

Editing for Compliance to Broadcast Specifications

Application Note

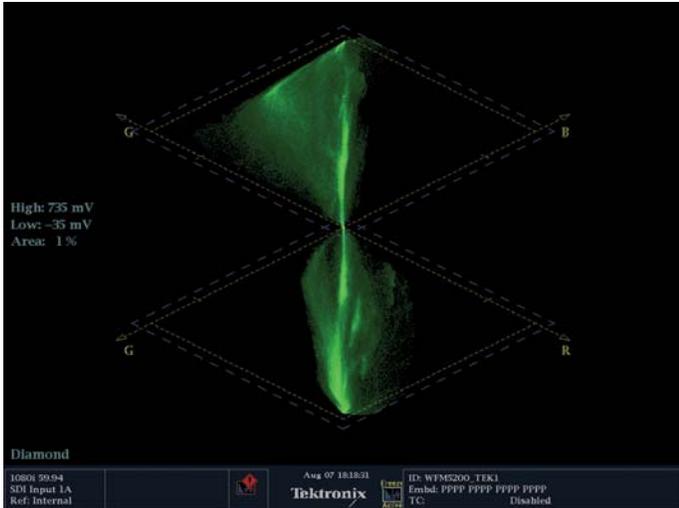


Figure 1. Tektronix's patented Diamond gamut display.

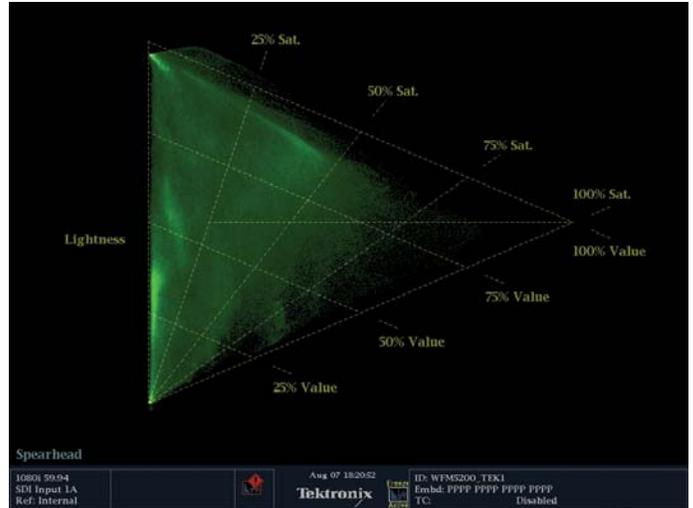


Figure 2. Tektronix's patented Spearhead gamut display.

This application note is about using a Waveform Monitor to insure compliance to specific broadcaster or client standards. We're going to discuss three things:

- 1) The increasing importance of gamut
- 2) How to use secondaries to maintain the look you want while still being legal
- 3) How to measure SPACE with a waveform monitor

Let's start with gamut. What is it? Why does it matter and how do you measure it?

Video gamut is defined by the voltage of the overall signal and of specific color channels inside the signal. The values have maximum and minimum limits. To remain inside of RGB gamut, all of the individual channels of Red, green and blue must be between 0 and 700 millivolts. If you do that, you

have LEGAL GAMUT. But video is often copied, recorded or transmitted in a different color space. Most broadcast television uses color difference space instead of RGB. So in addition to being legal, it also has to be VALID, which means that the colors are legal when they are moved to a different color space. You may think that a legalizer will keep you safe, but you have no control of how the signal is altered by the legalizer, so colors that you carefully tweaked may be altered in fairly radical ways. If you want control over your image, you have to creatively alter the image so that it is legal AND looks the way you want it to look.

Tektronix is a leader in analyzing gamut. They have patented displays that visualize gamut, including the diamond (Figure1), spearhead (Figure 2) and lightning displays.

Alarm	Alarm Status	Additional Information
HW Fault	OK	
SDI Input Missing	OK	
SDI Input Signal Lock	OK	
Reference Missing	Error	No Signal
Ref Lock	Error	No Signal
Ref Fmt Mismatch	OK	
RGB Gamut Error	Error	-rG-Bb
Composite Gamut Error	Error	C-
Luma Gamut Error	OK	
Video Fmt Change	OK	
Video Fmt Mismatch	OK	
Vid/Ref Mismatch	OK	
Video Not HD	OK	
Dual Link Format Mismatch	OK	
Line Length Error	OK	
Field Length Error	OK	
EAV Place Error	OK	
SAV Place Error	OK	
Line Number Error	OK	
Y Chan CRC Error	OK	
C Chan CRC Error	OK	
Y Anc Checksum Error	OK	
C Anc Checksum Error	OK	
Y Anc Parity Error	OK	
C Anc Parity Error	OK	

Arrow Left, Up - Previous page, Right, Down - Next page.

