SENCORE

Means Success In Electronic Servicing

tech tips

Testing VCR Color Circuits Using The VA62/VC63 And SC61

VCRs are used almost exclusively for recording and playing back color programs. Problems in the VCR color circuits produce many symptoms such as: no color, wrong tint, weak color, won't record color, or won't playback color on another VCR. A systematic approach to servicing will simplify your troubleshooting of these VCR color problems.

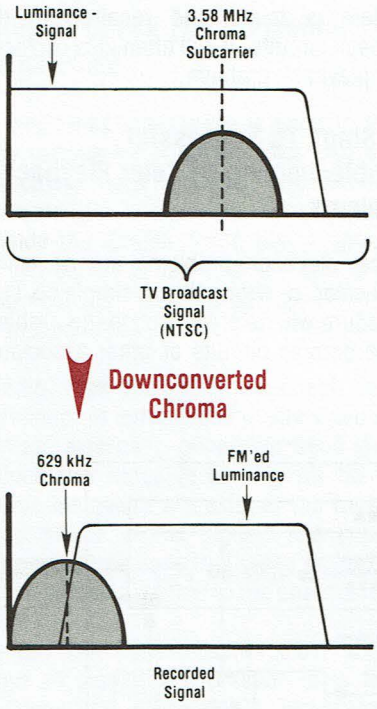

Fig. 1: The chroma information is converted down to a lower frequency so it can be better handled by the VCR circuits.

Understanding The Downconverted Chroma Signal

The color information, in a VCR, is converted down from 3.58 MHz to 629 kHz (688 kHz in Beta) before it is recorded on the tape (Figure 1). Special circuits in the chroma record section perform this conversion process while maintaining good frequency and phase stability.

During playback, additional chroma circuits convert the 629 kHz (688 kHz in Beta) chroma information back to a 3.58 MHz chroma signal needed by the television receiver (Figure 2). The action of the VCR servos along with changes in the video tape due to humidity, temperature, and tape tension, generates a relatively high amount of frequency and phase instability. The chroma playback circuits must also correct any frequency and phase errors that occur during the record/playback process.

Functional Testing Speeds VCR Color Troubleshooting

Figure 3 shows a functional block diagram of the VCR color playback circuits. Early VCRs were designed with each functional

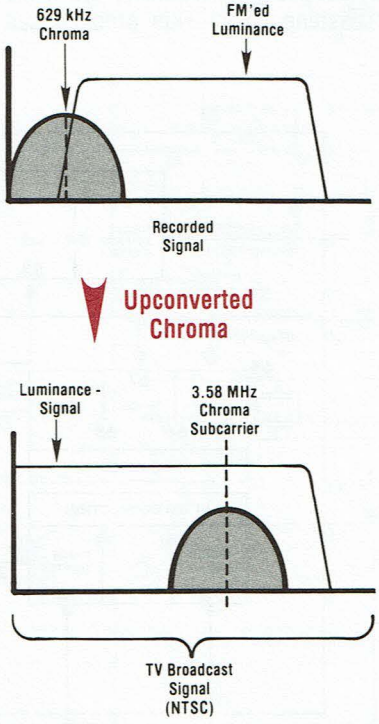

Fig. 2: During playback, the VCR converts the downconverted chroma information back up to a frequency that can be used by the television receiver.

circuit built out of discrete parts. These VCRs could be troubleshot by following the signal through each stage, one at a time. Today, many of the functional circuits are located within one or more ICs (Figure 4). No longer can you check a specific functional stage. You must service these VCRs using the available input and output signals. This does not, however, eliminate functional analyzing. In fact, functional analyzing is all the more important.

Four Signals Are Needed For Proper VCR Color Operation

The development of the color IC has actually simplified the servicing of color stages. Regardless of how simple or how complex a VCR chroma IC is, there are 4 basic signals that are required for proper color recording and playback. These signals are:

1. **The Chroma Signal:** The color circuits require a signal that contains the color information. In the VCR record mode, this signal consists of the color burst and chroma sideband signals that are stripped from the composite video signal. In the playback mode, this signal consists of the downconverted 629 kHz (688 kHz in beta) chroma signal taken off the video tape.

2. **The Horizontal Sync Signal:** This signal is required to sync the various burst gates, automatic color control circuits, color killer circuits, and phase shifting circuits. In the record mode, this signal comes from the incoming video signal. In the playback mode, it is obtained from the recorded luminance signal.

