30] The receiver and control method realized to fulfill the objective of the present invention is illustrated in the accompanying figures in which,
- [31] Figure 1 is the schematic view of the inventive receiver.
- [32] Figure 2 is the flowchart of an embodiment of the inventive method.
- [33] Figure 3 is the flowchart of another embodiment of the inventive method.
- [34] Figure 4 is the flowchart of a further embodiment of the inventive method.
- [35] The components shown in the figures are numbered as follows:
- [36] 1. Receiver
- [37] 2. Controller
- [38] The inventive video signal receiver (1) comprises a controller (2) which realizes automatic adjustment of the horizontal and vertical pixel numbers (HTotal and VTotal) in the video signal according to the broadcast received (Figure 1).
- [39] The controller (2), by using the HTotal, VTotal and DCLK minimum, normal and maximum values determined by the panel manufacturer during the production process, adjusts the HTotal or VTotal value used during operation of the receiver so as to prevent DCLK from exceeding its normal value and performs adaptation of different panels to the receiver automatically. Normal value of HTotal is defined as HTotalNorm, normal value of VTotal as VTotalNorm, and normal value of DCLK as DCLKNorm and the said values express the typical values that are determined by the manufacturer and may be used in the operation of the panel.
- [40] The controller (2), by using the minimum, maximum and normal values of either HTotal or VTotal values, adjusts the HTotal and/or VTotal values so as to maintain

DCLK signal at its normal value (DCLKNorm) or between its maximum and minimum values (DCLKmin–DCLKmax). The new horizontal and vertical pixel numbers resulting from the recalculation of HTotal and/or VTotal values for adjusting DCLK signal, are called new horizontal pixel number (NewHTotal) and new pixel number (New VTotal).

- [41] The method of controlling DCLK signal by automatic adjustment of the HTotal value in the video signal in the inventive receiver (1) comprises the steps (Figure 2) of
- [42] - Making horizontal pixel number (HTotal) equal to the normal horizontal pixel number (HTotalNorm), and vertical pixel number (VTotal) to the normal vertical pixel number (VTotalNorm) (101),
- [43] - Calculating DCLK value by multiplying HTotal, VTotal and refresh frequency (F) (102),
- [44] - Comparing the calculated DCLK value with the normal DCLK value (DCLKNorm) (103),
- [45] - If DCLK value is equal to the DCLKNorm value, determining the NewDCLK value by multiplying HTotal, VTotal values and F, (110),
- [46] - If DCLK value is not equal to the DCLKNorm value, calculating the NewHTotal value by multiplying DCLKNorm and HTotal value and dividing it by DCLK (104),
- [47] - Comparing the NewHTotal and minimum HTotal value (HTotalmin) (105),
- [48] - If the NewHTotal is smaller than HTotalmin value, making HTotal equal to HTotalmin value (106),
- [49] - If the NewHTotal is not smaller than HTotalmin value, comparing the NewHTotal with the maximum HTotal value (HTotalmax) (107),
- [50] - If the NewHTotal is greater than HTotalmax value, making HTotal equal to HTotalmax value (108),
- [51] - If the NewHTotal is not greater than HTotalmax value, making HTotal equal to NewHTotal value (109),
- [52] - Determining the NewDCLK = DCLK value by multiplying the HTotal value adjusted according to any of the above given options (106, 108, 109) by VTotal and F (110).
- [53] In the preferred embodiment of the inventive method whose steps are provided above, firstly HTotal is made equal to HTotalNorm and VTotal to VTotalNorm by the controller (2) (101), then HTotal, VTotal and F are multiplied to calculate the DCLK value (102). In order to find out whether or not the calculated DCLK complies with the panel specifications, the said value is compared with DCLKNorm (103). If DCLK is determined to comply with the panel specifications, the DCLK value obtained by multiplication of the existing HTotal, VTotal values and F is used as the NewDCLK value without making any changes (110). If DCLK value is not equal to DCLKNorm value,