Figure 3. Alarm Status display showing gamut errors as letter indications in the "Additional Information" column.

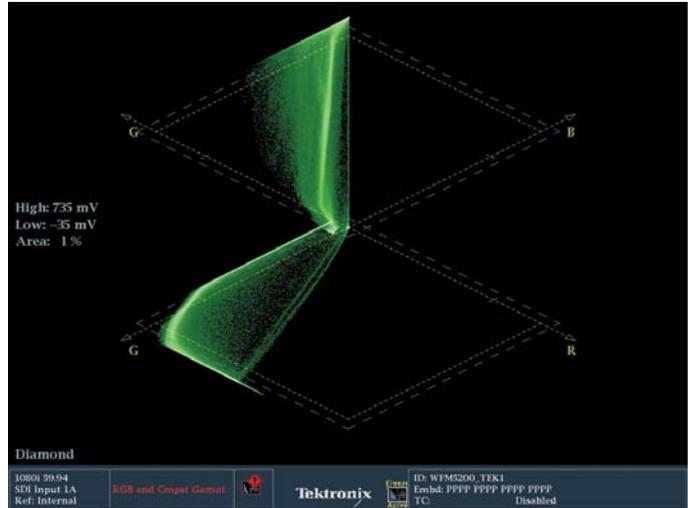


Figure 4. Diamond display showing gamut error.

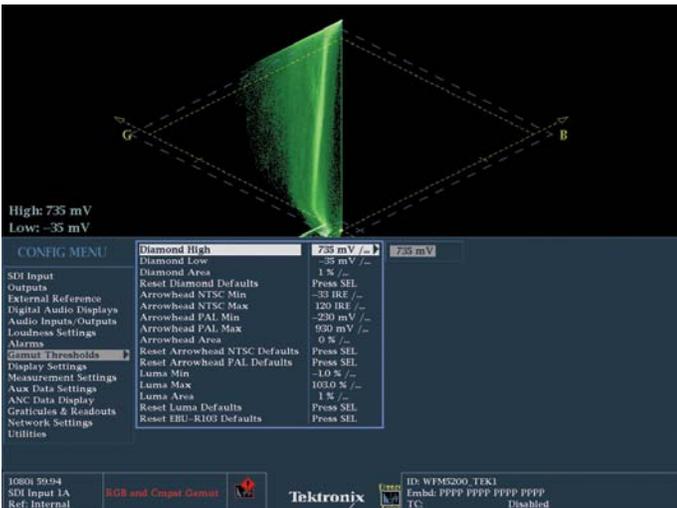


Figure 5. The Gamut Threshold Menu allows you to set tolerances on Gamut warnings and indications.

With the diamond display, the trace must stay inside the two diamonds to be within gamut (Figure 4). There are also warnings on screen in the status displays, like the Video Session display and the Alarm Status display (Figure 3) that let you know when you are violating gamut, but these alarms don't give you any subjective information about how drastic the violation is. The alarms and status displays include letters that describe in which channel the violation is occurring. The letters r, g and b refer to the color channels; y refers to luma; and c refers to chroma. If the warning uses a capital letter, then the error is OVER the maximum level. If a lower case letter appears, then the error is UNDER the minimum allowed. Dashes mean there is no error.

Based on broadcaster specifications, the limits on these displays and for these alarms can be customized by pressing the CONFIG button on the front of the unit and then navigating to the Gamut Threshold menu (Figure 5).

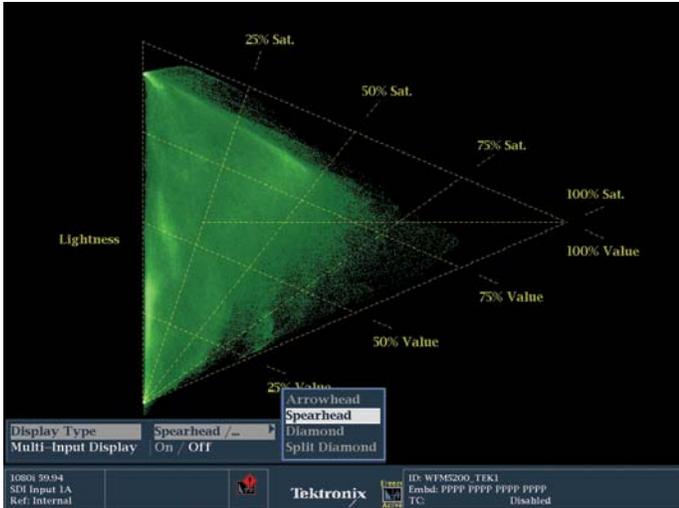


Figure 6. Gamut Menu display showing how to call up and select various gamut display choices. Spearhead is selected here.

