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tech tips

Servicing Video Comb Filters

Comb filters are widely used in video circuits to separate the luminance signals from the color signals. Compared to conventional bandpass filters, comb filters provide much better picture detail, and eliminate most of the interference caused by the interleaved chrominance and luminance.

This Tech Tip explains how to test, troubleshoot, and align comb filter circuits for optimum performance using the video patterns supplied by the VG91 Universal Video Generator. Refer to Tech Tip #201, "understanding Video Comb Filters" for information on how comb filters operate.

Symptoms Of A Bad Comb Filter

Comb filters fail in one of two ways:

1. One or both outputs missing.
2. Both outputs produce signals, but the signals are improperly separated.

If the chroma output is missing, the receiver usually produces a good black and white picture with weak or missing color. If the luminance signal is weak or missing, the receiver produces a dark or blank CRT. If the raster is not blanked, there may be large areas of color, without the detail carried by the luminance signal.

Often both comb filter outputs produce a signal, but a bad component or a change in the comb filter's alignment causes the signals to separate incorrectly. The receiver may appear to work normally, but the picture lacks the extra detail that the comb filter makes possible.

At other times, a defective comb filter causes the receiver to produce a worse picture than a conventional receiver, because of improper combing. The poorly combed signals cause excessive interference in the chroma and luminance circuits producing false colors and grainy color picture areas.

Using the VG91 Luma/Chroma Bar Sweep Pattern

The Sencore VG91 Universal Video Generator provides several features that help test and align comb filters. The Luma/Chroma Bar Sweep pattern, the Interlace Adder Button, and the STD video out jack.

The Luma/Chroma Bar sweep pattern tests for proper separation of the luminance and chroma signals. It also analyzes the frequency response of the luminance and chroma signals.

The Luma/Chroma Bar Sweep pattern has 10 different test frequency bars. The test frequency bars include 6 luminance phase and 4 chroma phase frequency bars. The frequency bars of the Luma/Chroma pattern are chosen to provide luminance and chroma test frequencies in the frequency spectrum shared by these two signals.

The 6 luminance frequency bars range from a 0 referfence to 4.5 MHz. The 3.28, 3.88, and 4.20 MHz luminance phase bars occupy the chroma frequency spectrum and must be combed out by the comb filter. The 4.2 MHz frequency bar is included to test how well the comb filter responds to the highest luminance frequency included in a broadcast signal. Each luminance bar represents a different amount of resolution (picture detail) on the CRT screen.

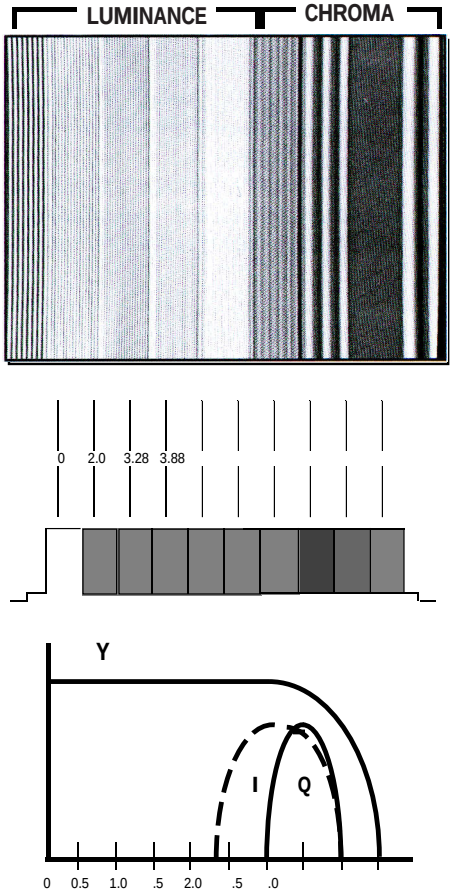


Fig. 1: The Luma/Chroma Bar Sweep video pattern includes luminance and chroma test frequency bars to dynamically tests separation and frequency response of comb filters

The 4 chroma phase frequency bars include a 3.58 MHz subcarrier bar and chroma test frequency bars of 3.08, 4.08 and 2.28. Three test frequenciy bars occupy the same specturm with luminace and must be combed out by the comb filter. The 2.28 MHz chroma frequency bar is near the highest I chroma sideband which may be transmitted in the composite video signal. The 3.08 and 4.08 chroma bars represent a different chroma sideband frequencies.

The VG91's "INTERLACE" Signal Adder is also important when analyzing comb filters operation. It removes the interlace sync. Non-interlaced video causes the phase of the color subcarrier to repeat from one vertical sweep to the next making chroma interference much easier to see. An interlaced signal, as available from TV stations, VCRs, and most video generators reverses the phase of the color subcarrier on alternating frames of video information, making tests form the TV CRT more difficult. Leave the VG91?s Interlace Signal Adder turned off for comb filter testing.