that is, if DCLK does not comply with the panel specifications, a new HTotal value is calculated in order to bring DCLK to a suitable (normal) value. NewHTotal value is obtained by multiplying DCLKNorm and HTotal value and dividing it by DCLK (104). Then NewHTotal is compared with HTotalmin (105); if it is determined to be smaller than HTotalmin value, HTotal is made equal to HTotalmin (106). If NewHTotal is not smaller than HTotalmin, it is compared with HTotalmax in the next step (107). If NewHTotal is greater than HTotalmax value, HTotal is made equal to HTotalmax value (108). If NewHTotal is not greater than HTotalmax value, HTotal is made equal to NewHTotal value (109). Finally, the HTotal value, which is obtained at any of the steps (106, 108, 109) given above wherein HTotal value is changed, is multiplied by VTotal and F values whereby the NewDCLK that will be used by the receiver (1) is calculated (110).

[54] The method which is comprised of the above described steps is applied whenever the specifications of the broadcasts (PAL, NTSC, etc.) received by the receiver device are changed. Accordingly, by using the standard values (minimum, maximum and normal values of HTotal, VTotal and DCLK) of the panel specified by the manufacturer and by performing the required adjustment on HTotal automatically, the device is ensured to operate with DCLKNorm signal or within the range of DCLKmin-DCLKmax. In case it is determined that the DCLK initially calculated is not equal to DCLKNorm (103), the NewHTotal, which has a value that will make DCLK equal to DCLKNorm, will be calculated with the formula of

[55]
$$\text{NewHTotal} = \text{HTotalNorm} \times \text{HTotal} / \text{DCLK}$$

[56] As it is apparent from the DCLK equation at step 2 (102), the NewHTotal value thus calculated brings DCLK to its normal DCLK value (DCLKNorm).

[57] But before using the NewHTotal value which will provide the DCLKNorm value, it is also necessary to check whether the NewHTotal complies with the panel specifications or not. For that reason, before the NewHTotal is designated as the value to be used by the receiver (1), it is checked whether this value is within the normal range or not, in other words, it is checked whether it satisfies the following condition or not:

[58]
$$\text{HTotalmin} \leq \text{NewHTotal} \leq \text{HTotalmax}$$

[59] The said control process is realized with the steps of checking whether or not NewHTotal is smaller than HTotalmin (105); if it is smaller than HTotalmin, making it equal to HTotalmin (106) and checking whether or not NewHTotal is greater than HTotalmax (107), if it is greater than HTotalmax, making it equal to HTotalmax (108). Thus, it is not diverged from the above given condition for HTotal and when a situation that violates this condition is not determined, the DCLK value used by the receiver (1) is brought to DCLKNorm.

[60] The above described embodiment of the inventive receiver (1) and control method,

discloses use of total horizontal pixel number (HTotal) as the variable changed in the video signal in order to obtain DCLKNorm value.

- [61] In another embodiment of the invention, the steps described above for HTotal to obtain DCLKNorm value are performed on VTotal and the same result is achieved. The method of controlling DCLK signal by automatic adjustment of the VTotal value in the video signal in the inventive receiver (1) comprises the steps (Figure 3) of
- [62] - Making horizontal pixel number (HTotal) equal to the normal horizontal pixel number (HTotalNorm), and vertical pixel number (VTotal) to the normal vertical pixel number (VTotalNorm) (201),
- [63] - Calculating DCLK value by multiplying HTotal, VTotal and F (202),
- [64] - Comparing the calculated DCLK value with the normal DCLK value (DCLKNorm) (203),
- [65] - If DCLK value is equal to the DCLKNorm value, determining the NewDCLK value by multiplying HTotal, VTotal values and F, (210),
- [66] - If DCLK value is not equal to the DCLKNorm value, calculating the NewVTotal value by multiplying DCLKNorm and VTotal value and dividing it by DCLK (204),
- [67] - Comparing the NewVTotal and minimum VTotal value (VTotalmin) (205),
- [68] - If the NewVTotal is smaller than VTotalmin value, making VTotal equal to VTotalmin value (206),
- [69] - If the NewVTotal is not smaller than VTotalmin value, comparing the NewVTotal with the maximum VTotal value (VTotalmax) (207),
- [70] - If the NewVTotal is greater than VTotalmax value, making VTotal equal to VTotalmax value (208),
- [71] - If the NewVTotal is not greater than VTotalmax value, making VTotal equal to NewVTotal value (209),
- [72] - Determining the NewDCLK = DCLK value by multiplying the VTotal value adjusted according to any of the above given options (206, 208, 209) by HTotal and F (210).
- [73] In the preferred embodiment of the inventive method whose steps are provided above, firstly HTotal is made equal to HTotalNorm and VTotal to VTotalNorm by the controller (2) (201), then HTotal, VTotal and F are multiplied to calculate the DCLK value (202). In order to find out whether or not the calculated DCLK complies with the panel specifications, the said value is compared with DCLKNorm (203). If DCLK is determined to comply with the panel specifications, the DCLK value obtained with multiplication of the existing HTotal, VTotal values and F is used as the NewDCLK value without making any changes (210). If DCLK value is not equal to DCLKNorm value, that is, if DCLK does not comply with the panel specifications, a new VTotal value is calculated in order to bring DCLK to a suitable (normal) value. NewVTotal