3. **The 30 Hz Switching Pulse:** In the record mode, the color information is changed in phase each horizontal line of information. The 30 Hz switching pulse keys in a different phase sequence for each video head. This is done to minimize crosstalk between the recorded tracks of

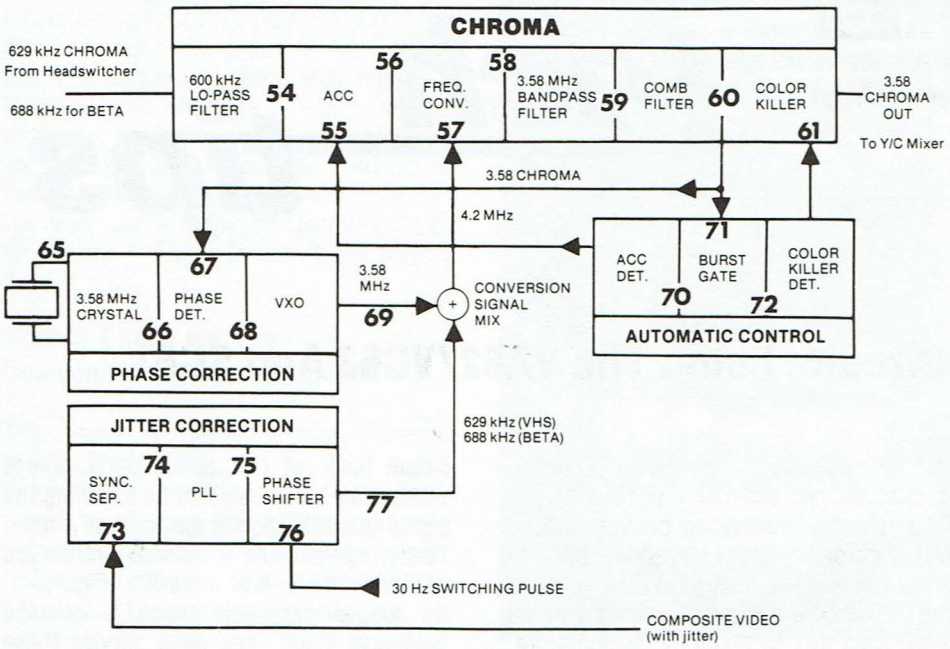

Fig. 3: In playback, a set of circuits performs the function of converting the color information from the downconverted signal up to a signal that can be used by a television receiver.

information. In the playback mode, the 30 Hz switching pulse is used to reverse the process that was done in record.

4. **The Local 3.58 MHz Oscillator Signal:** In the record mode, this signal is used to mix the chroma information down to the desired downconverted chroma signal. In the playback mode, the 3.58 MHz signal is used to mix the downconverted chroma information back up to the 3.58 MHz signal needed for the color circuits in the television receiver.

In addition to these four signals, there is often a control signal coming from the VCR microprocessor. This signal turns on either the record circuits or the playback circuits in the chroma IC.

All four of these signals, in addition to the control signal, must be present, and at the correct phase and amplitude, in order for the chroma circuits to operate properly.

Let's now see how to troubleshoot VCR chroma problems using the VA62/VC63 VCR Video Analyzing package and the SC61 Waveform Analyzer.

Make Sure The Problem Is Actually In The Color Circuits

Before you suspect a problem in the color circuits, check the VCR to be sure that the servo and luminance circuits are working properly. Play a pre-recorded tape in the VCR. Check to make sure that the tape is running at the correct speed and that you are getting a good luminance signal (black and white picture). If the VCR has a dirty or defective head, for instance, you will often see flashing color. This problem can be easily identified, however, since the luminance signal will also be flashing or have a lot of noise in it. Repair any problems that affect the luminance signal before suspecting problems in the color circuits.

A servo problem can also give symptoms that could be mistaken as a color problem. Servo problems can also be identified by looking at the luminance signal. If the picture has poor video, or is jittery, check the servo circuits. Check the tracking control to see if it operates correctly. Repair any servo problem before suspecting a problem in the color circuits.

Once you are sure that the VCR servos, video heads, and luminance circuits are working properly, check the quality of the color picture. Make sure that the VCR gives a good color picture from a prerecorded tape. Some color problems will allow a tape, recorded with the VCR, to play back properly on that VCR, but not play back on another VCR. In addition, if a problem is found and repaired in the playback circuits, it will often also correct a color playback problem.