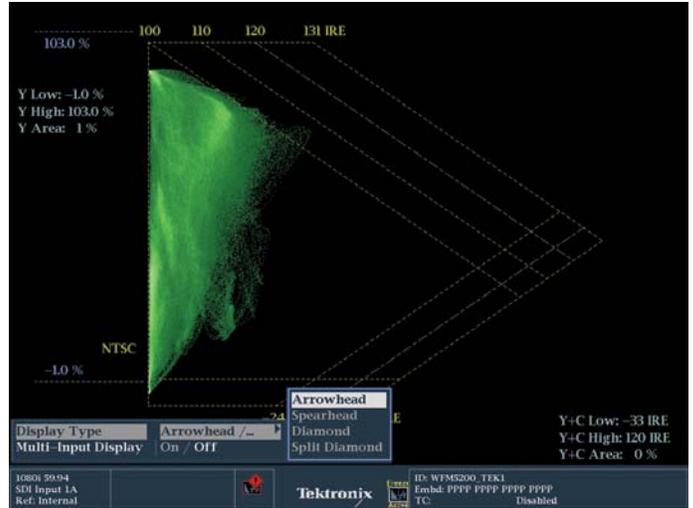


Figure 7. Gamut Menu display showing how to call up and select various gamut display choices. Arrowhead is selected here.

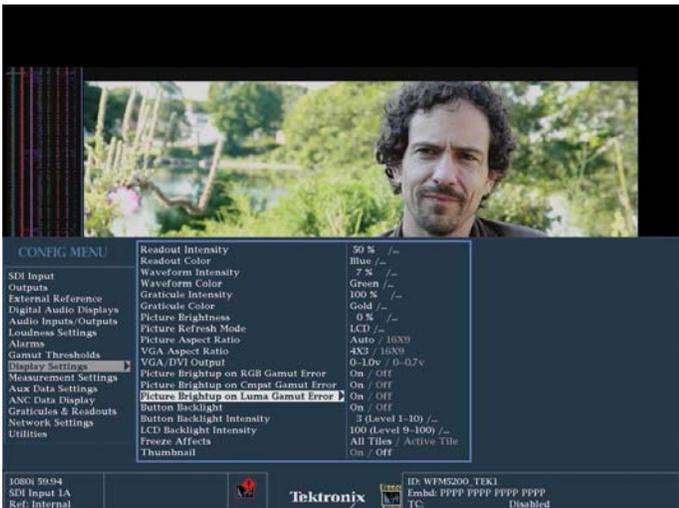


Figure 8. Display Settings Menu showing the Brightup Display choices.



Figure 9. Picture Display showing Brightup indicators where there are gamut errors (both highlights that are too bright and shadows that are too dark. These are indicated by the cross-hatch patterns on the image).

The spearhead display also displays gamut (Figure 6). Anything inside of the triangular spearhead is within gamut. Luminance is shown from bottom to top up the left hand side. Saturation is shown across the middle horizontally from left to right. And Value is shown on an angle from the bottom left corner up to the top angle of the triangular display.

For composite video signals, the Arrowhead display allows you to see illegal levels without having to convert the signal to composite first (Figure 7).

Another useful Tektronix display involves the picture monitor. Press the Config button on the front of the unit. In the Display settings menu, a series of “Brightup” choices is listed (Figure 8). Turning these on enables warning indications on the Picture monitor, similar to zebra stripes you may have seen on some cameras (Figure 9). The brightup displays show you WHERE in the picture the violations are happening, making it easier to fix them with creative color correction solutions.



Figure 10. Apple Color Secondary interface showing a matte created by selecting the color of the ultralight canopy. That color can now be manipulated independently of the rest of the shot.

