

PATTERN-ADAPTIVE DIGITAL COMB FILTER FOR SEPARATION
OF LUMINANCE AND COLOR COMPONENTS IN A VIDEO SIGNAL

The present invention relates to a pattern-adaptive digital comb filter which separates luminance and color (chrominance) signals by adaptive comb filtering according to the correlation between upper and lower horizontal scanning lines of three successive horizontal lines, when the luminance and color signals in an input video signal are to be separated. The invention is particularly useful in high definition television.

In a conventional color TV, the process of separating the input video signal into the luminance and color signal is essential and this process is carried out by a conventional comb filter.

In digital color televisions such as ID (Improved Definition) and ED (Extended Definition) televisions requiring high definition, in particular, the efficient separation of the luminance and color signals is required.

On the other hand, the comb filter is used on an assumption that the phase of color signal is inverted every 1H (one horizontal scanning period).

That is, the interleaving of the video signal in NTSC (National Television System Committee) way

corresponds to this.

Also, the signals before and after 1H must be similar.

Fig. 1(A) and (B) are conventional circuits for separating the luminance and color signals.

A circuit shown in Fig. 1(A) is largely divided into two parts: one is a 2H comb filter 1 including first and second 1H delays 1a and 1b, an adder 1c, first and second half-amplifiers (50% attenuators) 1d and 1f, and a subtracter 1e; and the other is an output stage 100 for providing the luminance and color signals, including a band pass filter (BPF) 102, a delay 104, and a subtracter 106.

Referring to Fig. 1(A), when a digital video signal is applied through an input port 101, the digital video signal is delayed by 1H in the first 1H delay 1a and is subsequently applied to the second 1H delay 1b, the adder 1e, and the delay 104 in the output stage 100.

The second 1H delay 1b delays the 1H-delayed video signal once more by 1H to provide a 2H-delayed video signal to the adder 1c.

Then, the adder 1c adds the 2H-delayed video signal to the input video signal.

That is, a new video signal in which luminance and color signal levels are added to each other by the addition of two video signals with the same phase, appears at the output terminal of the adder 1c and is

provided to the first half-amplifier 1d.

At this time, the first half-amplifier 1d decreases the level of the new video signal by half.

Thus, the video signal, with a level at the average of the present input video signal V level and the 2H-delayed video signal level, is applied to the subtracter 1e.

The subtracter 1e subtracts the average video signal from the 1H-delayed video signal VH to remove the luminance signal components.

In the NTSC way, on the other hand, since the phases of the video signals before and after 1H are the inverse of each other, the phases of the color signals of the 2H-delayed and the present input video signals are the same, while the phases of the color signals of the 1H-delayed video signal VH and the 2H-delayed video signal VHH or the phases of the color signals of the 1H-delayed and the present input video signals are opposite.

By subtracting the averaged video signal from the 1H-delayed video signal VH under an assumption that the luminance signal levels of the video signals before and after 1H are almost equal to each other, the luminance signal components are cancelled and only the sum of the color signal level appears at the output terminal of the subtracter 1e.

Therefore, the second half-amplifier 1f provides the

averaged value of the color signal levels of the 2H-delayed video VHH and the present input video signal by decreasing the sum of the color signal levels to one half.

The output of the second half-amplifier 1f includes the color signal components filtered in a vertical direction and a complete color signal C is finally provided from the BPF 102.

At this time, the BPF 102 passes only the signal within the color signal band in a horizontal direction.

Also, the delay 104 delays the 1H-delayed video signal VH by a time that corresponds to the delay taken for the generation of the complete color signal C through the aforementioned circuits, to provide the 1H-delayed video signal VH in synchronization with the color signal C.

Then, the subtracter 106 separates and provides only the luminance signal Y by subtracting the color signal C from the 1H-delayed (and further delayed) video signal.

In this way, the input digital video signal is separated into the digital luminance signal Y and color signal C.

At this time, the comb-filtering performed by the 2H comb filter 1 means the separation of the color signal components from the input video signal and the delayed video signal by a predetermined time, while cancelling the luminance signal components.

As described above, the circuit shown in Fig. 1(A)

can separate the luminance and color signals from the input video signal.

But, if a vertical transition is occurring across the three successive horizontal scanning lines, unwanted phenomena such as cross color and dot disturbance are generated by the circuit shown in Fig. 1(A).