Six Steps To Successful Troubleshooting Of Color Playback Problems

Typical playback problems are no color, weak color, or wrong tint. A simple six step procedure will help you isolate the problem to the chroma circuits or other associated

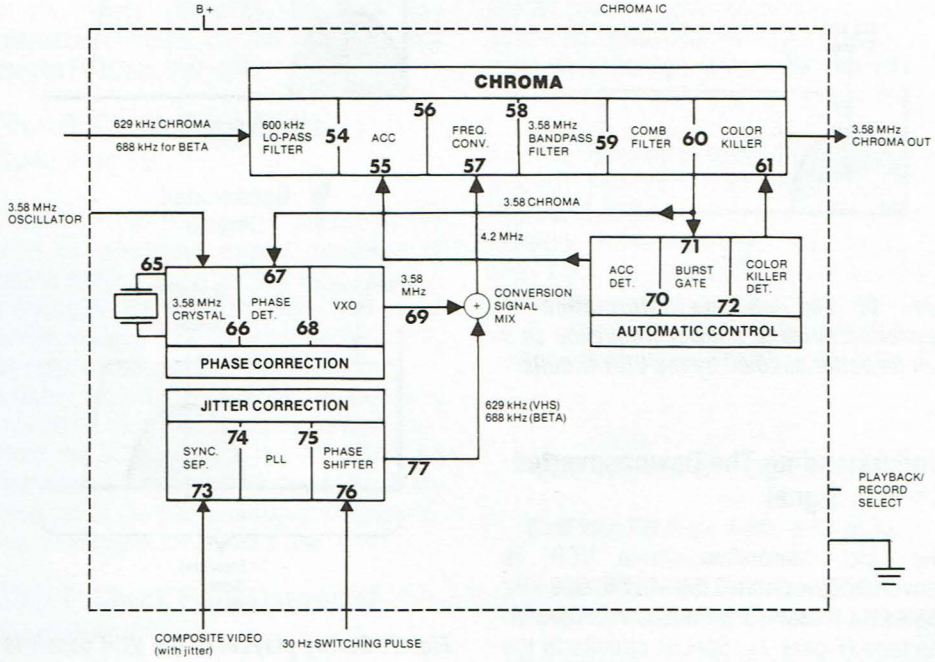

Fig. 4: Modern VCRs often have many of the funcitonal circuits contained within one or more ICs.

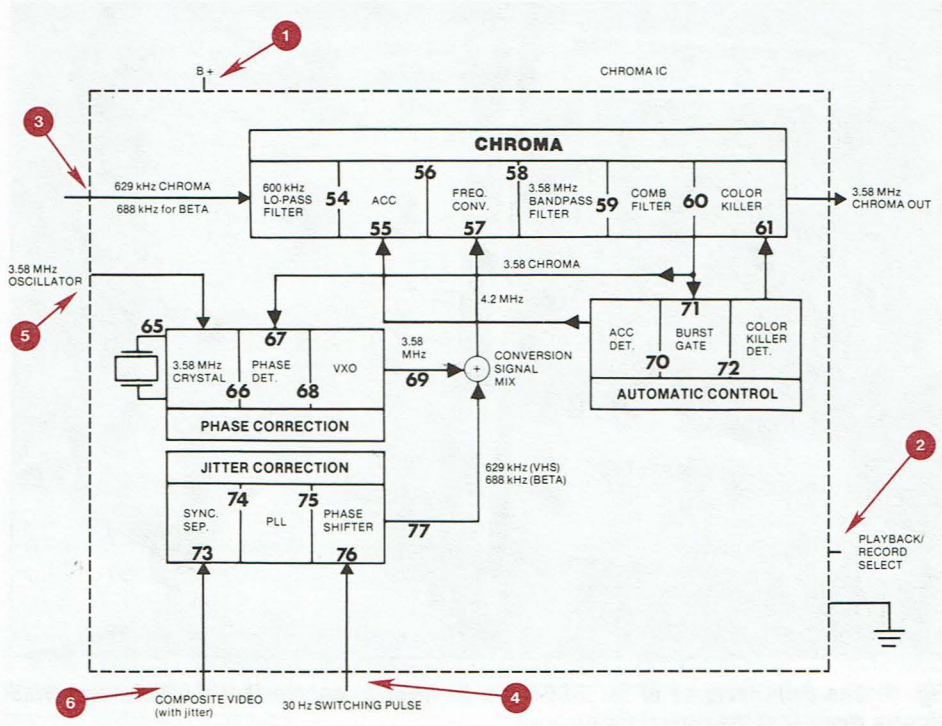

Fig. 5: There are six key points to check to determine if the chroma IC is receiving the correct information from other circuits.

circuits. For the six steps, insert a test tape in the VCR and place it in the play mode.

Step 1: Check The Power Supply

Always test the power supply first. Use the SC61 Waveform Analyzer to check for the proper voltage on the power supply pin of the chroma IC. Press the channel A DCV button on the SC61 and touch the SC61 probe to the power supply pin on the IC. The digital meter on the SC61 will display the DC voltage at this point. Compare this reading with the voltage shown on the VCR schematic. Look at the CRT on the SC61 to be sure that there is no ripple on the power supply line which would indicate a power supply filter problem.

