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BRIGHTNESS SIGNAL/COLOR SIGNAL SEPARATING FILTER

This invention relates to a brightness signal/color signal separating filter, and more particularly to an improvement thereof which separates brightness signal and color signal from a composite television signal, of e.g. NTSC (National Television System Committee) type or PAL (Phase Alternate Line) type, in dependence upon the magnitude of detected vertical or horizontal correlative energy of said composite television signal.

FIG. 16 of the accompanying drawings is a block diagram showing an example of conventional brightness signal/color signal separating filter. In FIG. 16, the numerals respectively designates: 111, an input terminal for inputting NTSC type composite color television signal; 2, an A/D converter for converting an analog composite color television signal into a digital signal; 3 and 4, a first and a second one line delay circuits; 5, compensating delay circuit; 6, a vertical filter; 7, a band pass filter; 8 and 10, output terminals; 9, subtracting circuit.

In operation, the composite color television signal

inputted to the input terminal 111 enters the A/D converter 2, the output digital signals of which are supplied to both the first one line delay circuit 3 and the vertical filter 6.

One output of the first one line delay circuit 3 is directly supplied to the vertical filter 6, while another output is delayed by one line in the second one line delay circuit 4 and thereafter supplied to the vertical filter 6.

The vertical filter 6 is generally referred as two line type comb-shaped filter, the output of which is fed to the band pass filter 7.

The band pass filter 7 outputs color signals 205, one to the output terminal 8, and another to one input terminal of the subtracting circuit 9. The other input terminal of the subtracting circuit 9 receives the output of the first one line delay circuit 3 through a compensating delay circuit 5 which compensates the amount delayed in the band pass filter 7. The subtracting circuit 9 then outputs a brightness signal 207 to the output terminal 10.

It will now be explained how function the above-mentioned filter on the NTSC type composite color television signal. The input signal 201 of the composite color television signal having been simultaneously sampled by the color subcarrier with the sampling frequency $f_s = 4 * f_{sc}$ (f_{sc} : a color subcarrier frequency which is approximately 3.58 MHz in

NTSC type, while approximately 4.43 MHz in PAL type) would be displayed in two-dimensional arrangement on the screen as shown in FIG. 17.

Namely, with $f_{sc} = (455/2) \cdot f_H$ (f_H : horizontal frequency: approximately 15.7 kHz in NTSC and 15.6 kHz in PAL), the phase of the color signal C inverts by 180 degrees per line, resulting in 4 samples at each cycle. Here, assuming that the codes Y and C1, C2 designate brightness signal and color signals respectively in the drawing, the white circle, the slashed circle, the white triangle, and the slashed triangle represent $Y + C1$, $Y - C1$, $Y + C2$, and $Y - C2$, respectively.

When Z^{-1} by Z-conversion is used as a code for representing the delay by one sample, it would be expressed as $Z^{-1} = \exp(-j 2\pi f / 4 f_{sc})$. Then, a delay by one line Z^{-L} becomes $Z^{-L} = \exp(-j 2\pi f / f_H) = \exp(-j 2 \pi f_L / 4 f_{sc})$, resulting in $L = 910$ upon $f_s = .4 \cdot (455/2) \cdot f_H$.

At this time, the vertical filter 3 extracts a line aiding signal 204, for aiding per each line including the color signal, from the one line delay signal and the two line delay signal which are delayed by the first and second one line delay circuit 3 and 4, and from the current input signal 201. The transmission function $H_v(Z)$ of the vertical filter 6 can be expressed as $H_v(Z) = (-1/4) \cdot (1 - Z^{-L})^2$.

In other words, the line aiding signal $H_c(m, n)$ at the coordinates (m, n) on the screen shown in FIG. 17 is sampled as $H_c(m, n) = - (1/4) * \{S(m, n-1) - 2S(m, n) + S(m, n+1)\}$. Since the line aiding signal contains the brightness signal Y too, the color signal $C(m, n)$ being high frequency component is separated from the line aiding signal $H_c(m, n)$ by the band pass filter 7. The resulting color signal 205 will be supplied to the subtracting circuit 9.

In this case, the transmission function of the band pass filter 7 can be composed, for example, as $H_h(Z) = (-1/32) * (1-Z^{-2})^2 * (1+Z^{-4})^2 * (1+Z^{-8})$.

The one line delay signal 202 is delayed, in accordance with the delaying amount of the band pass filter 7, by the compensating delay circuit 5. The subtracting circuit 9 subtracts the color signal $C(m, n)$ from the signal $S(m, n)$, thereby extracts the brightness signal $Y(m, n)$ as $Y(m, n) = S(m, n) - C(m, n)$.

As described above, in the conventional brightness signal/color signal separating filter, the characteristics of the vertical filter and the horizontal filter have been fixedly combined. Namely, the brightness signal/color signal separating process has been performed, in both the vertical and the horizontal directions, by a band pass filter.

Consequently, in regions where the brightness and the

color of the image greatly change, the brightness signal and the color signal have mutually leaked into the other's channel, causing degraded reproductive image by e.g. dot interference.

It is therefore an object of this invention to provide a
5 brightness signal/color signal separating filter which is capable of accurately separating a brightness signal and a color signal from a composite color television signal of e.g. NTSC type or PAL type, even when intensive change in brightness and color of an image takes place.

10 According to this invention, there is provided a brightness signal/color signal separating filter for separating the brightness signal and color signal from composite color television signal, comprising:

a first delay circuit which outputs a first delay composite
15 television signal generated by delaying the composite color signal by a predetermined number of lines;

a second delay circuit which outputs a second delay
composite color television signal generated by further delaying the composite color signal delayed by said first delay circuit by
20 the same number of lines as in said first delay circuit;

a vertical color signal extracting filter for extracting vertical color signal from the composite color television signal, first delay composite color television signal, and second delay composite color television signal;

25 a horizontal color signal extracting filter for extracting horizontal color signal from the first delay composite color television signal;

a horizontal/vertical color signal extracting filter for extracting horizontal and vertical color signals from the

undelayed and first and second delay composite color television signals;

a switching circuit for selectively outputting any one of the outputs from said vertical color signal extracting filter, 5 horizontal color signal extracting filter, and horizontal/vertical color signal extracting filter; and

an image correlation judging circuit which comparatively judges the correlation of an image by the undelayed and first and second delay composite color television signals in the vertical 10 and horizontal directions, and outputs horizontal color signal when the horizontal correlation is strong, outputs vertical color signal when the vertical correlation is strong and the horizontal correlation is weak, and outputs both horizontal and vertical color signals when both the horizontal and vertical correlations 15 are weak, respectively, from said switching circuit;

said image correlation judging circuit comprising:

(a) a non-correlative energy extracting means for extracting horizontal color signal non-correlative energy representative of correlative strength of the horizontal color 20 signal, horizontal brightness signal non-correlative energy representative of correlative strength of the horizontal brightness signal, vertical color signal non-correlative energy representative of correlative strength of the vertical color signal, and vertical brightness signal non-correlative energy 25 representative of correlative strength of the vertical brightness signal;

(b) a comparative signal generating means for generating four comparative signals representative of vertical and horizontal correlative strengths of the composite color

television signal, based on the horizontal color signal non-correlative energy, horizontal brightness signal non-correlative energy, the vertical color signal non-correlative energy, and the vertical brightness signal non-correlative energy;

- 5 (c) a comparative judging means which comparatively judges the horizontal and vertical correlative strengths of the composite color television signal^{as represented by said comparative signals}, and orders said switching circuit to output: horizontal color signal extracted by the horizontal color signal extracting circuit when the horizontal
10 correlation is strong ; vertical color signal extracted by the vertical color signal extracting filter when vertical correlation is stronger than horizontal correlation; and horizontal/vertical color signals extracted by the horizontal/vertical color signal extracting filter when both the horizontal
15 and vertical correlations are weak.

In the brightness signal/color signal separating filter of this invention mentioned above, composite color television signals of NTSC type or PAL type are sequentially delayed in the first delay circuit and the second delay circuit by a
5 predetermined number of lines. The numbers of lines for delaying process in the first delay circuit and the second delay circuit are identical. Namely, on the basis of the first delayed composite color television signal obtained by the first delay circuit, the composite color television signal on the
10 screen before delay is displayed prior to the composite color television signal delayed by the first delay circuit by a predetermined number of lines, and the composite color television signal delayed by the second delay circuit is displayed after the composite color television signal delayed
15 by the first delay circuit by the same number of lines.

These three kinds of composite color television signals are then supplied to the vertical color signal extracting
filter and the horizontal/vertical color signal extracting
filter, and particularly the first delayed composite color
20 television signal is supplied additionally to the horizontal color signal extracting filter.

The vertical color signal extracting filter extracts vertical color signal. In this case, "vertical" means the direction perpendicular to said lines. Therefore, the three types of composite color television signals are necessary for
5 the extraction of the vertical color signal by the vertical color signal extracting filter.

The horizontal color signal extracting filter extracts horizontal color signal. In this circuit, among the three types of composite color television signals, only the one
10 corresponding to the intermediate line i.e. the composite color television signal delayed by the first delay circuit is used, since a signal which belongs to an identical line will suffice.

The horizontal/vertical color signal extracting filter extracts color signals in the vertical and horizontal
15 directions.

The color signals extracted by these three types of filters are then supplied to the switching circuit. The switching circuit selectively outputs a color signal depending on the result of the comparative judgment carried out
20 in the image correlation judging circuit. The image correlation judging circuit lets the switching circuit selectively output: the horizontal color signal when horizontal correlation is strong; the vertical color signal when the horizontal correlation is weak and the vertical correlation is

strong; and vertical and horizontal color signals when both the horizontal and vertical correlations are weak.