Fig 1(B) is another separation circuit of luminance and color signals comprising an adaptive 2H comb filter.

Referring to Fig. 1(B), a 1H comb filter 2 comprises first and second 1H delays 2a and 2b, subtracters 2c and 2d, and first and second half-amplifiers 2e and 2f.

An adaptive selection circuit 3 also comprises first - third low pass filters (LPF) 3a-3c, subtracters 3d and 3e, first and second absolute value detectors 3f and 3g and a correlation detector 3h.

Finally, an output stage for providing the luminance and color signals comprises a band pass filter (BPF) 102, a delay 104, and a subtracter 106.

In the circuit shown in Fig. 1(B), if a digital video signal is applied through an input port 101, the input video signal

is delayed by 1 H in the first 1H delay 2a and is subsequently applied to the second 1H delay 2b, the subtracters 2c and 2d, the second LPF 3b, and the delay 102.

- 5 The second 1H delay 2b delays the 1H-delayed video signal once more by 1H to provide a 2-H delayed video signal to the subtracter 2d and the third LPF 3c.

Therefore, the subtracter 2c subtracts the 1H-delayed video signal V_H from the input video signal V through the input port 101.

That is, the luminance signal components are cancelled by subtraction of the 1H-delayed video signal V_H from the input video signal V , while the color signal components are added since the phases of the color signals of the 1H-delayed video signal and the present input video signal are inverted with respect to each other and their luminance signals almost equal to each other.

Then, the sum of the color signal component levels is provided to the first half-amplifier 2e.

On the other hand, the subtracter 2d subtracts the 1H-delayed video signal V_H from the 2H-delayed video signal V_{HH} .

Similarly, the luminance signal components are cancelled, while the levels of the color signal component are added, since the phases of the color signals of the 1H-delayed video signal V_H and the 2H-delayed video signal V_{HH} are inverted with respect to each other and their luminance signal components are almost equal to each other.

Therefore, the sum of the color signal components is provided from the subtracter 2d to the second half-amplifier 2f.

The first half-amplifier 2e provides a first

averaged color signal component of the 1H-delayed video signal VH and the present input video signal V to an input port Io of a multiplexer 4 by decreasing the added color signal component of the subtracter 2c to half.

Also, the second half-amplifier 2f provides a second averaged color signal component of the 1H-delayed video signal to another input port Ii of the multiplexer 4 by decreasing the added color signal component in the subtracter 2d to half.

On the other hand, the first-third LPF's 3a-3c filter the present input video signal V, the 1H-delayed video signal VH, and the 2H-delayed video signal VHH, to provide each luminance signal.

The subtracter 3d subtracts the output of the first LPF 3a from the output of the second LPF 3b and provides the result to the first absolute value detector 3f, while the subtracter 3e subtracts the output of the third LPF 3c from the output of the second LPF 3b and provides the result to the second absolute value detector 3g.

Then, the first absolute value detector 3f detects the absolute value of the output of the first subtracter 3d and provides the result to an input terminal of the correlation detector 3h, while the second absolute value detector 3g detects the absolute value of the output of the second subtracter 3e and provides the result to another input port of the correlation detector 3h.

The correlation detector 3h detects the correlation between the outputs of the two absolute value detectors 3f and 3g and provides a logic selection signal according to the detected degree of correlation to a selection signal input port B of the multiplexer 4.

At this time, the correlation detector 3h provides the selection signal so that the multiplexer 4 selects and provides the color signal component with a larger degree of correlation, that is, the comb-filtered color signal component corresponding to the smaller of the outputs of the first and second absolute value detectors 3f and 3g.

For example, if the output of the first absolute value detector 3f is smaller than that of the second absolute value detector, it means that the correlation between the input video signal V and the 1H-delayed video signal VH is larger than the correlation between the 1H-delayed video signal and the 2H-delayed video signal VHH.

Then, the selection signal provided from the correlation detector 3h becomes '0' so that the multiplexer 4 selects and provides the first color signal component generated by comb-filtering of the input video signal and the 1H-delayed video signal.

On the other hand, if the output of the first absolute value detector 3f is larger than that of the second absolute value detector 3g, the multiplexer 4

selects and provides the second color signal component by the selection signal B of '1'.

Next, the BPF 104 filters the first or second color signal component to provide the complete color signal c, and the delay 104 delays the 1H-delayed video signal to provide it in synchronization with the color signal c.

