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The AT2500RQV Spectrum Analyzer now has a built in video demodulator that makes color and video measurements possible. Part 76.605 of the FCC Rules and Regulations requires that Chroma to Luminance Delay be measured on 4 channels plus one for every 100 MHz or fraction thereof, in the headend, once every 3 years. This measurement is also known as Y/C Delay. This means that a 750 MHz system is required to test at least 12 channels. With the right test equipment, it is easy to ensure that all channels are measured. The FCC requires that Chroma to Luminance Delay be no more than ± 170 nSec. This paper will address what this measurement is, what it means, and how to make it correctly using the AT2500RQV.

Chroma to Luminance Delay is a form of group delay. Group delay means that different frequencies travel through the same medium at different speeds. For example if a 50 MHz signal and a 750 MHz signal are injected into a given length of cable at the exactly the same instant in time, there will be a difference in time when the 2 signals arrive at the end of the cable. There is also a difference in frequency between the video carrier and the color carrier and therefore there is some group delay. In this case it is known as Chroma to Luminance delay. It shows up as if the color portion of the picture is offset some distance from the video portion of the picture. Figure 1 illustrates this.

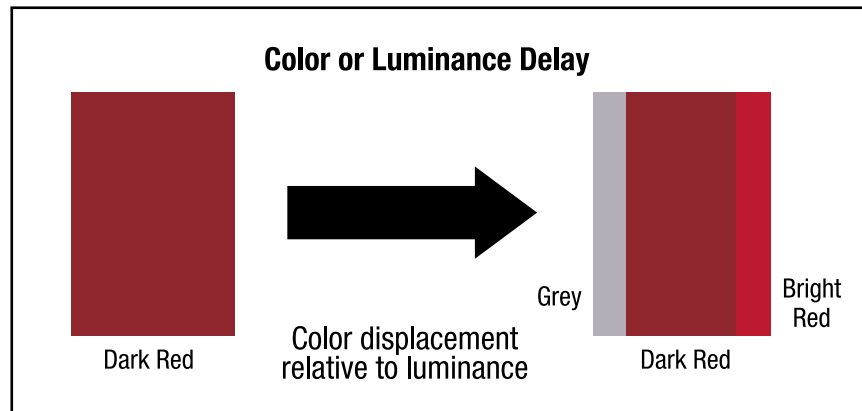


Figure 1

To make these measurements, a Vertical Interval Test Signal (VITS) is used. These VITS can be inserted by the broadcaster or by using a VITS inserter in the headend. There is no standard for a broadcaster on what VITS signals to carry, when to carry them, or what lines to place them on. Therefore Sunrise Telecom Broadband recommends the use of a VITS inserter.

There are many different types of VITS, but two of the VITS signals that can be used are the NTC-7 Composite test signal and the FCC Composite test signal. Both contain what is known as a 12.5T pulse that is a combination of a luminance and a chroma signal. These 2 signals as seen on an AT2500RQV are shown and labeled in Figure 2; they are basically mirror images of each other.