As a result, even when intensive color etc. changes arise in composite color television signals, it is possible to output color signals surely separated on the basis of the correlative judgment result.

A further significant feature of this invention lies in the composition and the function of the image correlation judging circuit.

The image correlation judging circuit performs the correlation judgment and controls the switching circuit in the following order of procedure: extraction of non-correlative energy -- generation of comparative signal -- comparative analysis based on the comparative signal.

For a start, the non-correlative energy extracting means extracts horizontal color signal non-correlative energy, horizontal brightness signal non-correlative energy, vertical color signal non-correlative energy, and vertical brightness signal non-correlative energy, representative of the correlative strength of the horizontal color signal, the horizontal brightness signal, vertical color signal, and the vertical brightness signal, respectively, from the aforementioned three types of delayed composite color television signals.

Next, first through fourth comparative signals, representative of horizontal or vertical correlative weaknesses (or horizontal or vertical non-correlative energies), are generated on the basis of the energies.

Accordingly, horizontal and vertical correlative strengths of the composite color television signal can be judged from the comparative signal.

There are four types of non-correlative energies depending on the subject signal being horizontal signal or vertical signal, and color signal or brightness signal. So there may be provided a non-correlative energy extracting means comprising four types of non-correlative energy extracting circuits: a horizontal color signal non-correlative energy extracting circuit; a horizontal brightness signal non-correlative energy extracting circuit; a vertical color signal non-correlative energy extracting circuit; and a vertical brightness signal non-correlative energy extracting circuit. Each of such circuits is preferably composed of FIR (finite impulse response) filter, or of course, IIR (infinite impulse response filter).

A FIR filter can be composed of each predetermined number of delay means, subtracting means, absolute value calculating means, filters, and maximum value calculating means. The comparative judging means, for comparatively judging the comparative signals, may be composed of a comparing

circuit and a judging circuit. As a comparing circuit, typical two signal-comparing-type circuits may be used. In this case, first and second comparing circuits are required, since four types of comparative signals appear.

5 The judging circuit determines the subject to be controlled in the switching circuit, and performs the controlling operation. The judging circuit, when the output of the comparing circuit being binary signal, can be a logical element of NOT, AND, etc.

10 A comparative signal can be generated by the combination of a multiplier, an adder and a maximum value circuit.

There may be two horizontal colour signal non-correlative energy extracting circuits and/or two vertical
15 colour signal non-correlative energy extracting circuits.

The invention will be further described by way of non-limitative example in the following detailed description, with reference to the accompanying drawings, in which:

20 Figure 1 is a block diagram showing a brightness signal/colour signal separating filter according to the first embodiment of this invention;

FIG. 2 is a detail block diagram of the image correlation judging circuit in FIG. 1;

FIG. 3 is a detail block diagram of the judging circuit in FIG. 2;

FIG. 4 is a detail block diagram of the horizontal color signal non-correlative energy extracting circuit in FIG. 1;

FIG. 5 is a detail block diagram of the horizontal brightness signal non-correlative energy extracting circuit in FIG. 1;

FIG. 6 is a detail block diagram of the vertical color signal non-correlative energy extracting circuit in FIG. 1;

FIG. 7 is a detail block diagram of the vertical brightness signal non-correlative energy extracting circuit in FIG. 1;

FIG. 8 is a block diagram of an image correlation judging circuit according to the second embodiment;

FIG. 9 is a block diagram of an image correlation judging circuit according to the third embodiment;

FIG. 10 is a block diagram of an image correlation judging circuit according to the fourth embodiment;

FIG. 11 is a block diagram of an image correlation judging circuit according to the fifth embodiment;

FIG. 12 is a block diagram of an image correlation

judging circuit according to the sixth embodiment;

FIG. 13 is a block diagram of an image correlation judging circuit according to the seventh embodiment;

FIG. 14 is a block diagram of an image correlation judging circuit according to the eighth embodiment;

FIG. 15 is a block diagram of an color signal/brightness signal separating filter according to the second embodiment, for separating the composite color television signal of PAL type;

FIG. 16 is a block diagram showing a conventional brightness signal/color signal separating filter;

FIG. 17 illustrates an arrangement of signal successions on the screen;

FIG. 18 is a block diagram of an image correlation judging circuit according to the ninth embodiment;

FIG. 19 is a block diagram of an image correlation judging circuit according to the tenth embodiment.

DETAILED DESCRIPTION

The principles of this invention are particularly useful when embodied in a brightness signal/color signal separating filter such as shown in FIG. 1.

In FIG. 1, of NTSC type circuit, NTSC type composite color television signal is supplied to the input terminal 11. An A/D converter 12 converts the composite color television

signal supplied through the input terminal 11 into digital signal. A first delay circuit 13 delays the output signal 101 of the A/D converter 12 by one line, and a second delay circuit 14 further delays that by another line. The compensating delay circuit 15 compensationally delays the output signal 102 of the first delay circuit 13. The output signals 101, 102, and 103 of the A/D converter 12, the first delay circuit 13, and the second delay circuit 14, are fed to a vertical color signal extracting filter 16, a horizontal/vertical color signal extracting filter 17, and the image correlation judging circuit 18, respectively. The output signal 102 of the first delay circuit 13 is additionally supplied to a horizontal color signal extracting filter 19. The output signal 104 of the vertical color signal extracting filter 16 is supplied to the compensating delay circuit 20, and likewise: the output signal 108 of the horizontal/vertical color signal extracting filter 17, to the compensating delay circuit 21; the output signal 106 of the horizontal color signal extracting filter 19, to the compensating delay circuit 22, respectively. The switching circuit selects any one of the output signals 105, 107, and 109 of the compensating delay circuit 20, 22, and 21, based on the supplied output signal 110 of the image correlation judging circuit 1. The signal outputted from the output terminal 24 of the switching circuit 23 is a color signal. Meanwhile, the

difference between the output signal 112 of the compensating delay circuit 15 and the output signal 111 of the switching circuit 23, obtained by the subtracting circuit 25, is outputted from the output terminal 26 as a brightness signal 113.

In FIG. 2, the numbers designate respectively: 1127, a horizontal color signal non-correlative energy extracting circuit; 1128, horizontal brightness signal non-correlative energy extracting circuit; 1129, vertical color signal non-correlative energy extracting circuit; 1130, vertical brightness signal non-correlative energy extracting circuit; 1139, 1140, 1141, 1142, maximum value circuits; 1131-1138, 1143, 1144, multiplier circuits; 1145, 1146 comparative circuits; 1147, judging circuit; 1148, color signal extraction controlling circuit.

The output signal 101 of the A/D signal 12 is supplied to the horizontal brightness signal non-correlative energy extracting circuit 1128, the vertical color signal non-correlative energy extracting circuit 1129 and the vertical brightness signal non-correlative energy extracting circuit 1130.

The output signal 102 of the first delay circuit 13 is supplied to the horizontal color signal non-correlative energy extracting circuit 1127, the horizontal brightness signal non-

correlative energy extracting circuit 1128, and the vertical brightness signal non-correlative energy extracting circuit 1130.

The output signal 103 of the second delay circuit 14 is supplied to the horizontal brightness signal non-correlative energy extracting circuit 1128, vertical color signal non-correlative energy extracting circuit 1129, and the vertical brightness signal non-correlative energy extracting circuit 1130.

The output signal DCH of the horizontal color signal non-correlative energy extracting circuit 1127 is supplied to the multiplier 1131, 37. The multiplying circuit 1137 multiplies the signal DCH by a constant K9 and supplies the multiplied result to the maximum value circuit 1140, while the multiplying circuit 1131 multiplies the signal DCH by a constant K1 and supplies the multiplied result to the maximum value circuit 1139. The output signal DYH of the horizontal brightness signal non-correlative energy extracting circuit 1128 is supplied to the multiplying circuit 1132, 1138. The multiplying circuit 1138 multiplies the signal DYH by a constant K10 and supplies the multiplied result to the maximum value circuit 1140, while the multiplying circuit 1132 multiplies the signal DYH by a constant K2 and supplies the multiplied result to the maximum value circuit 1139. The

output signal of the maximum value circuit 1139 is then supplied to the comparing circuit 1145 as first horizontal non-correlative energy DH1. The output signal of the maximum value circuit 1140 is, after multiplied by a constant K5 in the multiplying circuit 1143, supplied to the comparing circuit 1145 as second horizontal non-correlative energy DH2.

The output signal DCV of the vertical color signal non-correlative energy extracting circuit 1129 is supplied to the multiplying circuit 1135, 1133. The multiplying circuit 1135 multiplies the signal DCV by a constant K7 and supplies the multiplied result to the maximum value circuit 1141, while the multiplying circuit 1133 multiplies the signal DCV by a constant K3 and supplies the multiplied result to the maximum value circuit 1142. The output signal DYV of the vertical brightness signal non-correlative energy extracting circuit 1130 is supplied to the multiplying circuit 1136, 34. The multiplying circuit 1136 multiplies the signal DYV by a constant K8 and supplies the multiplied result to the maximum value circuit 1141, while the multiplying circuit 1134 multiplies the signal DYV by a constant K4 and supplies the multiplied result to the maximum value circuit 1142. The output signal of the maximum value circuit 1142 is supplied to the comparing circuit 1146 as first non-correlative energy DV1. The output signal of the maximum value circuit 1141 is, after

multiplied by a constant K_6 , to the comparing circuit 1145 of the color signal extraction controlling circuit 1148 as second vertical non-correlative energy DV2.

