SCH Phase Adjustments

Sub Carrier Horizontal (SCH) Phase Adjustments

SCH Phase Overview

Post-production editing of video requires attention to timing and phase shift effects of edits and dubs. Editing video can correctly be accomplished only when the edit point subcarrier to horizontal synchronizing pulse phase relationship completes one cycle and is in phase.

In PAL/SECAM this relationship occurs after eight fields (or after four frames). Using NTSC, the subcarrier to horizontal sync phase relationship completes one cycle and will be in phase after four fields (or after two frames). Edits can be accomplished in fewer fields or frames in NTSC, hence a shorter time lapse between edited frames. This translates into a smoother image edit transition. NTSC is the format typically used for video editing. As a result, PAL/SECAM to NTSC scan converters (transcoders) convert from PAL/SECAM to NTSC for editing. After editing is accomplished the NTSC format is converted back to PAL or SECAM.

Video production facilities typically utilize Gen-Lock and Time Base Correctors (TBC) to ensure color phase relationship is established for all equipment processing video. This ensures the color editing process will not affect subcarrier (3.579545MHz) and horizontal synchronization pulse (15.73426kHz) phase relationships.

If an edit is accomplished which disrupts the normal frame sequence, a discontinuity of subcarrier phase occurs at the edit point. The disruption will not affect video monitor display, as the color is decoded on a line by line basis. The edit disruption will be compounded by the time base correctors (TBC), which restore the continuous alternating subcarrier phase relationship; however, a single edit error will result in approximately 140nSec lag in delay time at the edit point. Cumulative edit lags can result in the undesirable effect of widening the Horizontal Blanking time.

SCH Phase Measurement

SCH adjustment can be broken down into a two step process:

a) Coarse Adjust
b) Fine Adjust

The Coarse Adjust is accomplished by utilizing the LeCroy analog scope ADD and INVERT function.

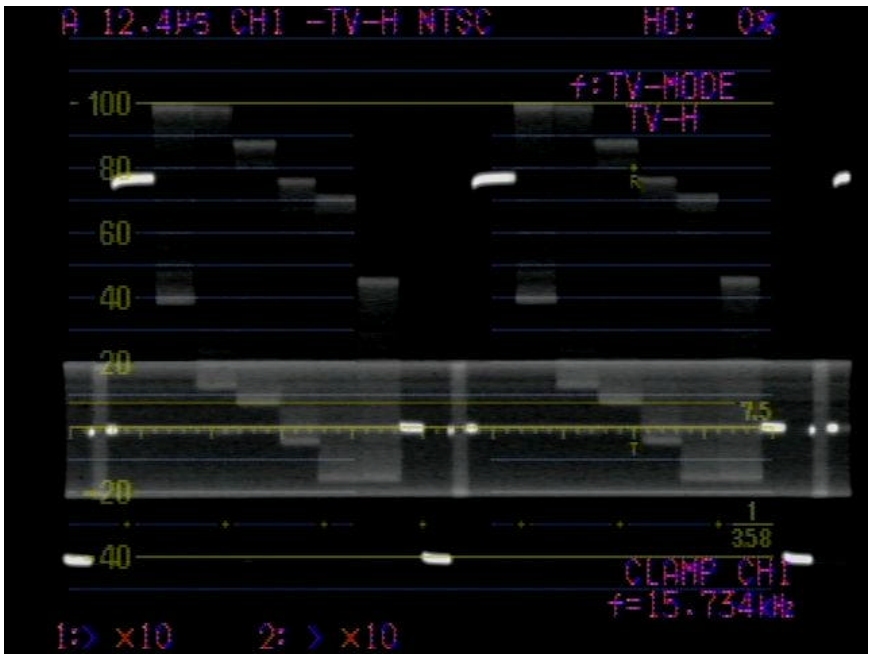

Figure 1: Overlay SMPTE* Color bars and CW subcarrier. The subcarrier is overlaying color burst.

By adding the composite video color burst and the inverted CW subcarrier and displaying the result, phase can be adjusted for a null.

The Fine Adjust is accomplished utilizing the delay function to expand the subcarrier and, the negative slope leading edge of horizontal sync. Displaying the overlay of these two traces, allows the operator to adjust CW subcarrier phase for coincident horizontal sync 50% transition and subcarrier zero crossing.

The Coarse SCH Adjustment was accomplished utilizing the oscilloscope CH1 connected to the composite video and triggered at NTSC TV-H rate. The CH 2 input was the CW subcarrier signal. For the coarse adjustment CH1 and CH2 were set to the same volts per division then CW subcarrier was overlaid atop composite color burst using independent channel variable position (see Figure 2). CH2 was inverted and added with CH1, only the math trace was displayed. The CW subcarrier phase was adjusted for a nulled color burst on the math trace (See Figure 3).