One of the powerful tools in the colorists toolbox for maintaining compliance without sacrificing the image, is to use secondaries to solve gamut issues (Figure 10). Instead of simply lowering overall saturation until the violation disappears, use a secondary color correction to isolate or “qualify” that specific color and just bring that single color into compliance, leaving the rest of the image vibrant and interesting (Figure 11). It’s easy to see these colors come back into compliance as you adjust your secondary color correction (Figure 12).

Finally, how do you measure space or location within your raster (on screen) with a waveform monitor? In the broadcast specification sheets for networks, they sometimes mention that you can’t violate a specific area of the screen. Usually this involves the placement of the network’s BUG or the little network ID that usually sits in the lower right corner of the screen. Let’s take a look at this example from The Discovery Channel: “No text shall fall into the space between 21 microseconds and 24.5 microseconds between lines 459 and 541 [in a 1080i signal].”

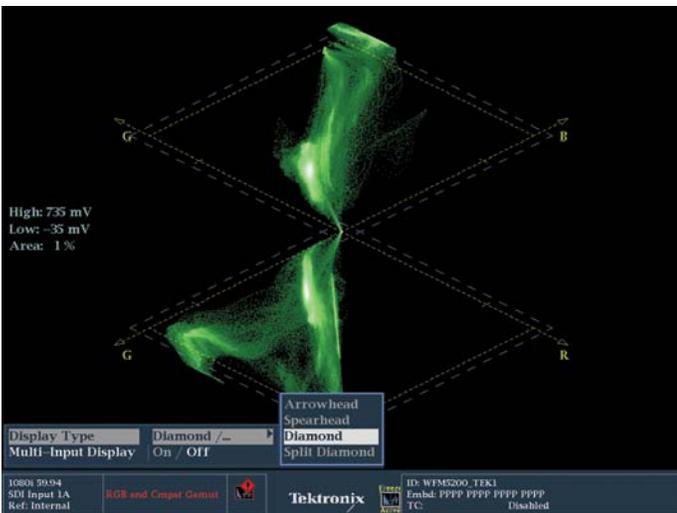


Figure 11. Diamond display showing the canopy of the ultralight out of gamut. The trace at the top of the display, outside the diamond represents the blue canopy of the ultralight. Notice the gamut warning at the bottom of the display.

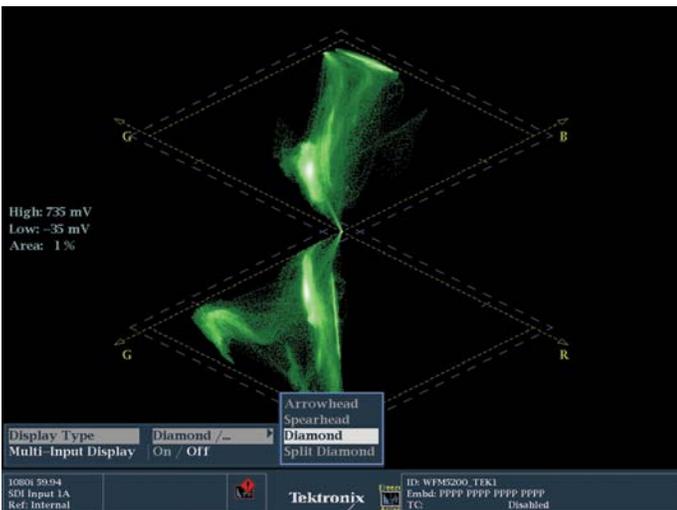


Figure 12. Diamond display representing the ultralight shot shown in Figure 10. The part of the trace along the top of the display just to the right represents the canopy, which has been pulled back within safe gamut limits.



Figure 13. The Line Select button on the front of the WFM5200 is on the right side about half way down.

First, find where lines 459 and 541 are vertically on the monitor. Use the LINE SEL button (Figure 13) on the face of the WFM5200 or other Tektronix waveform monitor or rasterizer and use the General dial at the top right while looking at the numeric display (Figure 14).

If you want, with your live source, use something like a wipe to translate the location from the Waveform Monitor to the edit system.