The comparing circuit 1145 compares the first horizontal non-correlative energy DH1 with the product $K_6 * DV2$ of the second vertical non-correlative energy DV2 multiplied by a constant K_6 , and makes the output signal 115 HIGH level in case of $DH1 \geq K_6 * DV2$ and LOW level in other cases.

The comparing circuit 1146 compares the first vertical non-correlative energy DV1 with the product $K_5 * DH2$ of the second horizontal non-correlative energy DH2 multiplied by a constant K_5 , and makes the output signal 114 HIGH level in case of $DV1 \geq K_5 * DH2$ and LOW level in other cases.

The output signals 115 and 114 of the comparing circuit 1145 and 1146 respectively are supplied to the judging circuit 1147 of the color signal extraction controlling circuit 1148. The output signal 110 of the judging circuit 1147 is sent out as an output of the image correlation judging circuit.

FIG. 3 is a circuit diagram showing an exemplified judging circuit 1147 in FIG. 2. This judging circuit 1147 is composed of an AND circuit 48, 49, a NOT circuit 50, 51. The output signal 115 of the comparing circuit 1145 is inputted to an input terminal of the AND circuit 49 through the NOT circuit. The output signal 114 of the comparing circuit 1146

is inputted to the AND circuit 48, 49 through the NOT circuit. The output signals of the AND circuit 48, 49 becomes an output signal 110 of the image correlation judging circuit.

FIG. 4 is a block diagram, showing an exemplified horizontal color signal non-correlative energy extracting circuit 1127 in FIG. 2., including a delay circuit 52, a subtracting circuit 53 and an absolute value circuit 54.

The output signal 102 of the first delay circuit 13 is fed to an input terminal of the delay circuit 52 having a delaying amount equivalent to one cycle of color subcarrier [= $(1/fsc)$].

The output signal 102 of the first delay circuit 13 and the output signal of the delay circuit 52 are supplied to the subtracting circuit 53. The output signal of the subtracting circuit 53 i.e. the difference between the both supplied signals are fed to the absolute value circuit 54, the output DCH of which becomes an output of the horizontal color signal non-correlative energy extracting circuit 1127.

FIG. 5 is a block diagram showing an exemplified horizontal brightness signal non-correlative energy extracting circuit 1128 in FIG. 2 including a vertical low pass filter 55, a first delay circuit 56, a second delay circuit 57, a first subtracting circuit 58, a second subtracting circuit 59, a first absolute value circuit 60, a second absolute value

circuit 61, a maximum value circuit 62.

The output signals 101, 102, and 103 of the A/D converter 12, the first delay circuit 13 and the second delay circuit 14 respectively, are inputted to the vertical low pass filter.

The output signal of the vertical low pass filter in FIG. 5 is supplied to the first delay circuit 56 having a delaying amount corresponding to a half of the cycle of color subcarrier, and thereafter, further supplied to the first subtracting circuit 58 along with the output of the first delay circuit 56. On the other side, the output of the first delay circuit 56 is fed to the input terminals of the second delay circuit 57 and the second subtracting circuit 59. The output of the delay circuit 57 is also supplied to the second subtracting circuit 59. The outputs of the first subtracting circuit 58 are sequentially inputted to the maximum value circuit through the first absolute value circuit 60, while the output of the second subtracting circuit 59 is inputted to the maximum value circuit 62 through the second absolute value circuit 61. The output DYH of the maximum value circuit 62 becomes an output of the horizontal brightness signal non-correlative energy extracting circuit 1128.

FIG. 6 is a block diagram showing an exemplified vertical color signal non-correlative energy extracting circuit

1129 in FIG. 2 including a first and a second horizontal band pass filters 63, 64, a subtracting circuit 65, and an absolute value circuit 66.

The output signal 101 of the A/D converter 12 is supplied to the first horizontal band pass filter 63, and the output signal 103 of the second delay circuit 14 is supplied to the second horizontal band pass filter 64. The outputs of the first and second horizontal band pass filters 63, 64 are supplied to the subtracting circuit 65, the output of which is then inputted to the absolute value circuit 66. The output DCV of the maximum value circuit 66 becomes an output of the vertical color signal non-correlative energy extracting circuit 1129.

FIG. 7 is a circuit diagram showing an exemplified vertical brightness signal non-correlative energy extracting circuit in FIG. 2 including a first through a third horizontal low pass filters 67-69, a first and a second subtracting circuits 70, 71, a first and a second absolute value circuits 72, 73 and a maximum value circuit 74.

The output signal 101 of the A/D converter 12 is inputted to the horizontal low pass filter 67, and likewise: the output signal 102 of the first delay circuit 13, to the horizontal low pass filter 68; the output signal 103 of the second delay circuit 14, to the horizontal low pass filter 69;

the output of the first horizontal low pass filter 67, to the first subtracting circuit 70; the output of the second horizontal low pass filter 68, to the first and the second subtracting circuits 70,71; the output of the third
5 horizontal low pass filter 69, to the second subtracting circuit 71.

The outputs of the first and the second subtracting circuits 70 and 71 are supplied to the first and the second absolute value circuits 72 and 73
10 respectively, and the outputs of the first and the second absolute value circuits 72, 73 are supplied to the maximum value circuit 74. The output DYV of this absolute value circuit 74 becomes the output of the vertical brightness signal non-correlative energy extracting circuit 1130.

15 In operation, when a NTSC type composite colour television signal is given via the input terminal 11, the A/D converter 12 samples this signal with the sampling frequency $f_s = 4f_{sc}$.

The output signal 102 of the first delay circuit
20 13 represents a sampling value at a target sampling point, and a sampling value at a position up by one line on screen is output from A/D converter 12 and a sampling value at a position lower by one line on the screen is output from the second delay circuit 14.

25 Namely, signals $S(m, n-1)$ and $S(m, n+1)$ appear at

the outputs of the second delay circuit 14 and the A/D converter 12 respectively when a composite color television signal (sampling value) $S(m, n)$ is outputted from the first delay circuit 13 (see FIG. 17). The brightness signal/color signal separating filter is designed on the basis of these sampling values at the sampling points over three lines on the screen.

The both sampling values outputted from the first and the second delay circuits 13 and 14 are supplied to the vertical color signal extracting filter 16, the horizontal/vertical color signal extracting filter 17, the image correlation judging circuit 1. The sampling value from the first delay circuit 13 is additionally supplied to the horizontal color signal extracting filter 19.

In this case, the transmitting functions of the vertical color signal extracting filter 16, the horizontal color signal extracting filter 19, and the horizontal/vertical color signal extracting filter 17 are can be expressed respectively e.g.:

$$C_v(Z) = (-1/4) (1-Z^{-1})^2$$

$$C_h(Z) = (-1/4) (1-Z^{-2})^2$$

$$\begin{aligned} \text{Chv}(Z) &= (-1/4) (1-Z^{-2})^2 + \\ &\quad (-1/4) (1-Z^{-1})^2 \end{aligned}$$

The output signals 104, 106 and 108 of these filters 16, 19 and 17 are compensating-delayed respectively in the compensating delay circuit 20, 22 and 21, and thereafter inputted to the switching circuit 23 as signals 105, 107 and 109.

The switching circuit 23 selects any one of the color output signals from the vertical color signal extracting filter 16, horizontal color signal extracting filter 19, and the horizontal/vertical color signal extracting filter 17.

This selection is carried out on the following basis. Firstly, the image correlation judging circuit 1 detects the vertical and horizontal image correlations on the target sampling point. Based on the detected result, the switching circuit 23 is switched upon receiving the signal 110 to select: the output signal 105 of the compensating delay circuit 20 when the vertical correlation is particularly strong; the output signal 107 of the compensating circuit 22 when the horizontal correlation is particularly strong; and the output signal 109 of the compensating delay circuit 21 in other cases.

The image correlation judging circuit 1 controls the switching circuit 23 in the manner as described hereinafter.

A transmission function DCH (Z) of the horizontal color signal non-correlative energy extracting circuit 1127, likewise DYH (Z) of the horizontal brightness signal non-correlative energy extracting circuit 1128, DCV (Z) of the vertical color signal non-correlative energy extracting circuit 1129, and DYV (Z) of the vertical brightness signal non-correlative energy extracting circuit 1130 can be expressed from the composition of the circuit 1127-1130, as:

$$DCH (Z) = |1 - Z^{-4}|$$

$$DYH (Z) = \max (|(1/4) * (1+Z^{-2})^2 * (1-Z^{-2})|, |(1/4) * (1+Z^2)^2 * (Z^{-2} - Z^{-4})|)$$

$$DCV (Z) = |(1-Z^{-2})^2 * (1-Z^{-2L})|$$

$$DYV (Z) = \max (|(1/4) * (1+Z^{-2})^2 * (1-Z^{-2})|, |(1/4) * (1+Z^{-2})^2 * (Z^{-L} - Z^{-2L})|)$$

The output DCH, DYH, DCV, and DYV of the circuits 1127-1130 having these transmission functions are as mentioned above supplied to the maximum value circuits 1139-1142 through the multipliers 1131-1138. As a result, generated first horizontal non-correlative energy DH1, second horizontal non-

correlative energy DH2, first vertical non-correlative energy DV1, and second vertical non-correlative energy DV2 are expressed as follows:

$$DH1 = \max (K1 * DCH, K2 * DYH)$$

$$DH2 = \max (K9 * KCH, K10 * DYH)$$

$$DV1 = \max (K3 * DCV, K4 * DYV)$$

$$DV2 = \max (K7 * DCV, K8 * DYV)$$

At this time, the comparing circuit 1146 of the image correlation judging circuit 1, if $DV1 \geq K5 * DH2$, outputs signal "1" to the judging circuit 1147 regarding that there is horizontal correlation without any vertical correlation; and if $DV1 < K5 * DH2$, outputs signal "0" to the judging circuit 1147 regarding that there is no horizontal correlation.