Step 2: Check For Proper System Control Signals

A control signal is sent from the VCR microprocessor to the chroma IC. This signal turns on either the record or the playback circuits in the chroma IC. Connect the SC61 probe to the control pin of the chroma IC. Place the VCR in the play mode and check the DC level of the control pin using the DCV function of the SC61. Compare this voltage to the control voltage shown on the VCR schematic for the play mode. If the voltage is incorrect, this indicates a problem in the system control circuits instead of the chroma circuits.

Step 3: Inject The VC63 Signal Into The Chroma IC

The VC63 VCR Test Accessory supplies a signal that is identical to the signal that comes off the video tape. This signal can be injected into the early stages of the playback circuits to determine which circuits are working and which circuits are not. In this particular application, we will use this signal to determine if the chroma circuits are working or if the problem is before the chroma stages.

The best place to start injecting the VC63 signal is at the output of the A/B headswitcher. This point allows the VC63 to supply a correctly phased signal to both the chroma and the luminance circuits. The VC63 can be used for VHS, Beta, or U-Matic VCRs. In the case of a VHS machine, select the VHS LUM & CHROMA signal. You will need to use a fairly large signal, since the injection point is after the head preamps. Set the OUTPUT LEVEL on the VC63 to the X.1 range and the VOLTS PP to the midrange position. This is a good starting range.

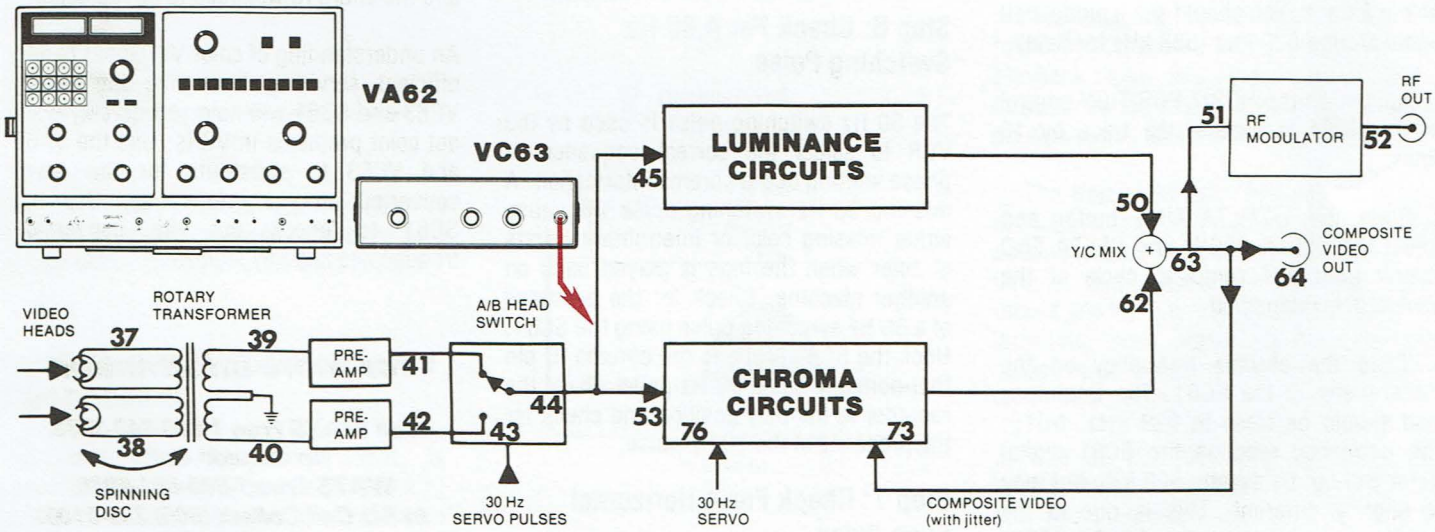

Fig. 6: The best place to inject the VC63 VCR Test Accessory is at the output of the A/B headswitcher. This supplies both the necessary chroma and luminance signals to the VCR circuits.

Place the VCR in the play mode and watch the picture on the television monitor. If the black and white signal is weak or has a lot of noise in it, turn up the VOLTS PP control on the VC63. If the color circuits are operating, you should see color on the television screen. The color may flash on and off. This is because the VCR and the VC63 are not synced up to each other.