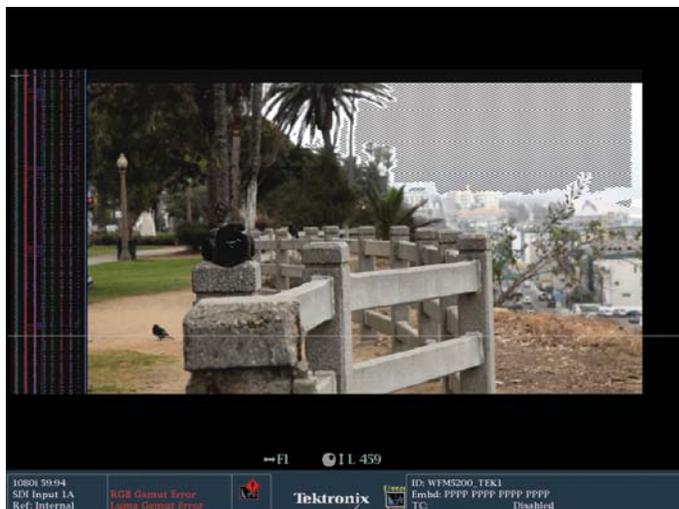


Figure 14. The white line on the picture monitor indicates the position of the line on the screen and the blue numeric display centered at the bottom of the screen indicates the numeric position of the line. Line 459 in this case.

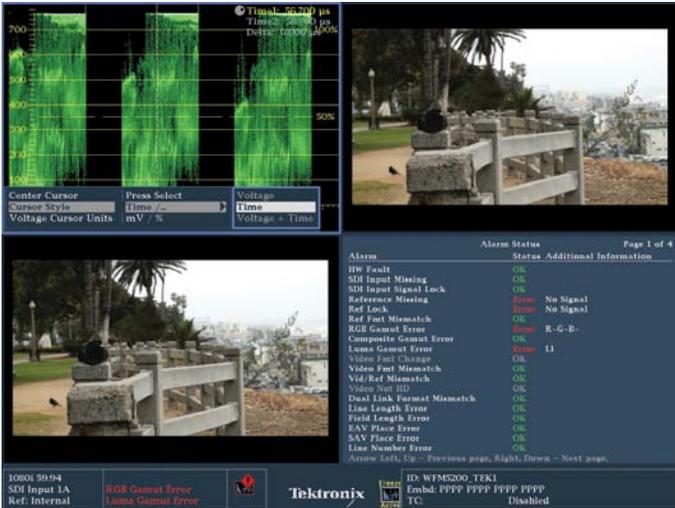


Figure 15. Note the menu options at the bottom of the RGB Parade waveform. This is called up with the CURSOR button on the front of the unit.

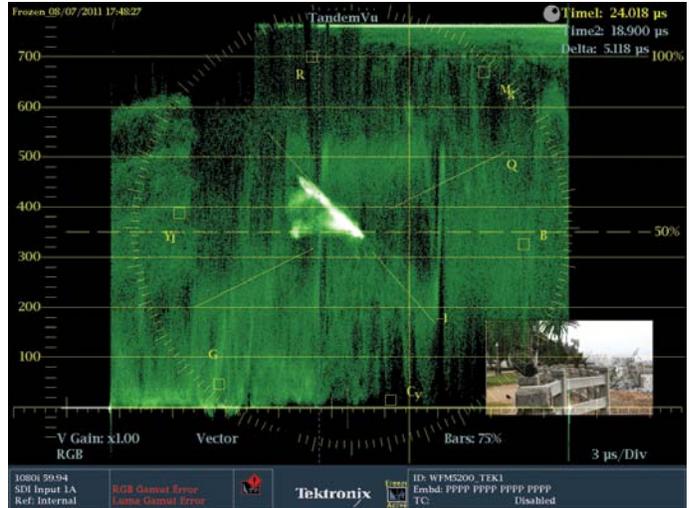


Figure 16. Note that a wipe has been added in the source editing application to match the position of the cursor on the Tektronix waveform monitor with a position in the editing application.

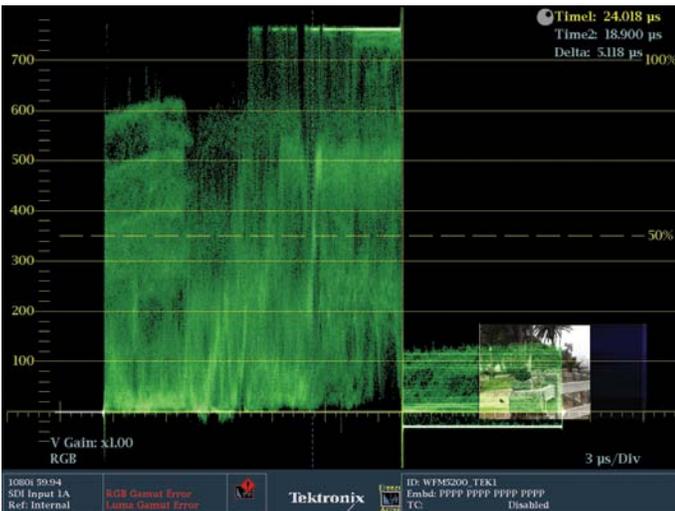


Figure 17. Note the numerical display of “Time” in the top right hand corner and the vertical yellow cursor line just to the left of the thumbnail image.