On the other hand, the comparing circuit 1145 of the image correlation judging circuit 1, if $DH1 \geq K6 * DV2$, outputs a signal "1" to the judging circuit 1147 regarding that there is vertical correlation without any horizontal correlation; and if $DH1 < K6 * DV2$, outputs a signal "0" to the judging circuit 1147 regarding that there is no vertical correlation.

The judging circuit 1147 controls the switching

circuit 23 according to the detected result of above correlation, namely, the relationship between the input and the output of the judging circuit 1147 becomes as the TABLE 1.

TABLE 1

output signals of:				
114 of the comparing circuit 1146	115 of the comparing circuit 1145	110 of the judging circuit 1147		111 selected by the switching circuit 23
		110a of the AND circuit 48	110b of the AND circuit 49	
0	0	0	1	109
0	1	1	0	105
1	0	0	0	107
1	1	0	0	107

{ for H/V
extraction
for V extra
ction

{ for H
extraction

(H:horizontal)

(V:vertical)

The switching circuit 23 is switched in response to these outputs of the AND circuits 48 and 49: the output signal 107 of the compensating delay circuit 22 is passed when the both output signals of the AND circuits 48 and 49 are "0"; the output signal 105 of the compensating delay circuit 20 is passed when the output signal of the AND circuit 48 is "1" and the output signal of the AND circuit 49 is "0"; the output signal 109 of the compensating delay circuit 21 is passed when the output signal of the AND circuit 48 is "0" and the output signal of the AND circuit 49 is "1".

Thus, in the embodiment shown in FIG. 1, the color signal extracting filter characteristic $C(Z)$ becomes switched, according if the correlation exists or not, as follows:

$C(Z) = C_h(Z)$, when horizontal correlation is strong;

$C(Z) = C_v(Z)$, when horizontal correlation is weak and vertical correlation is strong; and

$C(Z) = C_{hv}(Z)$, when neither of the above conditions is satisfied.

In this manner, according to this embodiment, the vertical and horizontal image correlations of a composite color television signal are detected by the image correlation judging

circuit 1 and that the switching circuit 23 is switched in response to the detected result. Consequently, mutual leakage of the brightness signal and the color signal into another's channel can be reduced, thereby avoiding dot jamming.

FIG. 8 shows an image correlation judging circuit of the brightness signal/color signal separating filter according to the second embodiment of this invention.

In this embodiment, the horizontal non-correlative energy extracting circuit 1227 is divided into sub-circuits 1227a and 1227b having mutually different property, and the vertical color signal non-correlative energy extracting circuit 1229 is divided into sub-circuits 1229a and 1229b in the same manner. The horizontal color signal non-correlative energy extracting circuit 1227a supplies the DCH1 to the multiplier 1231, while the horizontal color signal non-correlative energy extracting circuit 1227b supplies the DCH2 to the multiplier 1237, respectively. Likewise, the vertical color signal non-correlative energy extracting circuit 1229a supplies the DCV1 to the multiplier 1235, while the vertical color signal non-correlative energy extracting circuit 1229b supplies DCV2 to the multiplier 1233, respectively.

Also in such composition, the similar effect to the first embodiment can be rendered.

Alternatively, it is also possible to divide each of

the horizontal brightness signal non-correlative energy extracting circuit 1228, the vertical brightness signal non-correlative energy extracting circuit 1230 into two sub-circuits of mutually different properties.

FIG. 9 shows a image correlation judging circuit 1 of the brightness signal/color signal separating filter according to the third-embodiment of this invention.

This embodiment incorporates an adder 1375 for adding the output DCH of the horizontal color signal non-correlative energy extracting circuit 1327 to the output DYH of the horizontal brightness signal non-correlative energy extracting circuit 1328, and likewise, an adder 1376 for adding the output DCV of the vertical color signal non-correlative energy extracting circuit 1329 to the output DYV of the vertical brightness signal extracting circuit 1330.

The adder 1375 is connected to the comparing circuit 1346 of the color signal extraction controlling circuit 1348 via the multiplier 1377. The multiplier 1377 multiplies the output DH1 of an integer m , and supplies the multiplied result $m \cdot DH1$ to the comparing circuit 1346. The output DH1 of the adder 1375 is additionally supplied to the comparing circuit 1345 of the color signal extraction controlling circuit 1348.

Similarly, the adder 1376 is connected to the comparing circuit 1345 through the multiplier 1378. The adder

1378 multiplies the output DV1 of the multiplier 1376 by an integer n , and supplies the multiplied result $n * DV1$ to the comparing circuit 1345. The output DV1 of the multiplier 1376 is additionally supplied to the comparing circuit 1346 of the color signal extraction controlling circuit 1348.

The comparing circuit 1346 compares the magnitude of $m * DH1$ with DV1, and makes the output signal 114 high level in case of $DV1 \geq m * DH1$ and makes that low level in remained cases.

Similarly, the comparing circuit 1345 compares $n * DV1$ with DH1, and makes the output signal 115 high level when $DH1 \geq n * DV1$ and makes that low level in remained cases.

In this embodiment, the outputs of the adder 1375 and the 1376, i.e. horizontal non-correlative energy DH1 and vertical non-correlative energy DV1 respectively, can be expressed as:

$$DH1 = DCH + DYH$$

$$DV1 = DCV + DYV$$

The comparing circuit 1346 compares DV1 with $m * DH1$. In case of $DV1 \geq m * DH1$, this circuit 1346 judges that there is horizontal correlation and no vertical correlation and outputs high level signal 114 to the judging circuit 1347, and

contrastingly in case of $DV1 < m * DH$ 1, judges that there is no horizontal correlation and outputs low level signal 114 to the judging circuit 1347.

Similarly, the comparing circuit 1345, in case of $DH1 \geq n * DV1$, judges that there is vertical correlation and no horizontal correlation and outputs high level signal 115 to the judging circuit 1347, and contrastingly in case of $DV1 < n * DV1$ judges that there is no vertical correlation and outputs low level signal 115 to the judging circuit 1347.

The judging circuit 1347 judges and controls the switching circuit 23 according to the signals 114 and 115. In consequence, the color signal to be selected will be as shown in the TABLE 1.

Thus, this embodiment can also render the same effect as in the first embodiment.

FIG. 10 shows a image correlation judging circuit 1 of the brightness signal/color signal separating filter according to the fourth embodiment of this invention.

In this embodiment, the output DCH of the horizontal color signal non-correlative energy extracting circuit 1427 is multiplied by an integer b in a multiplier 1437 and then supplied to a maximum value circuit 1440. Likewise, the output DYH of the horizontal brightness signal non-correlative energy extracting circuit 1428 is multiplied by an integer a in a

multiplier 1438 and then supplied to the maximum value circuit 1440. The maximum value circuit 1440 compares $b * DCH$ with $a * DYH$ for the maximum value and outputs this as a second horizontal non-correlative energy $DH2$, which is multiplied by and integer m in the multiplier 1443 and supplied thereafter to the comparing circuit 1446 of the color signal extraction controlling circuit 1448.

Similarly, the output DCV of the vertical color signal non-correlative energy extracting circuit 1429 is multiplied by an integer d in the multiplier 1435 and then supplied to a maximum value circuit 1441. Likewise, the output DYV of the vertical brightness signal non-correlative energy extracting circuit 1430 is multiplied by an integer c in a multiplier 1436 and then supplied to a maximum value circuit 1441. The maximum value circuit 1441 compares $d * DCV$ with $c * DYV$ for the maximum value and outputs this as a second vertical non-correlative energy $DV2$, which is multiplied by an integer n in the multiplier 1444 and supplied thereafter to the comparing circuit 1445 of the color signal extraction controlling circuit 1448.

Besides the $m * DH2$, also the first vertical non-correlative energy $DV1$ is supplied to the comparing circuit 1446. This energy $DV1$ has been obtained by adding the output DCV of the vertical color signal non-correlative energy

extracting circuit 1429 to the output DYV of the vertical brightness signal non-correlative energy extracting circuit 1430 in the adder 1476.

Similarly, besides the $n * DV2$, also the first horizontal non-correlative energy DH1 is supplied to the comparing circuit 1445. This energy DH1 has been obtained by adding the output DCH of the horizontal color signal non-correlative energy extracting circuit 1427 to the output DYH of the horizontal brightness signal non-correlative energy extracting circuit 1428 in the adder 1475.

The comparing circuits 1446 and 1445 performs comparing operation similar to that in the third embodiment, and also the judging circuit 1447 of the color signal extraction controlling circuit 1448 functions likewise. Here, the relationship between the signals can be formulated as follows:

$$DH1 = DCH + DYH$$

$$DH2 = \max (b * DCH, a * DYH)$$

$$DV1 = DCV + DYV$$

$$DV2 = \max (d * DCV, c * DYV)$$

With these formulas, too, the switching circuit 23 carries out the same selecting operation as in the first

embodiment.

Accordingly, also this embodiment can render similar effect to the first embodiment.

FIG. 11 shows an image correlation judging circuit 1 of the brightness signal/color signal separating circuit according to the fifth embodiment of this invention.