Then the subtracter 104 subtracts the color signal c from the 1H-delayed video signal VH to select and provide only the luminance signal.

The circuit shown in Fig. 1(B) can reduce the cross color phenomenon by adaptive 1H comb-filtering according to the correlation between the three horizontal scanning lines.

However, even if all three horizontal scanning lines have good correlation with one another, the 1H comb-filtering is still carried out on one side only.

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According to the present invention, there is provided a pattern-adaptive digital comb filter, comprising: a comb filter for providing first and second 1H comb data signals by 1H comb-filtering of an input digital video signal on three successive horizontal scanning lines, and for providing 2H comb data signal by 2H comb-filtering, digital

correlation means, connected to said comb filter, for providing first and second correlation data signals, by detecting the low band transition of luminance signals produced from each pair of the said horizontal scanning lines through low pass filtering of the first and second 1H comb data signals and by detecting their absolute values, selecting means, connected to said comb filter, for selecting and providing as an output one of the first and second 1H comb data signals and the 2H comb data signal and comb-filtering control means, connected to said digital correlation means, for providing selection data to the selecting means to select the 2H comb data signal when both first and second correlation data are indicative of a correlation better than a predetermined level of correlation, and to select whichever data signal has the larger correlation, either the first or the second 1H comb data signal, when either the first or second comb data is indicative of a correlation better than said predetermined level of correlation.

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With conventional filters, if an irregular video input that does not agree with the assumed condition of the comb-filter is applied from a video tape recorder or a games player, the 1H comb-filtering is carried out on one side. Thus, the possibility of error generation becomes significant. It is

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therefore a preferred feature of the invention to provide means for determining whether the input digital video signal is irregular, and in which the comb-filtering control means causes the selecting means instead to select as the output
5 the input digital video signal without any comb-filtering,

in response to such a determination that the signal is irregular.

The present invention will now be illustrated by a description of a preferred embodiment, with reference to the accompanying drawings, in which:

Figs. 1(A) and 1(B) are block diagrams of the conventional circuits for separating luminance and color signals, already described above; and

Fig. 2 is a block diagram of a pattern-adaptive digital comb filter for separation of a luminance and a color signal, according to an embodiment of the present invention.

With reference to Figure 2, a correlation data generator 20 and a multiplexer 30 are connected to a comb filter 10 for providing first and second 1H comb data by 1H comb-filtering of video signals on three successive horizontal scanning lines applied through a video signal input terminal and providing a 2H comb data by 2H comb-filtering, and providing a 1H-delayed video signal.

In the comb filter 10, a second 1H delay 12 for providing a 2H-delayed video signal VHH by delaying a 1H-delayed video signal VH once more is connected to a first 1H delay 11 for providing the 1H-delayed video signal VH by delaying a video signal V applied through a video signal input terminal 101.

Next, a subtracter 13 for performing the 1H

comb-filtering by subtracting the presently applied video signal V from the 1H-delayed video signal VH is connected to the video signal input port 101 and the output terminal of the first 1H delay 11.

Also, another subtracter 14 for performing the 1H comb-filtering by subtracting the 2H-delayed video signal VHH from the 1H-delayed video signal VH is connected to the output stages of the first and second 1H delays 11 and 12.

On the other hand, first and second half-amplifiers 15 and 16 are respectively connected to the subtracters 13 and 14 to provide first and second 1H comb data after amplifying the outputs of the subtracters 13 and 14 to one half.

Also, an adder 17 for performing the 2H comb-filtering by adding the outputs of the first and second half-amplifiers 15 and 16 to each other is connected to the output terminals of the first and second half-amplifiers 15 and 16.

Next, a third half-amplifier 18 for providing 2H comb data after amplifying the output of the adder 17 to half is connected to the output terminal of the adder 17.

In the correlation data generator 20, on the other hand, first and second LPF's 22 and 24 are respectively connected to the output terminals of the first and second half-amplifiers 15 and 16 to detect the low band transition of luminance signal produced between each of

the horizontal scanning line pairs, by low pass filtering of the first and second 1H comb data.

Next, first and second absolute value detector circuits 26 and 28 for providing first and second correlation data by detecting the absolute value of the low band transition are connected to the first and second LPF's 22 and 24, respectively.