value is obtained by multiplying DCLKNorm and VTotal value and dividing it by DCLK (204). Then NewVTotal is compared with VTotalmin (205); if it is determined to be smaller than VTotalmin value, VTotal is made equal to VTotalmin (206). If NewVTotal is not smaller than VTotalmin, it is compared with VTotalmax in the next step (207). If NewVTotal is greater than VTotalmax value, VTotal is made equal to VTotalmax value (208). If NewVTotal is not greater than VTotalmax value, VTotal is made equal to NewVTotal value (209). Finally, the VTotal value, which is obtained at any of the steps (206, 208, 209) given above wherein VTotal value is changed, is multiplied by HTotal and F values whereby the NewDCLK that will be used by the receiver (1) is calculated (210).

[74] The method which is comprised of the above described steps is applied whenever the specifications of the broadcasts (PAL, NTSC, etc.) received by the receiver device are changed. Accordingly, by using the standard values (minimum, maximum and normal values of HTotal, VTotal and DCLK) of the panel specified by the manufacturer and by performing the required adjustment on HTotal automatically, the device is ensured to operate with DCLKNorm signal or within the range of DCLKmin-DCLKmax. In case it is determined that the DCLK initially calculated is not equal to DCLKNorm (203), the NewVTotal, which has a value that will make DCLK equal to DCLKNorm, will be calculated with the formula of

[75]
$$\text{NewVTotal} = \text{VTotalNorm} \times \text{VTotal} / \text{DCLK}$$

[76] As it is apparent from the DCLK equation at step 2 (202), the NewVTotal value thus calculated brings DCLK to its normal DCLK value (DCLKNorm).

[77] But before using the NewVTotal value which will provide the DCLKNorm value, it is also necessary to check whether the NewVTotal complies with the panel specifications or not. For that reason, before the NewVTotal is designated as the value to be used by the receiver (1), it is checked whether this value is within the normal range or not, in other words, it is checked whether it satisfies the following condition or not:

[78]
$$\text{VTotalmin} \leq \text{NewVTotal} \leq \text{VTotalmax}$$

[79] The said control process is realized with the steps of checking whether or not NewVTotal is smaller than VTotalmin (205); if it is smaller than VTotalmin, making it equal to VTotalmin (206) and checking whether or not NewVTotal is greater than VTotalmax (207), if it is greater than VTotalmax, making it equal to VTotalmax (208). Thus, it is not diverged from the above given condition for VTotal and when it is not determined a situation that violates this condition is not determined, the DCLK value used by the receiver (1) is brought to DCLKNorm.