In this embodiment, the output DCH of the horizontal color signal non-correlative energy extracting circuit 1527 is, after multiplied by an integer b in a multiplier 1537, supplied to the maximum value circuit 1540, and after multiplied by an integer f in the multiplier 1531, supplied to the maximum value circuit 1539. Likewise, the output DYH of the horizontal brightness signal non-correlative energy extracting circuit 1528 is, after multiplied by the integer a, supplied to the maximum value circuit 1540, and after multiplied by an integer e, supplied to the maximum value circuit 1539.

Similarly, the output DCV of the vertical color signal non-correlative energy extracting circuit 1529, after multiplied by an integer h in the multiplier 1533, supplied to the adder 1576, and after multiplied by an integer d in the multiplier 1535, supplied to the maximum value circuit 1541. Likewise, the output DYV of the vertical brightness signal non-correlative energy extracting circuit 1530, after multiplied by an integer g in the multiplier 1534, supplied to

the adder 1576, and after multiplied by an integer c , supplied to the maximum value circuit 1541.

The maximum value circuit 1540 compares the $b * DCH$ with the $a * DYH$, and selects and outputs the larger one to the comparing circuit 1546 as second horizontal non-correlative energy $DH2$.

The maximum value circuit 1539 compares the $f * DCH$ with the $e * DYH$ and outputs the result as third horizontal non-correlative energy $DH3$, which is supplied to the comparing circuit 1545 of the color signal extraction controlling circuit 1548 after being multiplied by an integer m in the multiplier 1544.

The adder 1576 adds the $h * DCV$ to the $g * DYV$ and outputs the added result as third vertical non-correlative energy $DV3$, which is supplied to the comparing circuit 1546 of the color signal extraction controlling circuit 1548 after being multiplied by an integer n in the multiplier 1545.

The maximum value circuit 1541 compares the $d * DCV$ with the $c * DYV$, and selects outputs the larger one to the comparing circuit 1545 as second vertical non-correlative energy $DV2$.

The comparing circuit 1546 compares the $DH2$ with the $n * DV3$, and, if $DH2 \geq n * DV3$, outputs a high level signal 115 to the judging circuit 1547 of the color signal extraction

controlling circuit 1548 regarding that there is vertical correlation and no horizontal correlation; and contrastingly, if $DH2 < n * DV3$, outputs a low level signal 11 to the judging circuit 1547 regarding that there is no vertical correlation.

Similarly, the comparing circuit 1545 compares the $DV2$ with the $m * DH3$, and, if $DV2 \geq m * DH3$, outputs a high level signal 114 to the judging circuit 1547 regarding that there is horizontal correlation and no vertical correlation; and contrastingly, if $DV2 \leq m * DH3$, outputs low level signal 114 to the judging circuit 114 regarding that there is no horizontal correlation. The judging circuit 114 operates in same manner as the aforementioned fourth embodiment.

Accordingly, also in this embodiment, the switching circuit 23 functions according to the TABLE 1 and similar effect can be rendered.

FIG. 12 shows an image correlation judging circuit 1 of the brightness signal/color signal separating filter according to the sixth embodiment of this invention.

This embodiment differs from said fifth embodiment in having replaced the maximum value circuit 1539 in the fifth embodiment by an adder 1675, and the adder 1576 in the fifth embodiment by a maximum value circuit 1642. Also the same effect can be obtained by this embodiment.

FIG. 13 shows an image correlation judging circuit

1 of the brightness signal/color signal separating filter according to a seventh embodiment of this invention.

This embodiment features to dividedly compose the horizontal color signal non-correlative energy extracting circuit 1527 and the vertical color signal non-correlative energy extracting circuit 1529 respectively into two sub-circuits having mutually different characteristics.

Among the two sub-circuits of the horizontal color signal non-correlative energy extracting circuit 1727, the one 1727a supplies the output DCH1 to the maximum value circuit 1740, and the other 1727b supplies the output DCH2 to the maximum value circuit 1739. Similarly, the one sub-circuit 1729a of the vertical color signal non-correlative energy extracting circuit 1729 supplies the output DCV1 to the maximum value circuit 1741, and the other 1729b supplies the output DCV2 to the adder 1776.

The switching circuit 23 of this embodiment also functions according to the TABLE 1, and can render same effect as in the aforesaid embodiments.

FIG. 14 shows an image correlation judging circuit of the brightness signal/color signal separating filter according to the eighth embodiment of this invention.

This embodiment features to dividedly compose the horizontal color signal non-correlative energy extracting

circuit 1827 and the vertical color signal non-correlative energy extracting circuit 1829 in said sixth embodiment shown in FIG. 12, each into two sub-circuits having mutually different characteristics, similarly to the seventh embodiment shown in FIG. 13.

Also in this embodiment, the switching circuit 23 functions according to the TABLE 1, rendering same effect as in the aforesaid embodiments.

FIG. 18 shows an image correlation judging circuit 1 according to the ninth embodiment of this invention.

Likewise the third embodiment shown in FIG. 9 this embodiment uses adders 1975, 1976 and multipliers 1977, 1978, and likewise the seventh embodiment shown in FIG. 13 this embodiment includes a horizontal color signal non-correlative energy extracting circuit 1927 and a vertical color signal non-correlative energy extracting circuit 1929.

Namely, this embodiment has two horizontal color signal non-correlative energy extracting circuits 1927a, 1927b, and the former outputs DCH1 based on three types of signals 101, 102, and 103, and the latter outputs DCH2 based on a signal 102.

These outputs DCH1 and DCH2 are supplied to the adder 1975a along with the output DYH from the horizontal brightness signal non-correlative energy extracting circuit 1928.

The adder 1975a adds the output DCH1 of the horizontal color signal non-correlative energy extracting circuit 1927a with the output DYH of the horizontal brightness signal non-correlative energy extracting circuit 1928, and outputs the added result as horizontal non-correlative energy DH11 to the comparing circuit 1945.

The adder 1975b adds the output DCH2 of the horizontal color signal non-correlative energy extracting circuit 1927b with the output DYH of the horizontal brightness signal non-correlative energy extracting circuit 1928, and outputs the added result as horizontal non-correlative energy DH12. This energy is then multiplied by a constant m, and the multiplied result is supplied to the comparing circuit 1946.

On the other hand, this embodiment includes two vertical color signal non-correlative energy extracting circuits 1929a, 1929b, and the former outputs DCV 1 based on three kinds of signals 101, 102, and 103, while the latter outputs DCV2 based on signals 101 and 102.

These outputs DCV1 and DCV2 enter the adder 1976a and 1976b respectively along with the output DYV of the vertical brightness signal non-correlative energy 1930.

The adder 1976a adds the output DCV1 of the vertical color signal non-correlative energy extracting circuit 1929a with the output DYV of the vertical brightness signal non-

correlative energy extracting circuit 1930, and outputs the added result as vertical non-correlative energy DV11 to the comparing circuit 1946.

The adder 1976b adds the output DCV2 of the vertical color signal non-correlative energy extracting circuit 1929b with the output DYV of the vertical brightness signal non-correlative energy extracting circuit 1930, and outputs the added result as vertical non-correlative energy DV12. This energy DV12 is then multiplied by a constant n in the multiplier 1978 and thereafter outputted to the comparing circuit 1945.

The comparing circuits 1945 and 1946, as the other embodiments mentioned earlier, make judgement on the basis of the DH11, $m * DH12$, DV1 and $n * DV12$.

Namely, the comparing circuit 1945, judges that there is vertical correlation without horizontal correlation and outputs high level signal 115 to the judging circuit 1947 if $DH11 \geq n * DV12$. On the contrary, it judges that there is no vertical correlation and outputs low level signal 115 to the judging circuit 1947 if $DH11 < n * DV12$.

Likewise, the comparing circuit 1946 judges that there is horizontal correlation without vertical correlation and outputs high level signal 114 to the judging circuit 1947 if $DV11 \geq m * DH12$. On the contrary, it judges that there is no

horizontal correlation and outputs low level signal to the judging circuit 1947 if $DV11 < m \cdot DH12$.

Therefore, also in this embodiment, the switching circuit operates according to the TABLE 1, rendering same effect as in the aforesaid embodiments.

FIG. 19 shows an image correlation judging circuit 1 according to a tenth embodiment of this invention.

This embodiment has such a composition that the adders 1975a and 1976b are replaced by the same 2075 and 2076 respectively, and likewise the adders 1975b and 1976b by the maximum value circuit 2040 and 2041 respectively. Further, multipliers 2037, 2038 and 2035, 2036 are provided before the maximum value circuits 2040 and 2041, respectively.

Accordingly, in this embodiment too, the comparing circuits 2045, 2046 operates along the same logic as the ninth embodiment, and the switching circuit functions according to the TABLE 1.

Namely, the output DCH1 of the horizontal color signal non-correlative energy extracting circuit 2027a enters the adder 2075 along with the output DYH of the horizontal brightness signal non-correlative energy extracting circuit 2028. The adder 2075 adds the output DCH1 of the horizontal color signal non-correlative energy extracting circuit 2027a with the output DYH of the horizontal brightness signal non-

correlative energy extracting circuit 2028, and outputs the added result as horizontal non-correlative energy DH1 to the comparing circuit 2045.

Meanwhile, the output DCH2 of the horizontal color signal non-correlative energy extracting circuit 2027b is multiplied by a constant b in the multiplier 2037 and thereafter supplied to the maximum value circuits 2040. The value, obtained by multiplying the output DYH of the horizontal brightness signal non-correlative energy extracting circuit 2028 by a constant a in the multiplier 2038, is also supplied to the maximum value circuit 2040.