For the horizontal placement of the bug, looking at a waveform monitor, hold down the CURSOR button to call up the menu (Figure 15). Under Cursor style, select “time.” That will become a cursor that runs vertically. Choosing “voltage” gets you a horizontal cursor. You can move the cursor with the General dial in the top right corner and dial in to the prescribed number of milliseconds (Figure 16). Again, manipulate something in your video feed – like a live wipe in Avid or Final Cut Pro – and you can find the area for the bug (Figure 17).

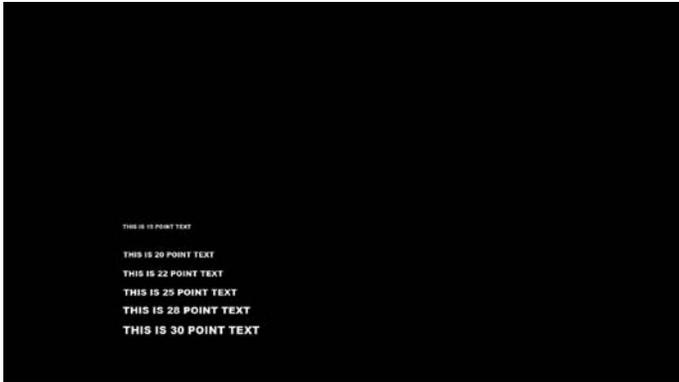


Figure 18. This Photoshop file shows 7 lines of text of varying heights. The font size in editing applications or in Photoshop does not bear a relation to how tall the letters are as measured in video lines.

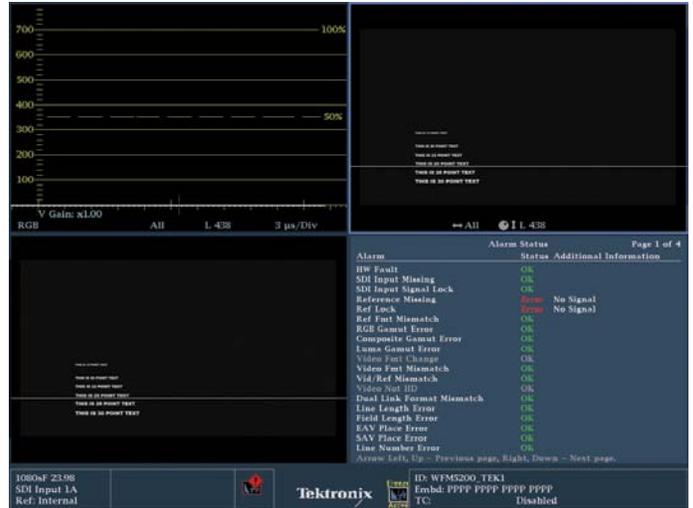


Figure 19. Note that when the Line Select is on a black line, the waveform shows a clean line at 0 all the way across (upper left quadrant). Also note the Line Select numerical position indicator at the bottom of the picture monitor displaying L438.



Figure 20. Note that when the Line Select is on the text, the waveform shows a strong trace display from top to bottom (upper left quadrant). Also note the Line Select numerical position indicator at the bottom of the picture monitor displaying L430.

You can also use this technique for determining how many lines tall any disclaimer type is in TV commercials. There is often a minimum height for “legal copy,” for example: nine lines tall. So you can measure this easily by typing several lines of varying heights in Photoshop or your NLE’s Title Tool (Figure 18) and then, in the WFM5200’s waveform, using LINE SELECT to see how many lines tall your text is (Figure 19). As you roll the line select up and down, the trace will show where the white letters are (Figure 20). Count the lines of the numerical display to determine the height of the lines of text.

Tektronix waveform monitors are a critical tool in maintaining broadcast standards and compliance to the requirements of various end users. Look for other Tektronix webinars and applications notes, like the more in-depth one about gamut, on the Tektronix website.

And be sure to check out the on-line demo of the Tektronix WFM5200 and the rest of the Color Correction for Video clips on the Tektronix web site.

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For Further Information

Tektronix maintains a comprehensive, constantly expanding collection of application notes, technical briefs and other resources to help engineers working on the cutting edge of technology. Please visit www.tektronix.com



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