[80] In a further embodiment of the invention, in controlling DCLK signal in the inventive receiver (1), both HTotal and VTotal values in the video signal are adjusted automatically and DCLK value is brought to normal DCLK value (DCLKNorm). The

- method in the said embodiment of the invention comprises the steps (Figure 2) of
- [81] - Calculating DCLK value by multiplying HTotal, VTotal and F (301),
 - [82] - Comparing the calculated DCLK value with the normal DCLK value (DCLKNorm) (302),
 - [83] - If DCLK value is equal to the DCLKNorm value, determining the NewDCLK value by multiplying HTotal, VTotal values and F, (314),
 - [84] - If DCLK value is not equal to the DCLKNorm value, calculating the NewHTotal value by multiplying DCLKNorm and HTotal value and dividing it by DCLK (303),
 - [85] - Comparing the NewHTotal and minimum HTotal value (HTotalmin) (304),
 - [86] - If the NewHTotal is smaller than HTotalmin value, making HTotal equal to HTotalmin value, and calculating the NewVTotal value by multiplying DCLKNorm and VTotal value and dividing it by DCLK (305).
 - [87] - If the NewHTotal is not smaller than HTotalmin value, comparing the NewHTotal with the maximum HTotal value (HTotalmax) (306),
 - [88] - If the NewHTotal is greater than HTotalmax value, making HTotal equal to HTotalmax value, and calculating the NewVTotal value by multiplying DCLKNorm and VTotal value and dividing it by DCLK (307).
 - [89] - If the NewHTotal is not greater than HTotalmax value, making HTotal equal to NewHTotal value (308),
 - [90] - Comparing the NewVTotal and minimum VTotal value (VTotalmin) (309),
 - [91] - If the NewVTotal is smaller than VTotalmin value, making VTotal equal to VTotalmin value (310),
 - [92] - If the NewVTotal is not smaller than VTotalmin value, comparing the NewVTotal with the maximum VTotal value (VTotalmax) (311),
 - [93] - If the NewVTotal is greater than VTotalmax value, making VTotal equal to VTotalmax value (312),
 - [94] - If the NewVTotal is not greater than VTotalmax value, making VTotal equal to NewVTotal value (313),
 - [95] - Determining the NewDCLK value by multiplying the HTotal and VTotal values adjusted according to any of the above given options (305, 307, 308; 310, 312, 313) by F (314).
 - [96] In the embodiment of the inventive method whose steps are provided above, a more effective control and adjustment can be realized on DCLK value by having the controller (2) change both HTotal and VTotal values. For this purpose, the steps until the step of comparing the NewHTotal with HTotalmin (105) of the steps given for the first embodiment are carried out. Different from the previous embodiment, in the said embodiment where HTotal and VTotal are changed together, after this step, adjustment procedures on VTotal, the second variable, are also performed. In the case that

NewHTotal is smaller than HTotalmin, when HTotal is being made equal to HTotalmin, a new value (NewVTotal) is calculated also for VTotal. NewVTotal is obtained by multiplying DCLKNorm and VTotal value and dividing it by DCLK (305). If NewHTotal is not smaller than HTotalmin, it is compared with HTotalmax in the next step (306). If NewHTotal is greater than HTotalmax value, HTotal is made equal to HTotalmax value (308), and NewVTotal value is calculated by multiplying DCLKNorm and VTotal value and dividing it by DCLK (307). It is used in calculating NewDCLK value obtained by multiplying HTotal, VTotal and F (314). If NewHTotal is not greater than HTotalmax value, HTotal is made equal to NewHTotal value (109). In the next step, NewVTotal is compared with VTotalmin (309); in the case that NewVTotal is smaller than VTotalmin, VTotal is made equal to VTotalmin and NewDLCK is calculated using the VTotal and HTotal values calculated until this step. If NewVTotal is not smaller than VTotalmin, it is compared with VTotalmax in the next step (311). If NewVTotal is greater than VTotalmax value, VTotal is made equal to VTotalmax value (308) and NewDLCK is calculated using the VTotal and HTotal values calculated until this step (314). If NewVTotal is not greater than VTotalmax value, VTotal is made equal to NewVTotal value (313) and NewDLCK is calculated using the VTotal and HTotal values calculated until this step (314).