The attached Fine SCH adjustment examples were accomplished using the oscilloscope CH1 connected to the composite video and triggered at NTSC TV-H rate. The CH 2 input was the CW subcarrier signal. The delayed sweep was positioned to "zoom" on the leading edge negative slope of any horizontal

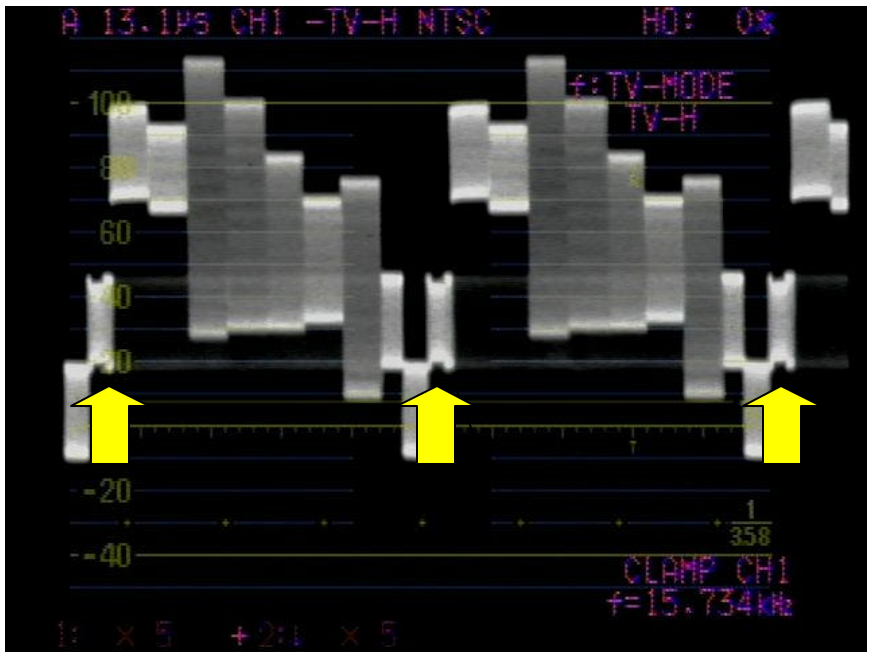

Figure 2: SCH Coarse Adjust Math Trace. ADD CH1 and INVERT(ed) CH2. Before CW subcarrier and composite video subcarrier are nulled. Note minor drop in color burst amplitude.

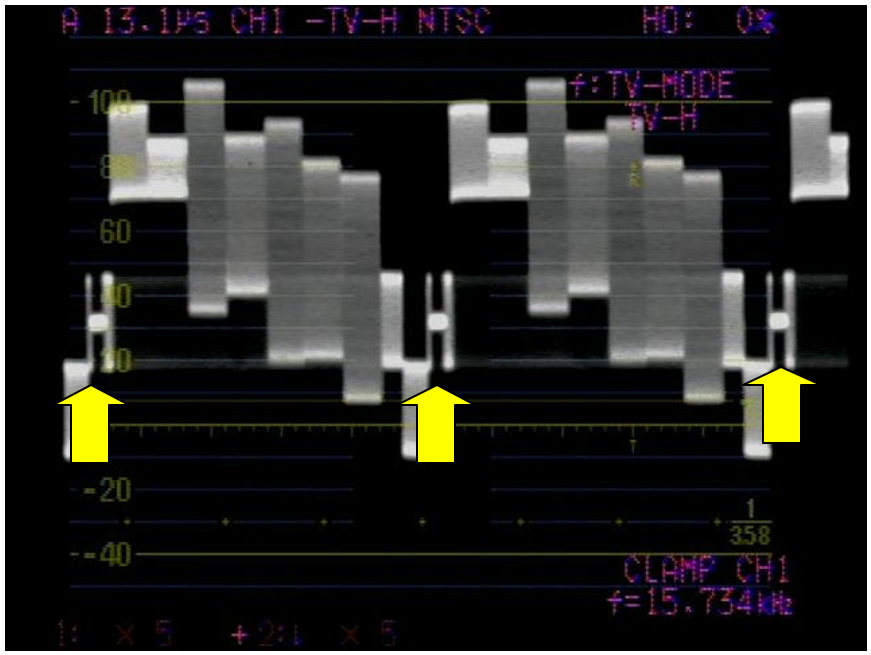

Figure 3: SCH Coarse adjustment after CW subcarrier nulled. Note the reduced amplitude of the nulled color burst.

sync pulse. Both channel amplitude scales were adjusted so that both waveforms were superimposed. This was accomplished using both variable vertical position and variable gain (See Figure 4). Adjusting the CW subcarrier phase moved the subcarrier zero crossing with respect to the 50% horizontal sync transition. Subcarrier phase was adjusted for the two points to be coincident (See Figure 5).