Step 4: Sync Up The VC63 Signal Using The VA62 30 Hz Servo Signal

You must also feed the VA62 30 HZ SERVO DRIVE signal into the color circuits of the VCR in order to get good color. The 30 HZ SERVO DRIVE signal, from the VA62, is phase locked to the signal being supplied by the VC63.

The 30 Hz servo signal in a VCR normally has a very low impedance. If you attempt to completely swamp out this signal with the VA62 30 HZ SERVO DRIVE signal, there is a possibility of damaging the 30 Hz servo drive IC in the VCR. Therefore, use the following procedure to insure that you have applied enough signal to give the VA62 control of the circuit, without risking damage to one of the ICs:

1. Connect up a set of test leads to the VA62 SERVO DRIVE jack located in the lower center of the VA62.

2. Turn the VA62 SERVO DRIVE control to zero.

3. Move the VA62 DIGITAL METER switch to the 30 HZ SERVO DRIVE position.

4. Connect the 30 HZ SERVO DRIVE signal to the 30 Hz servo pin on the chroma IC in the VCR.

5. Put the VCR into the play mode. ***Note: Leave the VA62 30 HZ SERVO DRIVE control at zero.***

6. Note the reading on the VA62 digital meter. This reading is the amount of 30 Hz signal being applied to the chroma IC without any VA62 drive signal applied.

7. Carefully increase the setting of the VA62 30 HZ SERVO DRIVE control until the VA62 digital meter reads 0.5 to 1 volt higher than the voltage reading obtained in step 5. This is the maximum signal you should apply to the chroma 30 Hz drive pin.

If the color circuits are operating, the color will now lock up. If you do not get any color, try the opposite phase 30 HZ SERVO DRIVE signal. To do this, simply pull out or push in on the VA62 30 HZ SERVO DRIVE control. There is no practical way to predict which phase is needed for a given VCR since it depends on the design of the chroma IC. Therefore, simply try both polarities and watch for color. If the color circuits are working properly, you will either see colors that alternately change position at a rapid rate, or the colors will lock in.

NOTE: Some VCRs can not be directly driven with the 30 HZ SERVO DRIVE signal. They will shut down when you attempt to sync up the 30 Hz drive signal. If this happens, disconnect the VCR 30 Hz drive circuits from the chroma IC. To do this, trace back from the 30 Hz input pin on the chroma IC until you find a jumper wire or resistor. Unsolder one side of the jumper wire or resistor to isolate the rest of the 30 Hz servo circuits from the chroma IC. If no jumper wires are found, then carefully unsolder the 30 Hz input pin on the chroma IC. Once the 30 Hz input pin on the chroma IC has been isolated from the rest of the VCR, connect the VA62 30 HZ SERVO DRIVE signal to the 30 Hz input pin on the chroma IC and drive the IC.

If you now see good color on the television monitor, the chroma IC and associated circuitry are good. If not, try the other phase of 30 HZ SERVO DRIVE signal. If you now see good color, you have confirmed the chroma circuits and have isolated the problem to the video heads, rotary transformer, head preamps, or A/B headswitchers. Generally, however, a problem in these areas will also show up as bad luminance. If you do suspect a problem in one of these circuits, simply walk back through the stages with the VC63 signal until the defective stage is located. If you don't obtain color, then proceed to step 5.

Step 5: Check The 3.58 MHz Local Oscillator

A local 3.58 MHz oscillator signal is used to mix the downconverted chroma information back up to the 3.58 MHz signal needed by the television receiver. A missing 3.58 MHz local oscillator signal will result in no chroma information on the