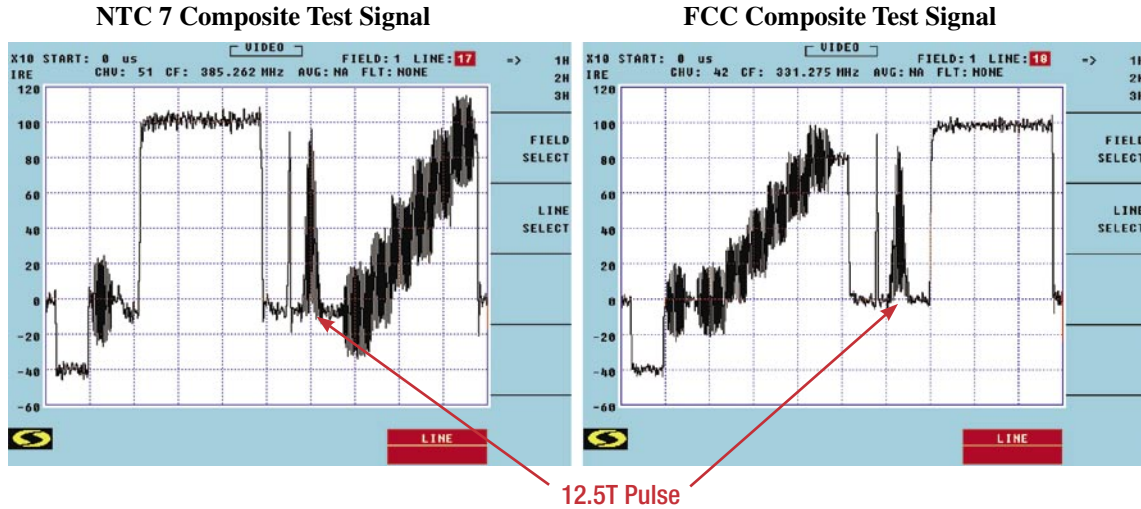


Figure 2

As stated before, the 12.5T pulse is a combination of the luminance and chrominance components of a video signal. Figure 3a shows a 12.5T pulse when it is ideal. Notice that the bottom of the pulse is flat. When either the chrominance or the luminance component is delayed, a sine wave effect is present at the bottom of the pulse as in Figure 3b. The more delay, the greater the amplitude of the sine wave. The analyzer measures the amplitude differences above and below the center-line and converts that to a difference in time between the luminance component and the chrominance component.

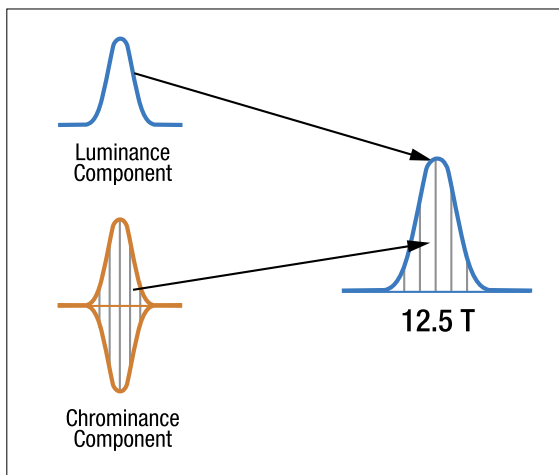


Figure 3a

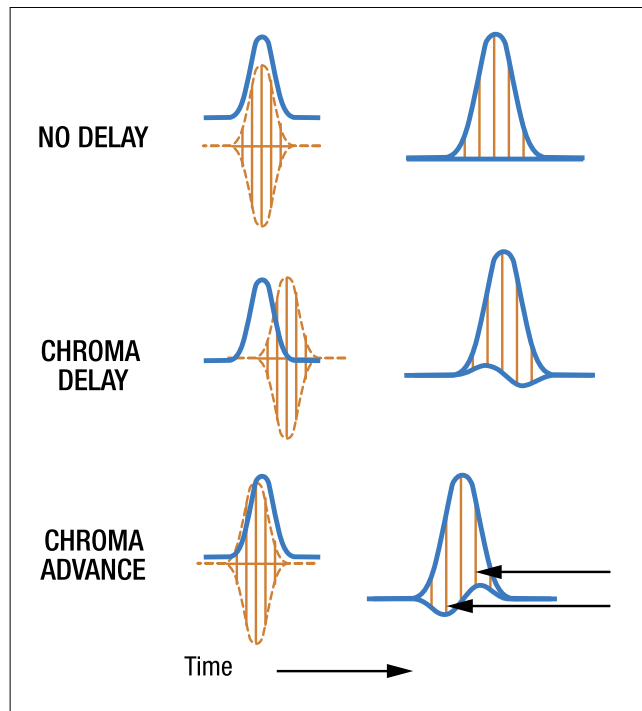


Figure 3b

To make these measurements using the AT2500RQV, the following procedure should be followed step by step. It is highly recommended that a channel plan is built, properly edited and loaded into the analyzer before making these measurements. If it is, the analyzer will automatically go to the correct test signal, line and field to make the measurement.

1. From the menu, choose the video icon by either the knob or the arrow keys and press enter.
2. Choose the channel on which to make the measurement by pressing the **FREQ** hard key, pressing the video carrier soft key, then entering the channel to be measured.
3. The analyzer will default to field 1, line 12 if no channel plan has been loaded into the instrument. If the plan has been correctly loaded and edited, the analyzer will automatically go to the correct field and line to make the measurement.
4. To select the correct field and line, press the **SPAN** key, then the line select soft key. Using the up and down arrow keys, search for either the NTC 7 signal or the FCC as shown in Figure 2 above, then press the escape key.
5. The measurement parameters must now be set up. Press the soft key and the screen like Figure 4 will appear. Press the enter key until the appropriate test signal is displayed. In the example in Figure 4, the NTC 7 signal is used.