Also, a multiplexer 30, of which input terminals I_0 - I_3 are connected to the output terminals of the comb filter 10, selects one of the first and second 1H comb data, the 2H comb data, and the 1H-delayed video signal according to the selection data applied to the selection terminals B0 and B1 and provides the selected data through an output terminal Z.

A comb-filtering controller 40 is connected simultaneously to the output terminal of the correlation data generator 20, and the selection terminals B0 and B1 of the multiplexer 30.

The comb-filtering controller 40 compares the first and second correlation data with the reference data applied to the reference input terminal 102, respectively.

Subsequently, the comb filtering controller 40 provides the selection data B0 and B1 to the multiplexer 30 so that if both the first and second correlation data are smaller than the reference data the 2H comb data is selected, if both the first and second

correlation data are larger than the reference data the one with the larger correlation of the first and second 1H comb data is selected, and if the irregular data applied through the irregular signal input terminal 103 is '1', the 1H-delayed video signal VH is selected.

The comb-filtering controller comprises first, second, and third comparators 42, 44 and 46, two AND gates AN1 and AN2, and three OR gates OR1, OR2 and OR3.

The first comparator 42, of which input terminals A and B are connected respectively to the output terminals of the first and second absolute value detectors 26 and 28, compares the first correlation data with the second correlation data and provides the comparison result through output terminals $A > B$ and $A < B$.

Also, the second comparator 44, of which input terminals A and B are connected respectively to the output terminal of the first absolute value detector 26 and the reference input terminal 102, compares the first correlation data with the reference data and provides the comparison result through an output terminal $A > B$.

The third comparator 46, of which input terminals A and B are connected respectively to the output terminal of the second absolute value detector 28 and the reference input terminal 102, compares the second correlation data with the reference data and provides the comparison result through an output terminal $A > B$.

Thus, the first, second, and third comparators 42,

44 and 46 compare the magnitudes of two inputs applied to the input terminals A and B and each provides '0' or '1' to the corresponding output terminals $A < B$ and $A > B$ according to the comparison result.

An input terminal of the AND gate AN1 is connected to the output terminal of the OR gate OR1, of which two input terminals are connected to the output terminals $A > B$ of the second and third comparators 44 and 46. Another input terminal of the AND gate AN1 is connected to the output terminal $A > B$ of the first comparator 42.

Also, an input terminal of the AND gate AN2 is connected to the output terminal of the above OR gate OR1, and its other input terminal is connected to the output terminal $A < B$ of the first comparator 42.

An input terminal of the OR gate OR2 and an input terminal of the OR gate OR3 are connected to the irregular signal input terminal 103, and another input terminal of the OR gate OR2 is connected to the output terminal of the AND gate AN 1.

The other input terminal of the OR gate OR3 is connected to the output terminal of the AND gate AN2.

These OR gates OR2 and OR3 provide the 2-bit selection data to the multiplexer 30.

On the other hand, a BPF 108 in an output stage 100 of luminance and color signals filters the output of the multiplexer 30 to provide a color signal C.

A delay 104 delays the 1H-delayed video signal VH by

a predetermined time, and a subtracter 106 subtracts the color signal C from the 1H-delayed video signal VH to generate a luminance signal Y.

In the present circuit as described above, if the power is turned on and the digital video signal V is applied to the first 1H delay 11 and the subtracter 13, the first 1H delay 11 delays the video signal V to generate the 1H-delayed video signal and the second 1H delay 12 delays the 1H delayed video signal VH once more to generate the 2H-delayed video signal VHH.

The subtracter 13 subtracts the video signal V from the 1H-delayed video signal VH and provides the result to the first half-amplifier 15.

Then the output of the subtracter 13 is decreased to half by the first half-amplifier 15 and subsequently is provided to the input terminal I_1 of the multiplexer 30 as the first 1H comb data related to the video signal V and the 1H-delayed video signal VH.

Also, the subtracter 14 subtracts the 2H-delayed video signal VHH from the 1H-delayed video signal VH and provides the result to the second half-amplifier 16.

Similarly, the output of the subtracter 14 is decreased to half by the second half-amplifier 16 and subsequently is provided to the input terminal I_2 of the multiplexer as the second 1H comb data related to the 1H-delayed video signal VH and the 2H-delayed video signal VHH.

The adder 17 adds the first and second 1H comb data to each other and provides the result to the third half-amplifier 18.