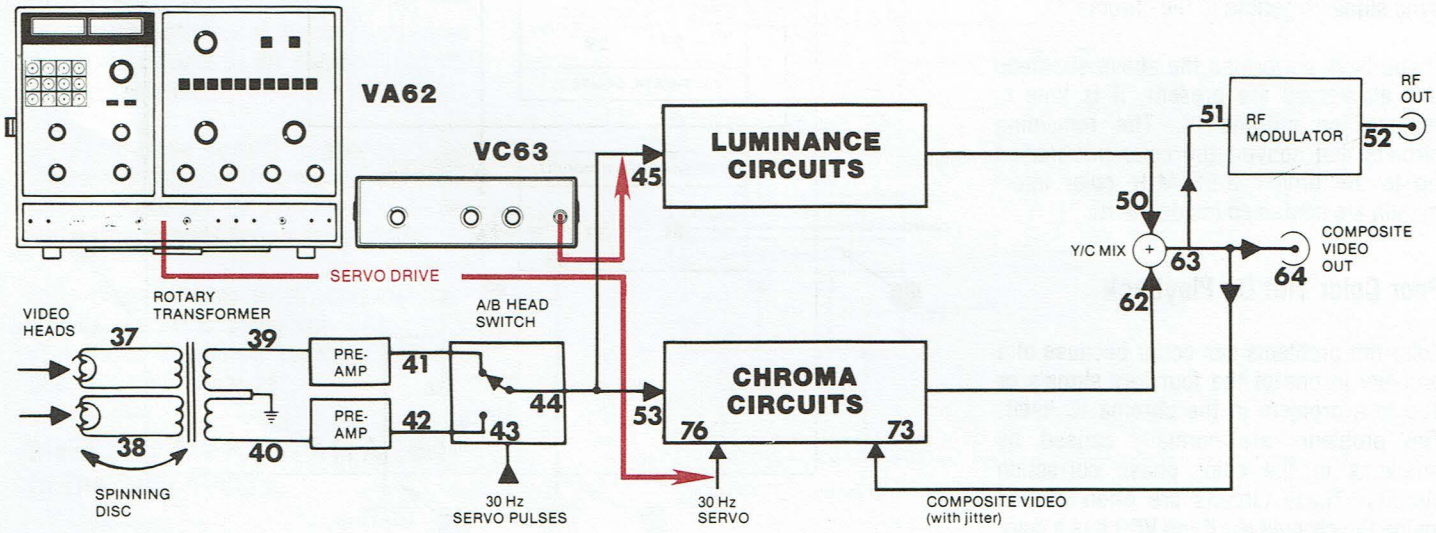

Fig. 7: Connect up both the VC63 test signal and the 30 Hz Servo drive signal from the VA62 to lock in the color.

video signal. An incorrect 3.58 MHz oscillator signal may provide chroma information on the video, but the frequency will be outside the range of the color circuits in the television receiver and no color will be observed either.

Check the frequency of the 3.58 MHz local oscillator using the digital frequency counter on the SC61. The 3.58 MHz local oscillator is often located immediately next to or inside the chroma IC. If it is located inside the IC, look for a 3.58 MHz reference pin on the chroma IC. Press the A channel FREQ button on the SC61 and connect the SC61 probe up to the 3.58 MHz local oscillator pin on the chroma IC. If the 3.58 MHz signal is missing or incorrect, determine the reason before proceeding on. In the case of a 3.58 MHz oscillator located inside the IC, the IC will need to be replaced. If the 3.58 MHz oscillator is located somewhere else in the VCR, trace back to the oscillator and correct the problem.

Step 6: Check The Horizontal Sync Pulse

A horizontal sync pulse is used to trigger the various burst gates, color killers, and chroma phase shifting circuits. Some chroma ICs contain the sync separators inside the IC. For these ICs, a composite video signal is fed into the IC. In other chroma ICs, an external sync signal is supplied to the IC.

Again, use the SC61 to check for the presence of either a composite video signal or for externally generated sync pulses. Since this video is coming off the tape, some instability will exist in the frequency and phase of this signal. The important thing is to be sure that video or horizontal sync signal is getting to the chroma IC.

If you have performed the above six steps and all signals are present, it is time to replace the chroma IC. The remaining circuits that convert the color information up to the proper 3.58 MHz color information are contained inside the IC.

Poor Color Tint On Playback

Color tint problems can occur because of a problem in one of the four key signals or due to a problem in the chroma IC itself. Tint problems are normally caused by problems in the color phase correction circuits. These circuits are often located inside the chroma IC. If the VCR has a color tint problem, first check to be sure the 4 key signals are present using the six step procedure given above. If all signals are present, then replace the chroma IC.

Weak Color On Playback

A symptom of weak color on playback is most often caused by problems in the automatic color circuits. This problem can be caused by one of the 4 key signals being missing or by a problem in the automatic color circuits. Again use the six step procedure given above to ensure that all 4 key signals are going into the chroma IC. If the signals are present and the color is still weak, then replace the chroma IC. The automatic color circuits are located inside this IC.

Seven Steps To Successful Troubleshooting Of Color Record Problems

Troubleshooting of VCR color record problems relies primarily on signal tracing. The VCR color record circuits also require 4 key signals for proper operation. Figure 8 shows a block diagram of a typical VCR record IC with these key signal inputs.

Typical color record problems are: won't record color, weak color, and won't playback color on another machine. The following seven step procedure will help isolate color record problems.

Step 1: Check The Tuner/IF Section

Many VCRs are used to record programs directly from an antenna. A problem in the tuner or IF section can eliminate the color information but allow the black and white signal to pass through. Before you suspect the VCR color record circuits, bypass the tuner and IF section by feeding a signal from the VCR STANDARD jack on the VA62 into the video input jack of the VCR. Select the CHROMA BAR SWEEP signal on the VA62. If the VCR now records color, then the problem is in the tuner or IF section. In this case, use the VA62 RF and IF troubleshooting signals to troubleshoot this type of a problem.