The waveforms were generated using a LeCroy LW420 Arbitrary Waveform Generator. The AWG CH1 output of composite video, NTSC SMPTE* Bars, was generated using a waveform sequence. The CH2 AWG output of CW subcarrier was generated using the Function Generator mode. Phase was adjusted directly on the AWG Function Generator control.

*SMPTE: Society of Motion Picture and Television Engineers

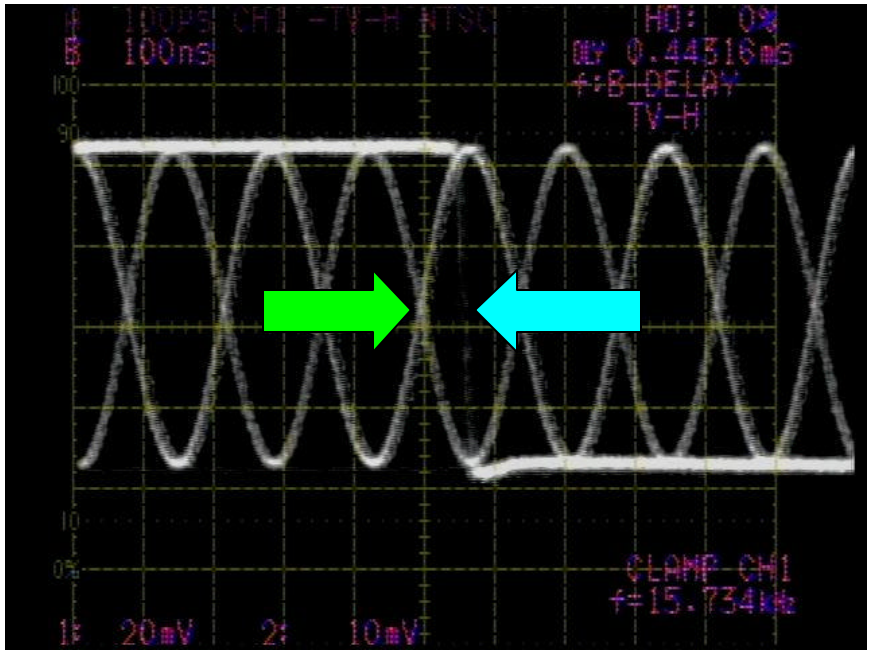

Figure 4: SCH Fine Adjust out of phase, zero crossings and 50% point separated.

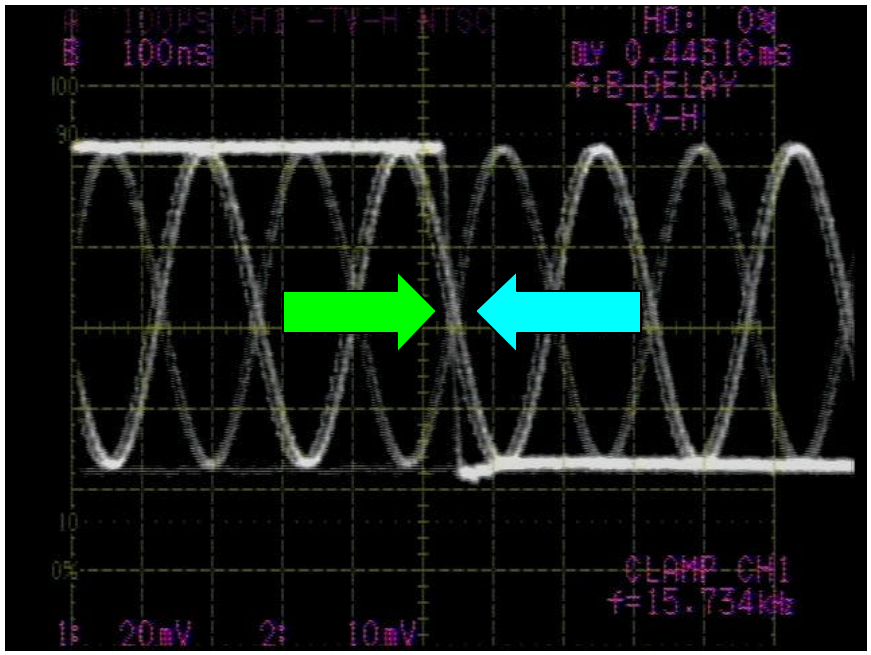

Figure 5: SCH Fine Adjust in phase, crossings coincident.

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