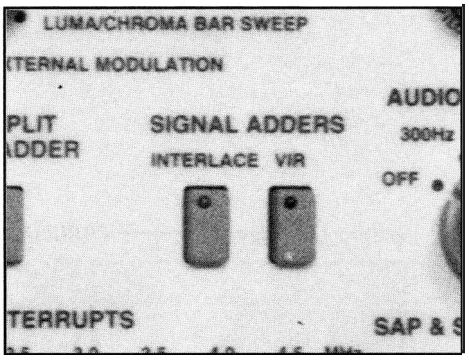


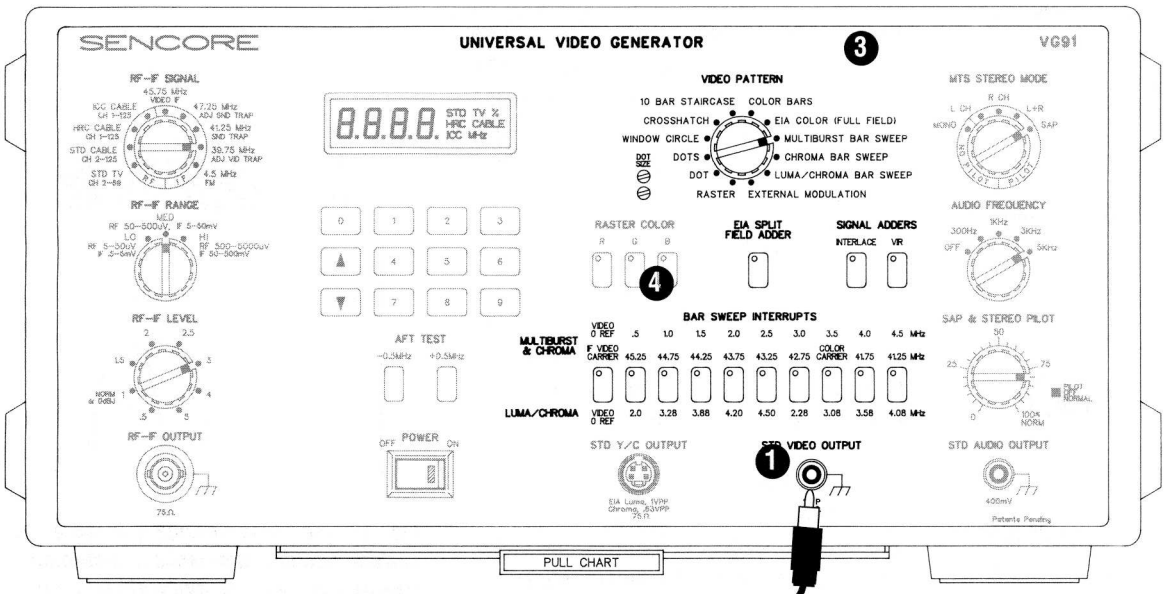
Fig. 2: The "Interlace" Signal Adder duplicates interlace or non-interlace video signals when testing comb filter operation.

Testing Comb Filter Performance

The Luma/Chroma Bar Sweep pattern provides an easy and dynamic check of the performance of the comb filter. When working properly, the comb filter should separate the luminance and chroma frequency bars of the pattern.

To test Comb Filter Performance:

1. Connect the VIDEO TEST CABLE from VIDEO OUTPUT of the VG91 to the VIDEO INPUT of the TV/Video system.
2. Set the video system to receive a signal input from its External VIDEO INPUT Jack.
3. Select the LUMA/CHROMA BAR SWEEP Video Pattern of the VG91.
4. Set all BAR SWEEP INTERRUPTS switches "On".