Then the output of the adder 17 is decreased to half by the third half-amplifier 18 and subsequently is provided to the input terminal 10 of the multiplexer 30 as the 2H comb data related to the three horizontal scanning lines, that is, the video signal V, the 1H-delayed video signal VH, and the 2H-delayed video signal VHH.

On the other hand, the first and second LPF's 22 and 24 detect the low band transitions generated between each horizontal scanning line pair by filtering the first and second 1H comb data, and provide the detected low band transitions to the first and second absolute value detectors 26 and 28 respectively.

Then, the first and second absolute value detectors 26 and 28 output the first and second correlation data by detecting the absolute values of the detected low band transitions, respectively.

At this time, the first and second correlation data are used to detect the degree of correlation between the present input video signal V and the 1H-delayed video signal VH and the 2H-delayed video signal VHH, respectively.

The smaller absolute value means the larger degree of correlation, while the larger absolute value means

the smaller degree of correlation.

That is, the large absolute value means the generation of the low band transition.

The first correlation data is applied to each input terminal A of the first and second comparators 42 and 44, while the second correlation data is applied to the input terminal B of the first comparator 42 and the input terminal A of the third comparator 46.

Also, the reference data which is applied in common to the input terminals B of the second and third comparators 44 and 46 is used to measure the level of the correlation provided from a system control microcomputer (not shown in the drawings).

If both first and second correlation data are smaller than the reference data, the outputs of the second and third comparators become '0' and outputs of the AND gates AN1 and AN2 also become '0'.

At this time, if the input video signal is a regular one, the outputs of the OR gates OR2 and OR3 become '0' since a low data, that is, '0' is applied through the irregular signal input terminal 103.

Thus, the 2-bit selection data '00' is applied to the selection terminals B_0 and B_1 of the multiplexer 30 so that the 2H comb data is selected by the multiplexer 30.

On the other hand, if both the first and second

correlation data are larger than the reference data, the outputs of the second and third comparators become '1' and thus the AND gates AN1 and AN2 are enabled. Further, if either (but not both) of the first and second correlation data are larger than the reference data, the outputs of the comparators will become '1' and '0', and the AND gates AN1 and AN2 are enabled. Further, if either (but not both) of the first and second correlation data are larger than the reference data, the outputs of the comparators will become '1' and '0', and the AND gates will still be enabled. In this enabled state, if the first correlation data is larger than the second correlation data, the level of correlation between the video signal V and the 1H-delayed video signal is smaller than that of correlation between the 1H-delayed video signal VH and the 2H-delayed video signal VHH and the output terminals A>B and A<B of the first comparator 42 provide '1' and '0', respectively.

Thus, the outputs of the OR gates OR2 and OR3, that is, the 2-bit selection data, become '10' and the multiplexer 30 selects and provides the 1H comb data derived from the 1H-delayed video signal VH and the 2H-delayed video signal VHH.

However, if the second correlation data is larger than the first correlation data, the level of correlation between the video signal V and the 1H-delayed video signal VH is larger than that of correlation between the 1H-delayed video signal

VH and the 2H-delayed video signal VHH, and the output terminals A>B and A<B provide '0' and '1' respectively. Thus, "01" is applied to the terminals B1 and B0 of the multiplexer 30. The multiplexer 30 therefore selects the H
5 comb data, derived from the undelayed video signal V and the 1H-delayed video signal VH.

In the event of an irregular video signal, '1' is applied to the irregular signal terminal 103 and the outputs of the OR
10 gates OR2 and OR3, that is, the 2-bit selection data, become '11'. Consequently, the multiplexer 30 selects and provides the 1H-delayed video signal.

Thus, the BPF 108 provides the color signal C by filtering
15 the output of the multiplexer 30, and the delay 104 delays the 1H-delayed video signal by a predetermined time and provides the delayed signal in synchronization with the color signal C. Then, the subtracter 6 separates only the luminance signal by subtracting the color signal from the
20 1H-delayed video signal VH.

As mentioned above, this circuit can reduce noise, as it performs adaptively the 1H comb-filtering or the 2H comb-filtering according to the correlations among the video
25 signal on the three horizontal scanning lines in the separation of the luminance and color signals of the digital color television.

Also, even if an irregular video signal is applied, the circuit can reduce unwanted effects, by passing it without the comb-filtering operation.