The maximum value circuit 2040 compares the $b \cdot DCH$ with $a \cdot DYH$, and selects and outputs the larger one as horizontal non-correlative energy DH2 to the comparing circuit 2046 through the multiplier 2043. The multiplier 2043 multiplies the horizontal non-correlative energy DH2 by a constant m.

The output DCV2 of the vertical color signal non-correlative energy extracting circuit 2029b and the output DYV of the vertical brightness signal non-correlative energy extracting circuit 2030 are supplied to the maximum circuit 2041 via the multiplier 2035 and 2036 respectively. The multipliers 2035 and 2036 multiply the DCV2 and the DYV by constants d and c, respectively. The maximum value circuit

2041 compares these both, and outputs the obtained maximum value $\max (d * DCV2, c * DYV)$ as vertical non-correlative energy DV2 which is then multiplied by a constant n in the multiplier 2044 and supplied to the comparing circuit 2045.

The comparing circuit 2046, if $m * DH2 > DV1$, outputs a high level signal 114 to the judging circuit 2047 regarding that there is vertical correlation without horizontal correlation. On the contrary, if $m * DH2 \leq DV1$, it outputs a low level signal 114 to the judging circuit 2047 regarding that there is no vertical correlation.

The comparing circuit 2045, if $n * DV2 > DH1$, outputs high level signal 115 regarding that there is horizontal correlation without vertical correlation. On the contrary, if $n * DV2 \leq DH1$, it outputs low level signal to the judging circuit 2047 regarding that there is no horizontal correlation.

Therefore, also in this embodiment, the switching circuit operates according to the TABLE 1, rendering the same effects as embodiments earlier mentioned.

Although in the embodiments described above the composite color television signal has been sampled at the quadruple frequency of the color subcarrier concorded with the horizontal scan frequency, any other frequency than such quadruple frequency can be used for sampling, on condition that the sampling points are arranged in grids on the screen.

It should be noted that the digital filter used in the embodiments is nothing more than an example, and other means e.g. one composed of multiple filters can also be used.

Further, despite that the embodiments described on NTSC type brightness signal/color signal separating filter, it is also possible, as shown in FIG. 15, to apply the composition to PAL type filter using a two line-delay of the composite color television signal by a third delay circuit 79 and a fourth delay circuit 80, instead of the one line-delay by the first delay circuit 13 and the second delay circuit 14 in FIG. 1, with other components same as FIG. 1. The same effect can be obtained by this design, too.

Still further, the FIR filter which constituted the digital filters in the embodiments can be substituted by the IIR filter.

As described above, according to this invention, since the brightness signal/color signal separating filter is properly used depending on the vertical and horizontal image correlations of composite color television signal, the undesirable influence caused by mutual leakage of brightness signal and color signal to the another's channel can be reduced, thereby minimizing the dot jamming.

CLAIMS

1. A brightness signal/color signal separating filter for separating the brightness signal and color signal from composite color television signal, comprising:

a first delay circuit which outputs a first delay composite television signal generated by delaying the composite color signal by a predetermined number of lines;

a second delay circuit which outputs a second delay composite color television signal generated by further delaying the composite color signal delayed by said first delay circuit by the same number of lines as in said first delay circuit;

a vertical color signal extracting filter for extracting vertical color signal from the composite color television signal, first delay composite color television signal, and second delay composite color television signal;

a horizontal color signal extracting filter for extracting horizontal color signal from the first delay composite color television signal;



a horizontal/vertical colour signal extracting filter for extracting horizontal and vertical colour signals from the undelayed and first and second delay composite colour television signals;

5 a switching circuit for selectively outputting any one of the output from said vertical colour signal extracting filter, horizontal colour signal extracting filter, and horizontal/vertical colour signal extracting filter; and

10 an image correlation judging circuit which comparatively judges the correlation of an image by the undelayed and first and second delay composite colour television signals in the vertical and horizontal directions, and outputs horizontal colour signal when the horizontal correlation is strong, outputs vertical colour
15 signal when the vertical correlation is strong and the horizontal correlation is weak, and outputs both horizontal and vertical colour signals when both the horizontal and vertical correlations are weak,
20 respectively, from said switching circuit;

 said image correlation judging circuit comprising:

 (a) a non-correlative energy extracting means for extracting horizontal colour signal non-correlative
25 energy representative of correlative strength of the horizontal colour signal, horizontal brightness signal non-correlative energy representative of correlative strength of the horizontal brightness signal, vertical colour signal non-correlative energy representative of
30 correlative strength of the vertical colour signal, and vertical brightness signal non-correlative energy representative of correlative strength of the vertical brightness signal;

 (b) a comparative signal generating means for
35 generating four comparative signals representative of vertical and



horizontal correlative strengths of the composite color television signal, based on the horizontal color signal non-correlative energy, horizontal brightness signal non-correlative energy, the vertical color signal non-correlative energy, and the vertical brightness signal non-correlative energy;

(c) a comparative judging means which comparatively judges the horizontal and vertical correlative strengths of the composite colour television signal as represented by said comparative signals, and orders said switching circuit to output: horizontal colour signal extracted by the horizontal color signal extracting circuit when the horizontal correlation is strong; vertical color signal extracted by the vertical color signal extracting filter when vertical correlation is stronger than horizontal correlation; and horizontal/vertical color signals extracted by the horizontal/vertical color signal extracting filter when both the horizontal and vertical correlations are weak.

2. A brightness signal/color signal separating filter according to claim 1, wherein said composite color television signal is NTSC signal.

3. A brightness signal/color signal separating filter according to claim 1, wherein said composite color television signal is a PAL signal.

4. A brightness signal/color signal separating filter according to claim 1, 2, or 3 wherein said non-correlative energy



extracting means comprises:

(a) a horizontal color signal non-correlative energy extracting circuit for extracting horizontal color signal non-correlative energy from the first delayed composite color television signal;

(b) a horizontal brightness signal non-correlative energy extracting circuit for extracting horizontal brightness signal non-correlative energy from the composite color television signal, the first delayed composite color television signal and the second delayed composite color television signal;

(c) a vertical color signal non-correlative energy extracting circuit for extracting vertical color signal non-correlative energy from the composite color television signal, and the second delayed composite color television signal;

(d) a vertical brightness signal non-correlative energy extracting circuit for extracting vertical brightness signal non-correlative energy from the composite color television signal, the first delayed composite color television signal, and the second delayed composite color television signal.

5. A brightness signal/color signal separating filter according to claim 4, wherein each of said horizontal color signal non-correlative energy extracting circuit, said



horizontal brightness signal non-correlative energy extracting circuit, said vertical color signal non-correlative energy extracting circuit and said vertical brightness signal non-correlative energy extracting circuit is a finite impulse response filter.

6. A brightness signal/color signal separating filter according to claim 4 or 5, wherein said horizontal color signal non-correlative energy extracting circuit further comprises:

a delay means for delaying the first delayed composite color television signal by one cycle of a color subcarrier;

a subtracting means for subtracting the output of said delay means from its input;

an absolute value calculating means for calculating the absolute value of the output of said subtracting means and for outputting the absolute value as horizontal color signal non-correlative energy.

7. A brightness signal/color signal separating filter according to claim 4, 5 or 6 wherein said horizontal brightness signal non-correlative energy extracting circuit further comprises:

a vertical low pass filter for low pass-filtering the inputted composite color television signal, the first delayed composite color television signal and the second delayed



composite color television signal;

a first delay means for delaying the output of said vertical low pass filter by a half of the cycle of the color subcarrier and for outputting it;

a second delay means for delaying the output of said first delay means by a half of the cycle of the color subcarrier;

a first subtracting means for subtracting the output of said first delay means from the output of said vertical low pass filter;

a second subtracting means for subtracting the output of said second delay means from the output of said first delay means and for outputting it;

a first absolute value calculating means for calculating the absolute value of the output of said first subtracting means and outputting it;

a second absolute value calculating means for calculating the absolute value of the output of said second subtracting means and outputting it; and

a maximum value calculating means for selecting the larger one between the both outputs of said first absolute value calculating means and said second absolute value calculating means and outputting it as horizontal brightness signal non-correlative energy.



8. A brightness signal/color signal separating filter according to claim 4,5,6 or 7 wherein said vertical color signal non-correlative energy extracting circuit further comprises:

a first horizontal band pass filter for band pass-filtering the composite color television signal and outputting it;

a second horizontal band pass filter for band pass-filtering the second delayed composite color television signal and outputting it;

a subtracting means for subtracting the output of said second vertical band pass filter from the output of said first vertical band pass filter; and

an absolute value calculating means for calculating the absolute value of the output of said subtracting means and outputting it as vertical color signal non-correlative energy.

9. A brightness signal/color signal separating filter according to claim 4,5,6,7 or 8 wherein said vertical brightness signal non-correlative energy extracting circuit further comprises:

a first horizontal low pass filter for low pass-filtering the composite color television signal and outputting it;

a second horizontal low pass filter for low pass-



filtering the first delayed composite color television signal and outputting it;

a third horizontal low pass filter for low pass-filtering the second delayed composite color television signal and outputting it;

a first subtracting means for subtracting the output of said second horizontal low pass filter from the output of said first horizontal low pass filter and outputting it;

a second subtracting means for subtracting the output of said third horizontal low pass filter from the output of said second horizontal low pass filter and outputting it;

a first absolute value calculating means for calculating the absolute value of the output of said first subtracting means and outputting it;

a second absolute value calculating means for calculating the absolute value of the output of said second subtracting means and outputting it; and

a maximum value calculating means for selecting the larger one between the outputs of said first absolute value calculating means and said second absolute value calculating means and outputting it as vertical brightness signal non-correlative energy.