Step 2: Check The Power Supply

A bad power supply will cause problems in the playback circuits as well as the record circuits. You should be sure that the playback circuits are working before proceeding to service the record circuits. Refer back to step 1 in the playback servicing section if you have not already checked the power supply.

Step 3: Check The Record Status Line

A control signal is sent from the system control microprocessor to the chroma

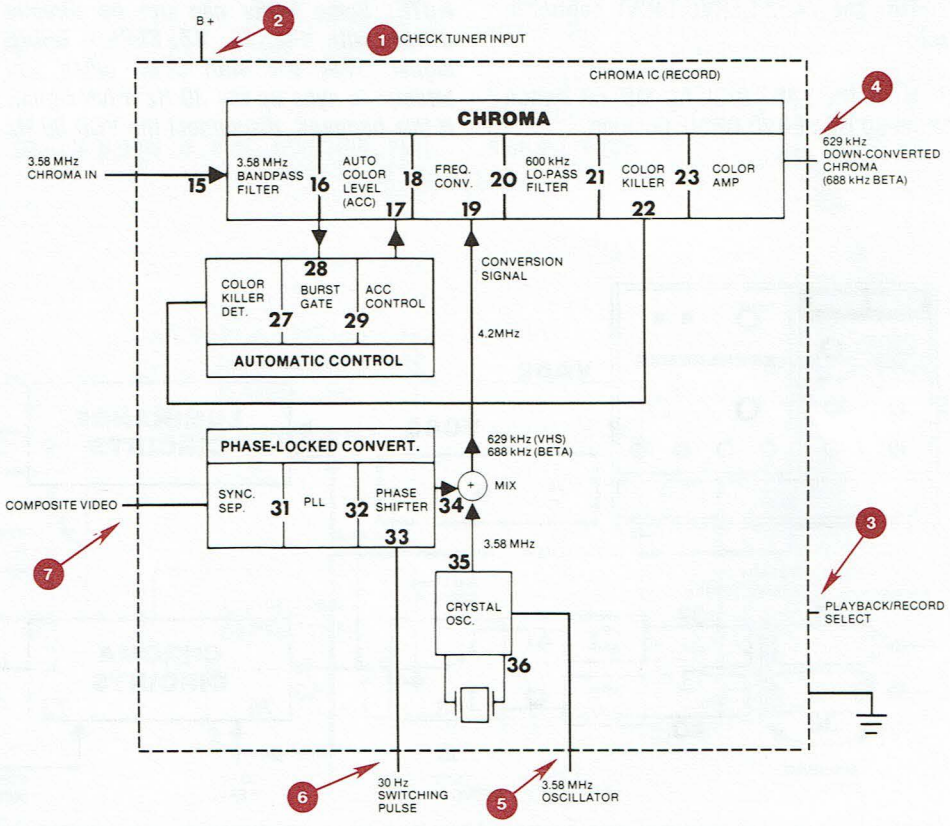

Fig. 8: There are 6 key points to check when troubleshooting chroma record problems.

circuits to select either the playback or the record circuits. Use the DCV function of the SC61 to check the status of this control line. It should be at either a logic high or a logic low level. Place the VCR in the record mode and compare the DC voltage on the control line with the voltages specified in the schematic. It the control line voltage is incorrect, check the system control circuits to determine why it is not at the correct level.

Step 4: Check For The Downconverted Chroma Signal

The chroma information is downconverted to a 629 kHz (688 kHz for Beta) signal before it is recorded onto the video tape. Check to be sure that a downconverted signal is present. Use the SC61 and the following procedure to check for the presence of the downconverted chroma signal.

1. Put a blank tape into the VCR and place the VCR in the record mode.

2. Locate the record luminance level control and turn it all the way down. ***Note: Once the VCR is repaired, you will need to perform the record current adjustments to set the luminance and chrominance record level to their proper level.***

3. Connect the SC61 test probe to the chroma input of the record Y/C mixer and select the A channel on the SC61.

4. Set the SC61 TRIGGER SOURCE to CH A, MODE to AUTO, and POLARITY to -.

5. Set the SC61 timebase control to 5 usec.

6. Adjust the TRIGGER LEVEL control to lock in a trace. You should see a modulated signal around 629 kHz (688 kHz for Beta).