- [97] With the inventive method, by performing the required adjustments on one or both of the horizontal total pixel number (HTotal) and vertical total pixel number (VTotal) values of the video signal, it is ensured that the said pixel numbers remain within the range suitable for the receiver (1) device and that the receiver can operate at the most suitable DCLK value (DCLKNorm) or a value close to this value. Thus, image distortions that might result from the incompatibilities in the video signal are prevented.
- [98] In the above described embodiments of the invention, the steps of comparing with the maximum and minimum values, wherein VTotal and HTotal values are brought to normal operation range (HTotalmin-VTotalmax or VTotalmin-VTotalmax) by comparing them with their maximum and minimum values, can be arranged to have any of these comparisons performed first.
- [99] In the embodiment where DCLK control is provided by changing both VTotal and HTotal in the process of controlling the normal operation range, an embodiment, where HTotal value range is controlled first, is described. In one variation of the said embodiment, the said control process (comparing the pixel number with the maximum and minimum values) is carried out first for VTotal value and then for HTotal value.

Claims

- [1] A video signal receiver (1) comprising a controller (2) which enables that the horizontal and vertical pixel numbers (HTotal and VTotal) in the video signal are automatically adjusted according to the broadcast received; characterized by a controller (2) which, when there is a deviation in the DCLK, changes the VTotal and/or HTotal in proportion to the amount of change in the DCLK value in order to bring DCLK to its normal value (DCLKNorm) or to its normal value range (DCLKmin-DCLKmax); makes DCLK equal to DCLKNorm if the NewVTotal and NewHTotal values obtained as a result of the change are within the minimum and maximum limits determined for VTotal and HTotal; and if NewVTotal and NewHTotal values are not within the said limits, pulls these values within the limits and brings DCLK to the normal value range (DCLKmin-DCLKmax) and thus minimizes the image distortion.
- [2] A video signal receiver (1) according to Claim 1 which calculates a new value (NewHTotal) for horizontal pixel number (HTotal), and uses the maximum (HTotalmax) and minimum (HTotalmin) values of horizontal pixel number for the maximum and minimum values of pixel number.
- [3] A video signal receiver (1) according to Claim 1 which calculates a new value (NewVTotal) for vertical pixel number (VTotal), and uses the maximum (VTotalmax) and minimum (VTotalmin) values of vertical pixel number for the maximum and minimum values of pixel number.
- [4] A control method for the receiver (1) according to Claim 1 or 2, characterized by the steps of
- Making horizontal pixel number (HTotal) equal to the normal horizontal pixel number (HTotalNorm), and vertical pixel number (VTotal) to the normal vertical pixel number (VTotalNorm) (101),
 - Calculating DCLK value by multiplying HTotal, VTotal and F (102),
 - Comparing the calculated DCLK value with the normal DCLK value (DCLKNorm) (103),
 - If DCLK value is equal to the DCLKNorm value, determining the NewDCLK value by multiplying HTotal, VTotal values and F, (110),
 - If DCLK value is not equal to the DCLKNorm value, calculating the NewHTotal value by multiplying DCLKNorm and HTotal value and dividing it by DCLK (104),
 - Comparing the NewHTotal and minimum HTotal value (HTotalmin) (105),
 - If the NewHTotal is smaller than HTotalmin value, making HTotal equal to HTotalmin value (106),

- If the NewHTotal is not smaller than HTotalmin value, comparing the NewHTotal with the maximum HTotal value (HTotalmax) (107),
- If the NewHTotal is greater than HTotalmax value, making HTotal equal to HTotalmax value (108),
- If the NewHTotal is not greater than HTotalmax value, making HTotal equal to NewHTotal value (109),
- Determining the NewDCLK value by multiplying the HTotal value adjusted according to any of the above given options (106, 108, 109) by VTotal and F (110).