10. A brightness signal/color signal separating filter



according to any preceding claim, wherein said comparative judging means further comprises:

a first comparing circuit for comparing the first comparative signal with the third comparative signal, and judges as: the vertical correlation being strong and the horizontal one being weak when the first comparative signal is larger than the third comparative signal; and the vertical correlation being weak when the third comparative signal is larger than the first comparative signal;

a second comparing circuit for comparing the second comparative signal with the fourth comparative signal, and judges as: the horizontal correlation being weak when the second comparative signal is larger than the fourth comparative signal; and the horizontal correlation being strong and the vertical correlation being weak when the fourth comparative signal is larger than the second comparative signal; and

a judging circuit for controlling said switching circuit based on the compared results by said first comparative circuit and said second comparative circuit.

11. A brightness signal/color signal separating filter according to claim 10, wherein:

said first comparing circuit comprises a means for outputting: the value "1" when judges as the vertical



correlation being strong and the horizontal correlation being weak; and the value "0" when judges as the vertical correlation being weak;

said second comparing means comprises a means for outputting: the value "1" when judges as the horizontal correlation being strong and the vertical correlation being weak; and the value "0" when judges as the horizontal correlation being weak; and

said judging means further comprises: a first NOT circuit for rendering a logical negation of the output of said first comparing circuit; a second NOT circuit for rendering a logical negation of the output of said second comparing circuit; a first AND circuit for rendering a logical product of the output of said first comparing circuit and the output of said second NOT circuit; and a second AND circuit for rendering a logical product of the output of said second comparing circuit and the output of said first NOT circuit.

12. A brightness signal/color signal separating filter according to any preceding claim, wherein said comparative signal generating means comprises:

a first multiplier for multiplying the horizontal color signal non-correlative energy by a predetermined first constant and outputting the multiplied result;



a second multiplier for multiplying the horizontal brightness signal non-correlative energy by a predetermined second constant and outputting the multiplied result;

a third multiplier for multiplying the horizontal color signal non-correlative energy by a predetermined third constant different from the first constant and outputting the multiplied result;

a fourth multiplier for multiplying the horizontal brightness signal non-correlative energy by a predetermined constant different from the second constant and outputting the multiplied result;

a fifth multiplier for multiplying the vertical color signal non-correlative energy by a predetermined fifth constant and outputting the multiplied result;

a sixth multiplier for multiplying the vertical brightness signal non-correlative energy by a predetermined sixth constant and outputting the multiplied result;

a seventh multiplier for multiplying the vertical color signal non-correlative energy by a predetermined seventh constant different from the fifth constant and outputting the multiplied result;

an eighth multiplier for multiplying the vertical brightness signal non-correlative energy by a predetermined constant different from the sixth constant and outputting the



multiplied result;

a first maximum value circuit which compares the output of said first multiplier with the output of the second multiplier, and selects and outputs the larger one as the first comparative signal;

a second maximum value circuit which compares the output of the third multiplier with the output of the fourth multiplier, and selects and outputs the larger one;

a third maximum circuit which compares the output of said fifth multiplier with the output of the sixth multiplier, and selects and outputs the larger one;

a fourth maximum circuit which compares the output of said seventh multiplier with the output of said eighth multiplier, and selects and outputs the larger one as the fourth comparative signal;

a ninth multiplier for multiplying the output of said second maximum value circuit by a predetermined ninth constant and outputs the multiplied result as the second comparative signal; and

a tenth multiplier for multiplying the output of said third maximum value circuit by a predetermined constant and outputting the multiplied result as the third comparative signal.



13. A brightness signal/color signal separating filter according to any one of claims 1 to 11, wherein said comparative signal generating means comprises:

a first adder for adding the horizontal color signal non-correlative energy to the horizontal brightness signal non-correlative energy and outputting the added result as the second comparative signal;

a second adder for adding the vertical color signal non-correlative energy to the vertical brightness signal non-correlative energy and outputting the added result as the third comparative signal;

a first multiplier for multiplying the second comparative signal by a predetermined constant and outputting the multiplied result as the first comparative signal; and

a second multiplier for outputting the third comparative signal by a predetermined constant and outputting the multiplied result as the fourth comparative signal.

14. A brightness signal/color signal separating filter according to any one of claims 1 to 11, wherein said comparative signal generating means further comprises:

a first multiplier for multiplying the horizontal color signal non-correlative energy by a predetermined constant and outputting the multiplied value;

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a second multiplier for multiplying the horizontal brightness signal non-correlative energy by a predetermined value and outputting the multiplied value;

a third multiplier for multiplying the vertical color signal non-correlative energy by a predetermined constant and outputting the multiplied value;

a fourth multiplier for multiplying the vertical brightness signal non-correlative energy by a predetermined constant and outputting the multiplied value;

a first maximum value circuit which compares the output of said first multiplier with the output of said second multiplier, and selects and outputs the larger one;

a first adder for adding the horizontal color signal non-correlative energy with the horizontal brightness signal non-correlative energy and for outputting the added result as the second comparative signal;

a second adder for adding the vertical color signal non-correlative energy and the vertical brightness signal non-correlative energy, and outputting the added result as the third comparative signal;

a second maximum value circuit which compares the output of said third multiplier with the output of said fourth multiplier, and selects and outputs the larger one;

a fifth multiplier for multiplying the output of said



first maximum value circuit by a predetermined constant and outputting the multiplied result as the first comparative signal;

a sixth multiplier for multiplying the output of said second maximum value circuit by a predetermined constant and outputting the multiplied result as the fourth comparative signal.

15. A brightness signal/color signal separating filter according to any one of claims 1 to 11, wherein said comparative signal generating means comprises:

a first multiplier for multiplying the horizontal color signal non-correlative energy by a predetermined first constant and outputting the multiplied result;

a second multiplier for multiplying the horizontal brightness signal non-correlative energy by a predetermined second constant and outputting the multiplied result;

a third multiplier for multiplying the horizontal color signal non-correlative energy by a predetermined third constant different from the first constant and outputting the multiplied result;

a fourth multiplier for multiplying the horizontal brightness signal non-correlative energy by a predetermined fourth constant different from the second constant and



outputting the multiplied result;

a fifth multiplier for multiplying the vertical color signal non-correlative energy by a predetermined fifth constant and outputting the multiplied result;

a sixth multiplier for multiplying the vertical brightness signal non-correlative energy by a predetermined sixth constant and outputting the multiplied result;

a seventh multiplier for multiplying the vertical color signal non-correlative energy by a predetermined seventh constant different from the fifth constant and outputting the multiplied result;

an eighth multiplier for multiplying the vertical brightness signal non-correlative energy by a predetermined eighth constant different from the sixth constant and outputting the multiplied result;

a first maximum value circuit which compares the output of said first multiplier with the output of said second multiplier, and selects and outputs the larger one as the first comparative signal;

a second maximum value circuit which compares the output of said third multiplier with the output of said fourth multiplier, and selects and outputs the larger one;

an adder for adding the output of said fifth multiplier to the output of said sixth multiplier and outputting the added



result;

a third maximum value circuit which compares the output of said seventh multiplier and the output of said eighth multiplier, and selects and outputs the larger one as the fourth comparative signal;

a ninth multiplier for multiplying the output of said second maximum value circuit by a predetermined ninth constant and outputting the multiplied result as the second comparative signal;

a tenth multiplier for multiplying the output of said adder by a predetermined tenth constant and outputting the multiplied result as the third comparative signal.

16. A brightness signal/color signal separating filter according to any one of claims 1 to 11, wherein said comparative signal generating means comprising:

a first multiplier for multiplying the horizontal color signal non-correlative energy by a predetermined first constant and outputting the multiplied result;

a second multiplier for multiplying the horizontal brightness signal non-correlative energy by a predetermined second constant and outputting the multiplied result;

a third multiplier for multiplying the horizontal color signal non-correlative energy by a predetermined third constant



different from the first constant and outputting the multiplied result;

a fourth multiplier for multiplying the horizontal brightness signal non-correlative energy by a predetermined fourth constant different from the second constant and outputting the multiplied result;__

— a fifth multiplier for multiplying the vertical color signal non-correlative energy by a predetermined constant and outputting the multiplied result;

a sixth multiplier for multiplying the vertical brightness—signal non-correlative energy by a predetermined constant and outputting the multiplied result;

a seventh multiplier for multiplying the vertical color signal non-correlative energy by a predetermined seventh constant different from the fifth constant and outputting the multiplied result;

an eighth multiplier for multiplying the vertical brightness signal non-correlative energy by a predetermined eighth constant different from the sixth constant and outputting the multiplied result;

a first maximum value circuit which compares the output of said first multiplier with the output of said second multiplier, and selects and outputs the multiplied result as the first comparative signal;



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an adder for adding the output of said third multiplier to the output of said fourth multiplier;

a second maximum value circuit which compares the output of said fifth multiplier with the output of
5 said sixth multiplier, and selects and outputs the larger one;

a third maximum value circuit which compares the output of said seventh multiplier with the output of said eighth multiplier and selects and outputs the larger one
10 as the fourth comparative signal;

a ninth multiplier for multiplying the output of said adder by a predetermined ninth constant and outputting the multiplied result as a second comparative signal;

15 a tenth multiplier for multiplying the output of said second maximum value circuit by a predetermined constant and outputting the multiplied result as a third comparative signal.