CLAIMS

1. A pattern-adaptive digital comb filter, comprising:
a comb filter for providing first and second 1H comb data
signals by 1H comb-filtering of an input digital video
5 signal on three successive horizontal scanning lines, and
for providing 2H comb data signal by 2H comb-filtering,
digital correlation means, connected to said comb filter,
for providing first and second correlation data signals, by
detecting the low band transition of luminance signals
10 produced from each pair of the said horizontal scanning
lines through low pass filtering of the first and second 1H
comb data signals and by detecting their absolute values,
selecting means, connected to said comb filter, for
selecting and providing as an output one of the first and
15 second 1H comb data signals and the 2H comb data signal and
comb-filtering control means, connected to said digital
correlation means, for providing selection data to the
selecting means to select the 2H comb data signal when both
first and second correlation data are indicative of a
20 correlation better than a predetermined level of
correlation, and to select whichever data signal has the
larger correlation, either the first or the second 1H comb
data signal, when either the first or second comb data is
indicative of a correlation better than said predetermined
25 level of correlation.



2. A digital comb filter according to claim 1, comprising means for determining whether the input digital video signal is irregular, and in which the comb-filtering control means causes the selecting means instead to select as the output
5 the input digital video signal without any comb-filtering, in response to such a determination that the signal is irregular.

3. A digital comb filter according to claim 1 or 2, in
10 which the selecting means is a multiplexer which has a selection terminal connected to receive the selection data from the comb-filtering control means.

4. A digital comb filter according to claim 2, in which
15 said comb filter comprises:

a first delay for providing a 1H-delayed video signal by delaying the input digital video signal applied through a video input terminal by 1H,

a second delay for providing a 2H-delayed video signal by
20 delaying the 1H-delayed video signal one more,

a first subtractor, connected to the video input terminal and the output stage of said first delay, for performing the 1H comb-filtering by subtracting the video input signal from the 1H-delayed signal,

25 a second subtractor, connected to the output



terminals of said first and second delays, for performing the 1H comb-filtering by subtracting the 2H-delayed video signal from the 1H-delayed video signal,

first and second half-amplifiers connected to the output terminals of said subtracters, for providing the first and second 1H comb data signals by decreasing the output of said subtracters to half,

a third subtractor, connected to the output terminals of said first and second half-amplifiers, for performing the 2H comb-filtering by adding the outputs of said first and second half-amplifiers, and

a third half-amplifier connected to the output terminal of said third subtracter, for providing the 2H comb data signal by decreasing the output of said third subtracter to half.

5. A digital comb filter according to claim 4, wherein said digital correlation means comprises:

first and second low pass filters connected respectively to said first and second half-amplifiers, for detecting low band transitions generated between each comb-filtered horizontal scanning line pair by low pass filtering of the first and second comb data signals, and

first and second absolute value detectors connected respectively to said low pass filters, for providing the first and second correlation data by detecting the



absolute values of the detected low band transitions.

6. The digital comb filter according to claim 5, wherein said comb-filtering control means comprises:

a first comparator, of which the input terminals are connected respectively to said first and second absolute value detectors, for comparing those inputs with each other and providing the comparison result through output terminals,

a second comparator, of which one input terminal is connected to the output terminal of said first absolute value detector and another input terminal is connected to receive reference data indicative of the said predetermined level of correlation, for comparing the first correlation data and the reference data with each other and providing the comparison result through an output terminal,

a third comparator, of which one input terminal is connected to the output terminal of said second absolute value detector and another input terminal is connected to receive the reference data, for comparing the second correlation data and the reference data with each other and providing the comparison result through an output terminal,

an OR gate of which the input terminals are connected to the output terminals of said second and third comparators, respectively,



- two AND gates of which a common input terminal is connected to the output terminal of said OR gate and the other input terminals are connected to the output terminals of said first and second comparators respectively, and
- 5 two OR gates, of which a common input terminal is connected to an input terminal for receiving the signal indicative of whether the input digital video signal is irregular, and the other two terminals are connected to the output terminals of said AND gates, respectively, for providing the selection
- 10 data as 2-bit data.

7. A digital comb filter for digital video signal, substantially as described herein with reference to Figure 2 of the accompanying drawings.

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8. High definition digital colour television apparatus incorporating a digital comb filter in accordance with any preceding claim.