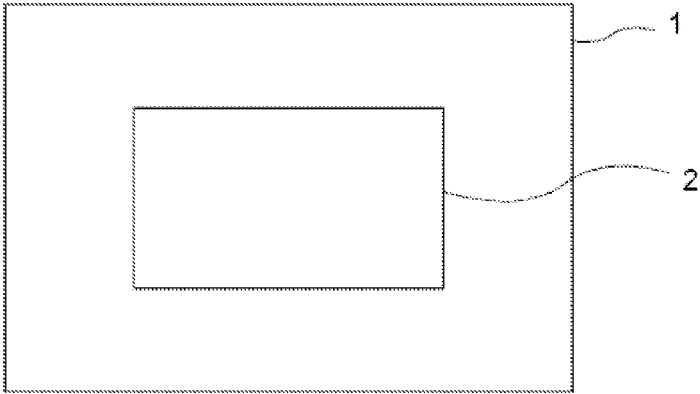
[5] A control method for the receiver (1) according to Claim 1 or 3, characterized by the steps of

- Making horizontal pixel number (HTotal) equal to the normal horizontal pixel number (HTotalNorm), and vertical pixel number (VTotal) to the normal vertical pixel number (VTotalNorm) (201),
- Calculating DCLK value by multiplying HTotal, VTotal and F (202),
- Comparing the calculated DCLK value with the normal DCLK value (DCLKNorm) (203),
- If DCLK value is equal to the DCLKNorm value, determining the NewDCLK value by multiplying HTotal, VTotal values and F, (210),
- If DCLK value is not equal to the DCLKNorm value, calculating the NewVTotal value by multiplying DCLKNorm and VTotal value and dividing it by DCLK (204),
- Comparing the NewVTotal and minimum VTotal value (VTotalmin) (205),
- If the NewVTotal is smaller than VTotalmin value, making VTotal equal to VTotalmin value (206),
- If the NewVTotal is not smaller than VTotalmin value, comparing the NewVTotal with the maximum VTotal value (VTotalmax) (207),
- If the NewVTotal is greater than VTotalmax value, making VTotal equal to VTotalmax value (208),
- If the NewVTotal is not greater than VTotalmax value, making VTotal equal to NewVTotal value (209),
- Determining the NewDCLK value by multiplying the VTotal value adjusted according to any of the above given options (206, 208, 209) by HTotal and F (210).

[6] A video signal receiver (1) according to Claim 1, which by using both horizontal and vertical pixel numbers (HTotal and VTotal) as the pixel number calculates a new value (NewHTotal and NewVTotal) for each of these pixel numbers, and uses the maximum (HTotalmax) and minimum (HTotalmin) values of horizontal

- pixel number for the maximum and minimum values of horizontal pixel number and the maximum (VTotalmax) and minimum (VTotalmin) values of vertical pixel number for the maximum and minimum values of vertical pixel number.
- [7] A control method for the receiver (1) according to Claim 6, characterized by the steps of
- Calculating DCLK value by multiplying HTotal, VTotal and F (301),
 - Comparing the calculated DCLK value with the normal DCLK value (DCLKNorm) (302),
 - If DCLK value is equal to the DCLKNorm value, determining the NewDCLK value by multiplying HTotal, VTotal values and F, (314),
 - If DCLK value is not equal to the DCLKNorm value, calculating the NewHTotal value by multiplying DCLKNorm and HTotal value and dividing it by DCLK (303),
 - Comparing the NewHTotal and minimum HTotal value (HTotalmin) (304),
 - If the NewHTotal is smaller than HTotalmin value, making HTotal equal to HTotalmin value, and calculating the NewVTotal value by multiplying DCLKNorm and VTotal value and dividing it by DCLK (305).
 - If the NewHTotal is not smaller than HTotalmin value, comparing the NewHTotal with the maximum HTotal value (HTotalmax) (306),
 - If the NewHTotal is greater than HTotalmax value, making HTotal equal to HTotalmax value, and calculating the NewVTotal value by multiplying DCLKNorm and VTotal value and dividing it by DCLK (307).
 - If the NewHTotal is not greater than HTotalmax value, making HTotal equal to NewHTotal value (308),
 - Comparing the NewVTotal and minimum VTotal value (VTotalmin) (309),
 - If the NewVTotal is smaller than VTotalmin value, making VTotal equal to VTotalmin value (310),
 - If the NewVTotal is not smaller than VTotalmin value, comparing the NewVTotal with the maximum VTotal value (VTotalmax) (311),
 - If the NewVTotal is greater than VTotalmax value, making VTotal equal to VTotalmax value (312),
 - If the NewVTotal is not greater than VTotalmax value, making VTotal equal to NewVTotal value (313),
 - Determining the NewDCLK value by multiplying the HTotal and VTotal values adjusted according to any of the above given options (305, 307, 308; 310, 312, 313) by F (314).