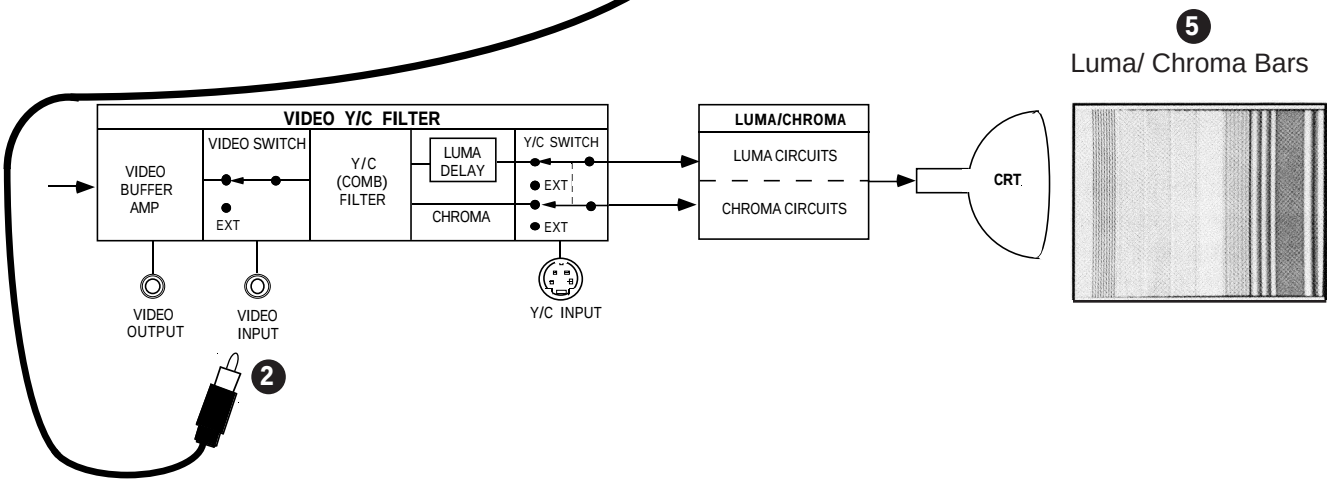


Fig. 3: The Luma/Chroma Bar Sweep pattern dynamically tests the separation and overall frequency response of the Comb filters.

5. Monitor the Luma/Chroma frequency bars on the CRT display or connect a dual trace oscilloscope to luminance and chroma outputs of the Y/C (Comb) filter.

When observing the Luma/Chroma frequency bars on the CRT you should see no color in the luminance bars. Color in the luminance bars indicates poor comb filter performance, or the need for the comb filter to be adjusted. Receivers which do not use comb filters will normally show color in the luminance portion of the luma/chroma video pattern.

The VG91 outputs the Luma/Chroma frequency bars at approximately the same amplitude to the STD Video Output Jack. Therefore, the comb filter should output luminance frequencies to 4.2 MHz. If the luminance bar frequencies are correctly passing through the comb filter, you should see distant vertical stripes on the CRT of the TV or monitor.

You can use the BAR SWEEP INTERRUPTS of the VG91 to identify poor separation between the luminance and chroma outputs. Turn off the luminance bars while observing the chroma waveform or chroma bars on the CRT. Noticeable changes in the chroma bars as you turn the luminance bars on and off are a result of luminance signals getting into the chroma circuits. Also observe the luminance waveform or luminance bars on the CRT while removing the chroma bar frequencies. Visible changes seen are a result of chroma interference to the luminance circuits.

A scope provides a more accurate method to measure the frequency response of the comb filter, as shown in Figure 4, since it clearly shows the comb filter?s response to each bar. The amplitude of the luminance frequency bars indicate the bandpass response of the comb filter. The comb filter's luminance output should include an output for each of the 0-4.2 MHz bars. A gradual reduction in the level of the 3.28, 3.88 and 4.2 MHz bars is normal.

The comb filter's chroma output should show the 2.28-4.08 MHz bars. The bars should be simalar amplitudes, although a slight reduction in the 2.28 MHz bar is normal. Observe the monitor for any noticable luminance interference in the chroma frequency bars. This indicates poor performance or the need for comb filter adjustment.

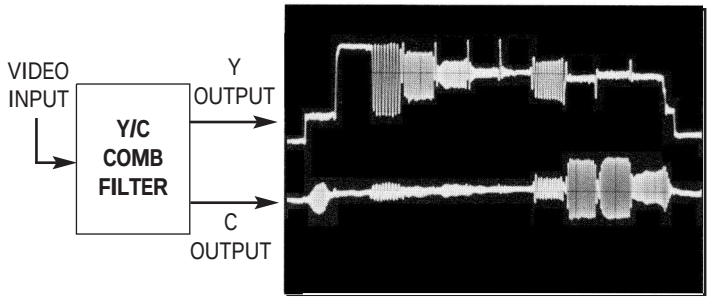


Fig. 4: Set the comb filter to null the chroma observed in the luminance bars and luminance interference to the chroma bars while obtaining best overall chroma and luminance frequenecy response and as shown here.

Aligning the Comb Filter

The Luma/Chroma Bar Sweep pattern can be used to simplify comb filter alignment. Adjustments optimize the filter for best separation and best overall luminance and chroma frequency response.

Most comb filters need to be properly aligned for optimum performance. Adjustable coils and potentiometers set the phase and levels of the signals for correct combing. The VG91's Luma/Chroma Bar Sweep video pattern lets you dynamically set the alignment controls.

Use non-interlace sync and adjust the controls for the least amount of chroma leakage observed in the luminamce bars. Monitor the luminance bars for the most detail (overall frequency response).

For the best results, connect a dual trace oscilloscope to the comb filter's luminance and chroma outputs. Then adjust the luminance output for minimal chroma in the 2.28-4.08 MHz bars while obtaining best overall luminance response

Observe both the chroma bars on the TV or monitor?s CRT and then the chroma output on the oscilloscope. Adust the coil and/or resistor that sets the chroma output to minimize the luminance in the 2.0-4.5 MHz bars while obtaining best overall chroma response.

For More Information,
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