17. A brightness signal/colour signal
20 separating filter according to claim 1, 2 or 3, wherein said non-correlative energy extracting means comprises:



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(a) a first horizontal color signal non-correlative energy extracting circuit for extracting first horizontal color signal non-correlative energy from the composite color television signal, the first delayed composite color television signal, and the second delayed composite color television signal;

(b) a second horizontal color signal non-correlative energy extracting circuit for extracting second horizontal color signal non-correlative energy from the first delayed composite color television signal;

(c) a horizontal brightness signal non-correlative energy extracting circuit for extracting horizontal brightness signal non-correlative energy from the composite color television signal, the first delayed composite color television signal and the second delayed composite color television signal;

(d) a first vertical color signal non-correlative energy extracting circuit for extracting first vertical color signal non-correlative energy from the composite color television signal, the first delayed composite color television signal, and the second delayed composite color television signal;

(e) a second vertical color signal non-correlative energy extracting circuit for extracting second vertical color signal non-correlative energy from the composite color



television signal and the second delayed composite colour television signal;

(f) a vertical brightness signal non-correlative energy extracting circuit for extracting vertical
5 brightness signal non-correlative energy from the composite colour television signal and the second delayed composite colour television signal.

18. A brightness signal/colour signal separating filter according to claim 17, wherein said
10 comparative signal generating means comprises:

a first multiplier for multiplying the first horizontal colour signal non-correlative energy by a predetermined first constant and outputting the multiplied result;

15 a second multiplier for multiplying the horizontal brightness signal non-correlative energy by a predetermined second constant and outputting the multiplied result;

a third multiplier for multiplying the second
20 horizontal colour signal non-correlative energy by a predetermined third constant and outputting the multiplied result;

a fourth multiplier for multiplying the horizontal brightness signal non-correlative energy by a
25 predetermined fourth constant different from the second constant and outputting the multiplied result;



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a fifth multiplier for multiplying the first vertical color signal non-correlative energy by a predetermined fifth constant and outputting the multiplied result;

a sixth multiplier for multiplying the vertical brightness signal non-correlative energy by a predetermined sixth constant and outputting the multiplied result;

a seventh multiplier for multiplying the second vertical color signal non-correlative energy by a predetermined seventh constant and outputting the multiplied result;

an eighth multiplier for multiplying the vertical brightness signal non-correlative energy by a predetermined eighth constant different from the sixth constant and outputting the multiplied result;

a first maximum value circuit which compares the output of said first multiplier with the output of said second multiplier, and selects and outputs the larger one as the first comparative signal;

a second maximum value circuit which compares the output of said third multiplier with the output of said fourth multiplier, and selects and outputs the larger one;

a third maximum value circuit which compares the output of said fifth multiplier with the output of said sixth multiplier, and selects and outputs the larger one as the third comparative signal;



a fourth maximum value circuit which compares the output of said seventh multiplier with the output of said eighth multiplier, and selects and outputs the larger one;

a ninth multiplier for multiplying the output of said second maximum value circuit by a predetermined constant and outputting the multiplied result as a second comparative signal;

a tenth multiplier for multiplying the output of said fourth maximum value circuit by a predetermined constant and outputting the multiplied result as the fourth comparative signal.

19. A brightness signal/color signal separating filter according to claim 17, wherein said comparative signal generating means comprises:

a first multiplier for multiplying the first horizontal color signal non-correlative energy by a predetermined first constant and outputting the multiplied result;

a second multiplier for multiplying the horizontal brightness signal non-correlative energy by a predetermined second constant and outputting the multiplied result;

a third multiplier for multiplying the second horizontal color signal non-correlative energy by a predetermined third constant and outputting the multiplied result;



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a fourth multiplier for multiplying the horizontal brightness signal non-correlative energy by a predetermined fourth constant different from the second constant and outputting the multiplied result;

a fifth multiplier for multiplying the first vertical color signal non-correlative energy by a predetermined fifth constant and outputting the multiplied result;

a sixth multiplier for multiplying the vertical brightness signal non-correlative energy by a predetermined sixth constant and outputting the multiplied result;

a seventh multiplier for multiplying the second vertical color signal non-correlative energy by a predetermined constant and outputting the multiplied result;

an eighth multiplier for multiplying the vertical brightness signal non-correlative energy by a predetermined constant different from the sixth constant and outputting the multiplied result;

a first maximum value circuit which compares the output of said first multiplier with the output of said second multiplier and selects and outputs the larger one as the first comparative signal;

a second maximum value circuit which compares the output of said third multiplier with output of said fourth multiplier, and selects and outputs the larger one;



a third maximum value circuit which compares the output of said fifth multiplier with the output of said sixth multiplier, and selects and outputs the larger one as the third comparative signal;

an adder for adding the output of said seventh multiplier to the output of said eighth multiplier and outputting the added result;

a ninth multiplier for multiplying the output of said second maximum value circuit by a predetermined constant and outputting the multiplied result as the second comparative signal;

a tenth multiplier for multiplying the output of said adder by a predetermined tenth constant and outputting the multiplied result as the fourth comparative signal.

20. A brightness signal/color signal separating filter according to claim 17, wherein said comparative signal generating means comprises:

a first multiplier for multiplying the horizontal color signal non-correlative energy by a predetermined first constant and outputting the multiplied result;

a second multiplier for multiplying the horizontal brightness signal non-correlative energy by a predetermined second constant and outputting the multiplied result;



a third multiplier for multiplying the second horizontal color signal non-correlative energy by a predetermined third constant and outputting the multiplying result;

a fourth multiplier for multiplying the horizontal brightness signal non-correlative energy by a predetermined fourth constant different from the second constant and outputting the multiplied result;

a fifth multiplier for multiplying the first vertical color signal non-correlative energy by a predetermined fifth constant and outputting the multiplied result;

a sixth multiplier for multiplying the vertical brightness signal non-correlative energy by a predetermined sixth constant and outputting the multiplied result;

a seventh multiplier for multiplying the second vertical color signal non-correlative energy by a predetermined seventh constant and outputting the multiplied result;

an eighth multiplier for multiplying the vertical brightness signal non-correlative energy by a predetermined eighth constant different from the sixth constant and outputting the multiplied result;

a first maximum value circuit which compares the output of said first multiplier to the output of said second multiplier, and selects and outputs the larger one as the first comparative signal;



an adder for adding the output of said third multiplier to the output of said fourth multiplier;

a second maximum value circuit which compares the output of said fifth multiplier with the output of said sixth multiplier, and selects and outputs the larger one as the third comparative signal;

a third maximum value circuit which compares the output of said seventh multiplier with the output of said eighth multiplier, and selects and outputs the larger one;

a ninth multiplier for multiplying the output of said adder by a predetermined ninth constant and outputting the multiplied result as the second comparative signal;

a tenth multiplier for multiplying the output of said third maximum value circuit by a predetermined tenth constant and outputting the multiplied result as the fourth comparative signal.

21. A brightness signal/color signal extracting filter according to claim 17, wherein said comparative signal generating means comprises:

a first adder for adding the first horizontal color signal non-correlative energy with the horizontal brightness signal non-correlative energy and for outputting the added result as the first comparative signal;



a second adder for adding the second horizontal color signal non-correlative energy with the horizontal brightness signal non-correlative energy and for outputting the added result;

a third adder for adding the first vertical color signal non-correlative energy with the vertical color brightness signal non-correlative energy and for outputting the added result as the third comparative signal;

a fourth adder for adding the second vertical color signal non-correlative energy with the vertical brightness signal non-correlative energy and for outputting the added result;

a first multiplier for multiplying the output of said second adder by a predetermined first coefficient and outputting the multiplied result as the second comparative signal;

a second multiplier for multiplying the output of said fourth adder by a predetermined second coefficient and outputting the multiplied result as the fourth comparative signal.

22. A color signal/brightness signal separating filter according to claim 17, wherein said comparative signal generating means comprises:



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a first adder for adding the first horizontal color signal non-correlative energy with the horizontal brightness signal non-correlative energy and for outputting the added result as the first comparative signal;

a first multiplier for multiplying the second horizontal color signal non-correlative energy by a predetermined first coefficient;

a second multiplier for multiplying the horizontal brightness signal non-correlative energy by a predetermined second coefficient and outputting the multiplied result;

a first maximum value circuit which compares the output of said first multiplier with the output of said second multiplier, and selects and outputs the larger one;

a second adder for adding the first vertical color signal non-correlative energy with the vertical brightness signal non-correlative energy and for outputting the added result as the third comparative signal;

a third multiplier for multiplying the second vertical color signal non-correlative energy by a predetermined third coefficient and outputting the multiplied result;

a fourth multiplier for multiplying the vertical brightness signal non-correlative energy by a predetermined fourth coefficient and outputting the multiplied result;

a second maximum value circuit which compares the



output of said third multiplier with the output of said fourth multiplier, and selects and outputs the larger one;

a fifth multiplier for multiplying the output of said maximum value circuit by a predetermined fifth coefficient and
5 outputting the multiplied result as the second comparative signal;

a sixth multiplier for multiplying the output of said second maximum value circuit by a predetermined sixth coefficient and outputting the multiplied result as the fourth
10 comparative signal.

23. A brightness signal/color signal separating filter according to any one of the preceding claims, further comprising means for producing, from the separated color signal and the composite signal, a brightness signal and outputting
15 the said brightness signal.

24. A brightness signal/color signal separating filter for separating the brightness and color signals in a composite color television signal constructed and arranged to operate substantially as hereinbefore described with reference to and
20 as illustrated in Figures 1-15 and 17-19 of the accompanying drawings.

25. A television receiver including a brightness signal/color signal separating filter according to any one of the preceding claims.