Figure1



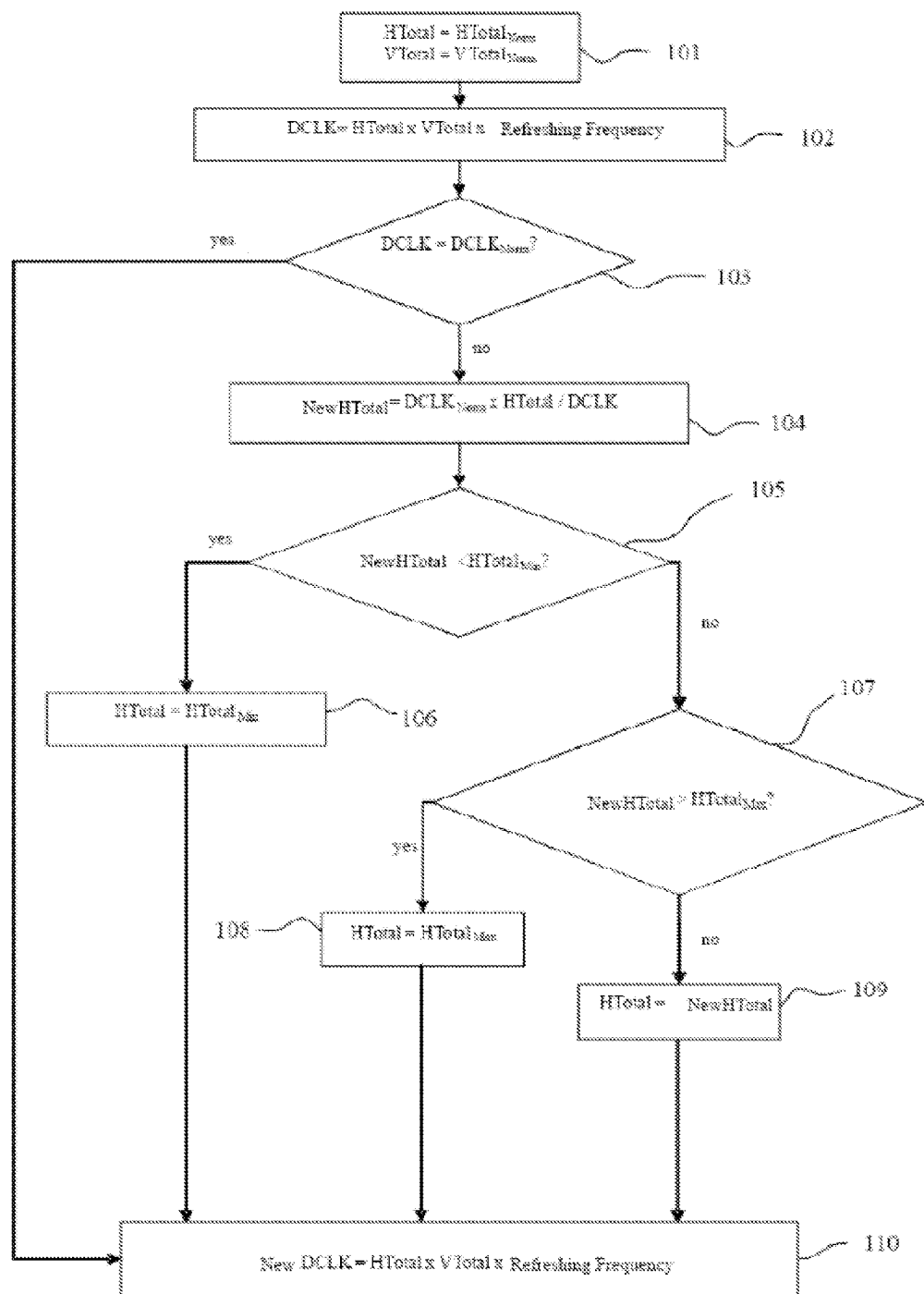