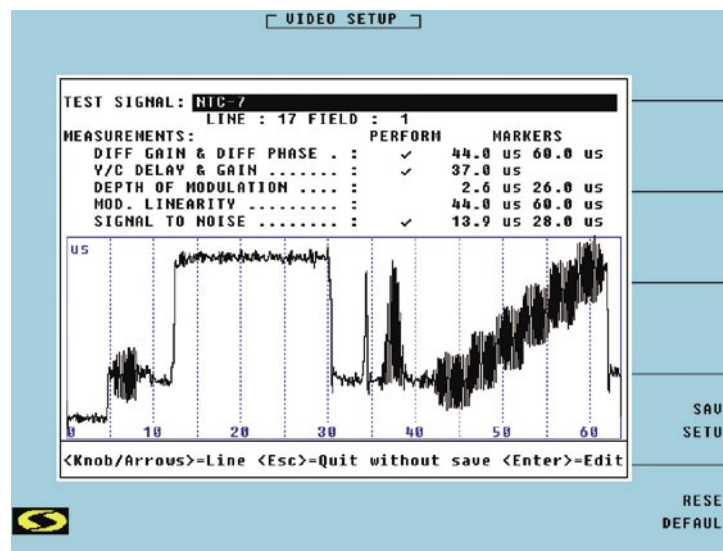


Figure 4

6. Next the correct line and field must be chosen. To do this, turn the knob to the right until the line selection field is highlighted, then press enter. To choose a different line, use the knob or the up / arrow keys to select the correct line. Press Enter. Use the knob to select the correct field. Press Enter, choose field 1 or field 2, and then press Enter again.
7. Use the knob to enter get to the perform field on the Y/C Delay and Gain measurement. Make sure that entry is checked as in Figure 4.
8. Use the knob to toggle through the remainder of the parameters screen and choose what measurements are to be performed. In example of Figure 4, Diff Gain, Diff Phase, Y/C Delay and Gain and Signal to Noise will all be performed.
9. Press the Save Set up soft key and the analyzer will return to the original screen as in Figure 2.
10. Press the measure soft key and the results will be displayed as in Figure 5.
11. To save the measurement press the **STORE** key and then the **STORE RECORD** softkey. Enter a file name, ID Code (optional) and comments (optional).

Note: If these measurements are to be used to create an FCC proof of performance report using WinCom II, you must enter the correct ID Code (HEAD for headend or TP01, TP02...for field test points) to identify the location of the measurement.

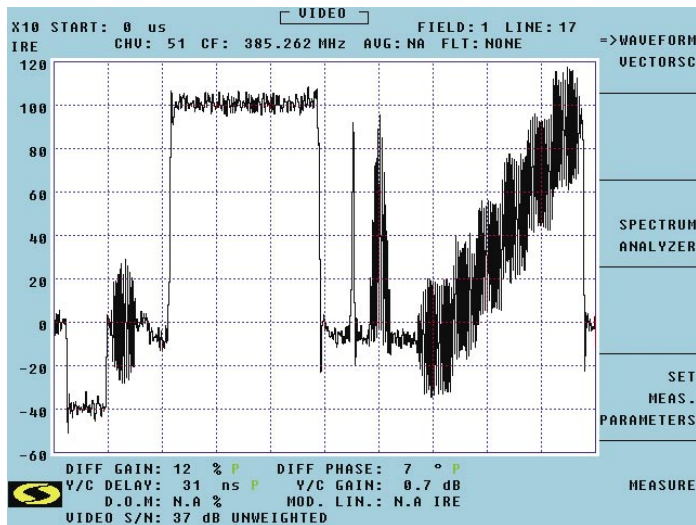


Figure 5

FCC specifications are less than 170 nSec for Chroma to Luminance Delay inequality. There is no specification for Chroma to Luminance Gain inequality, but the analyzer measures both. The analyzer gives a pass-fail indication measured against the FCC specification. Also if the channel plan is programmed properly, steps 4 to 9 above can be eliminated.

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