7. Pull out on the HORIZ POSITION control on the SC61 to expand the trace by 10 times.

8. Press the 1/DELTA TIME button and adjust the DELTA BEGIN and DELTA END control until one complete cycle of the waveform is intensified.

9. Read the chroma frequency on the digital meter of the SC61. The frequency read should be close to 629 kHz. NOTE: The frequency read on the SC61 digital meter will not be exactly 629 kHz but may be slightly different. This is due to the inability to exactly set the DELTA BEGIN and DELTA END controls for one complete cycle. The frequency should be close, however.

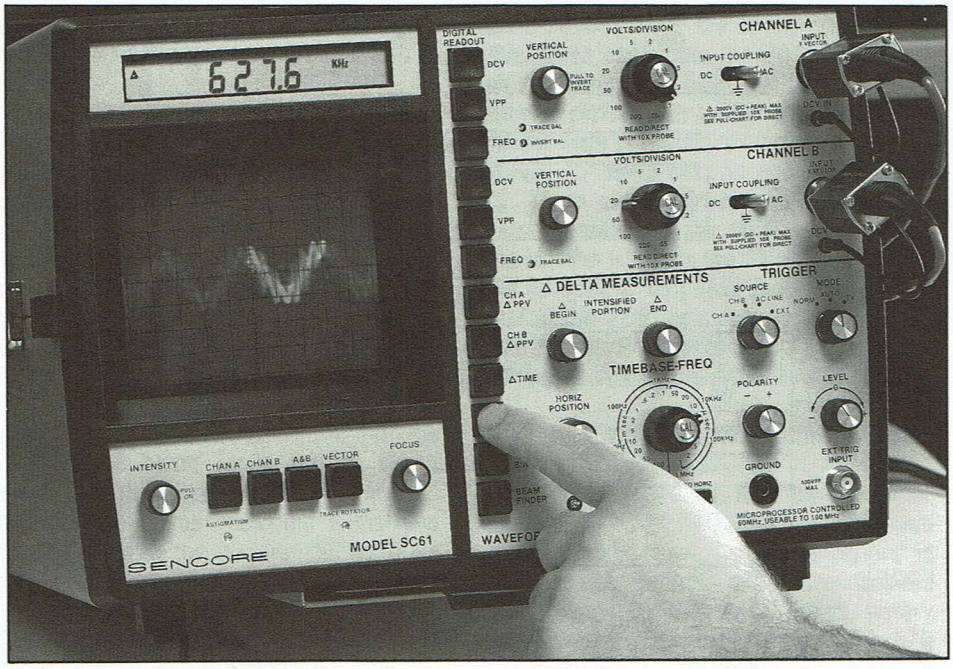

Fig. 9: The delta features of the SC61 can be used to ensure that the downconverted chroma signal is at the correct frequency.

Step 5: Check The 3.58 MHz Local Oscillator Frequency

If the 629 kHz (688 kHz for Beta) signal is either missing or at the wrong frequency, check to determine if the 3.58 MHz signal is present and at the correct frequency. Use the digital frequency counter on the SC61 to check the frequency of the 3.58 MHz local oscillator. A missing oscillator signal or an oscillator that is operating at the wrong frequency will cause the downconverted color signal to be either missing or at the wrong frequency. If it is at the wrong frequency, the tape may playback correctly on the VCR, but not playback on another VCR.

Step 6: Check For A 30 Hz Switching Pulse

The 30 Hz switching pulse is used by the VCR to select the correct sequence of phase shifting of the chroma information. A missing 30 Hz switching pulse will cause either missing color or intermittant bursts of color when the tape is played back on another machine. Check for the presence of a 30 Hz switching pulse using the SC61. Hook the SC61 probe to the chroma IC pin that normally has a 30 Hz pulse. Place the recorder in the play position and check for the presence of the 30 Hz pulse.

Step 7: Check For A Horizontal Sync Pulse

The horizontal sync pulse turns on the various burst gates as well as the correct phase shifting of the chroma down-converted signal. Use the SC61 to check for the presence of either a composite video signal or a sync pulse at the horizontal rate.

Weak Color When Recording

Weak color recordings are often caused by a misadjustment of the chroma record current. Perform the chroma record current adjustment. If the color is still weak, check the 4 key signal inputs into the chroma IC using the procedures given above. If they are all present, then suspect a defective automatic color circuit. This circuit is normally contained within the chroma IC and the entire IC will need to be replaced.

An understanding of color VCR circuits and efficient servicing tools like the VA62, VC63 and SC61 will help you quickly walk out color problems in VCRs. Use the VA62 and VC63 to substitute for the down converted chroma information. Use the SC61 to check out the conversion frequencies and key signals.

#133 #133