Figure 3

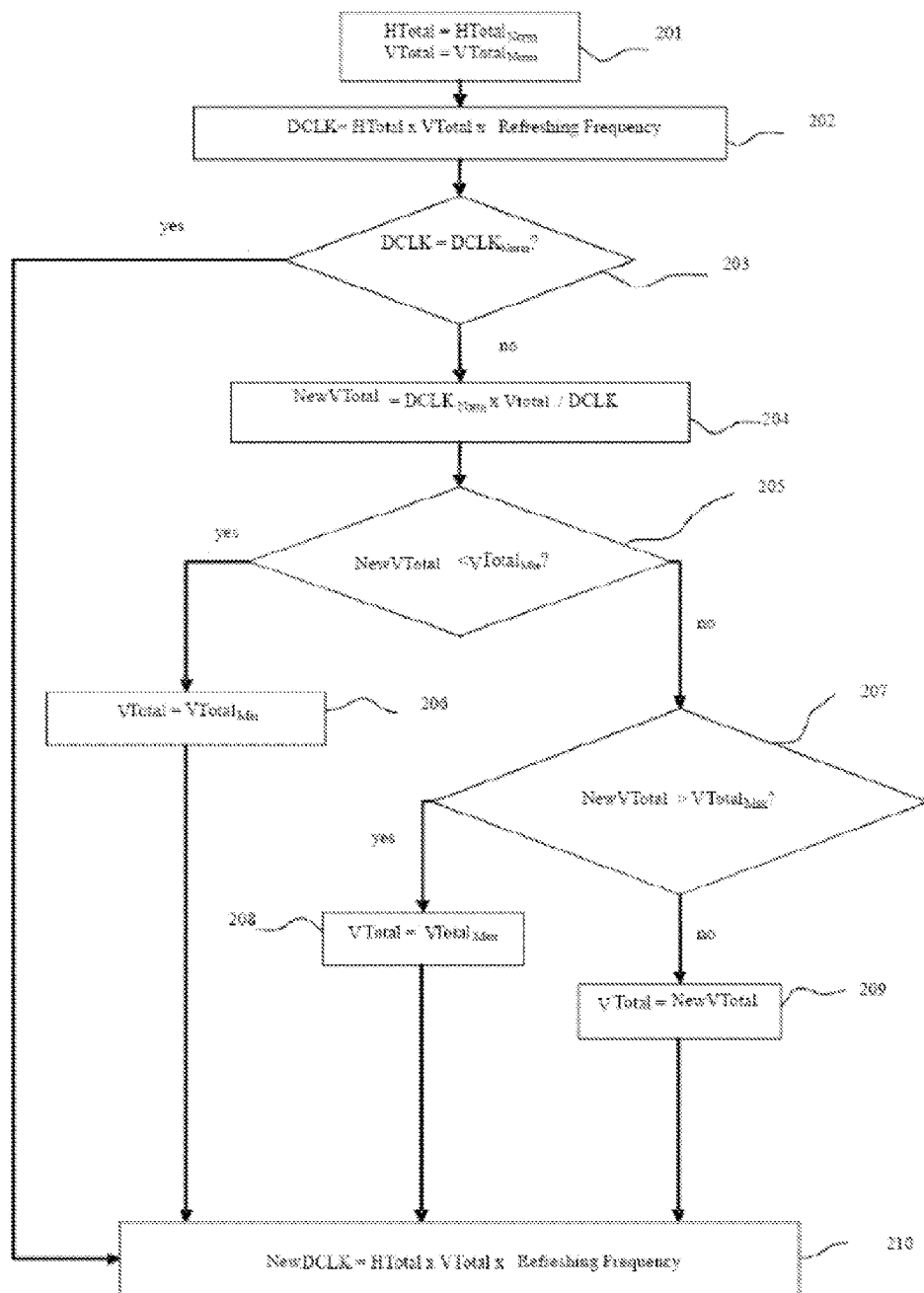


Figure 4

