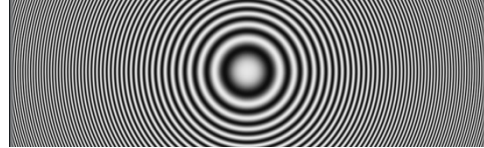


SDI7[4-1] : TEST SIGNAL : 1080i  
SMPTE EG1 Color Bars



# Principles of the Zone Plate Test Pattern

## For Evaluating the Steps in Video Processing

### 1. Assess Quality of Video Processes

To assess the quality of video processes, such as a format or standards conversion where frames of data are manipulated to produce a video output, the use of test pattern such as color bars is not enough to determine what is happening within the device.

### 2. Accurately Measure Equipment Frequency Characteristics

To accurately measure the frequency characteristics of the equipment, a "Zone Plate" test pattern is required.

#### Zone Plate Test Pattern

- Originally, the name was given to circular test patterns that could replace glass lenses using the Fresnel diffraction and light amplification principles through more or less tight circular stripes.
- Today, we talk about "Zone Plate" test patterns when the notion of frequency is introduced into the image to generate interference that can be seen or measured.

#### The SDI7 Module Generates 6 Easily Modified Zone Plate Patterns

Using the 'Sweep' button on the TG700 or TG8000 SDI7 module, you can select one of six basic signals:

1. Diagonal Circle
2. Horizontal Sine
3. Horizontal Sweep
4. Vertical
5. Sine
6. One of two user configurable patterns and saved in advance as Custom 1 and Custom 2.

Note that these patterns typically only contain the luma Y signals. The processing through a device can produce interference patterns resulting in color fringe effects.

The luminance on each point of the test pattern is calculated according to an equation taking into account:

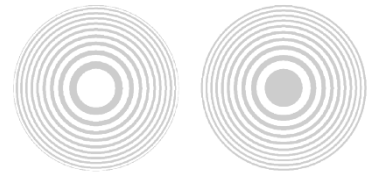
- The X and Y coordinates
- Time T. So therefore these are patterns whose content may vary over time. The concentric circles spread out or narrow faster or slower.

The equation is based on 10 various constants (k) that can be changed one at a time. However, these constants need to be dependent upon each other to maintain perfect concentric circles. For those mathematically minded, see below for the equation which will allow you endless measurement possibilities for the curious engineer! The algorithm can force transitions in 'Sine' or 'Triangle' or 'Square' Wave.

$$\phi_{xyt} = k_{\phi} + k_X (x) + k_Y (y) + k_T (t) + k_{XT} (xt) + k_{YT} (yt) + k_{XY} (xy) + \frac{1}{2}k_{X^2} (x^2) + \frac{1}{2}k_{Y^2} (y^2) + \frac{1}{2}k_{T^2} (t^2)$$

# Principles of the Zone Plate Test Pattern

## Using the Zone Plate Test Pattern



### A Example of Using the Zone Plate Test Pattern:

**Measuring the bandwidth of a Device Under Test (DUT) to determine the frequency response of the processing system.**

1. Connect one the SDI outputs of the SDI7 module in to the input of the device under test (DUT).
2. Connect the output of the DUT to a Waveform Monitor (WFM8300) and select the **WFM** button to display a waveform..
  - a. Ensure YPbPr is selected as display type and turn off the Pb and Pr components to show a single line.
3. Position the vertical amplitude cursors between +102.5 mv and +587.5 mv
  - a. -3dB below the amplitude of the original 700mV.
4. Under the **DISPLAY** button, set the Waveform Monitor to the "Infinite Persistence."
5. Within **CONFIG** of **Display Settings-> Waveform Color** menu, select "Pseudo" modes to view the signal envelope.
6. On the generator, select the Horizontal Zone Plate pattern (**SWEEP** button).
7. Go into the programming mode by pressing <Enter>. Using the Up & Down keys, scroll through all of the adjustable k parameters.
8. Make sure that the starting amplitude of the generator is 700mV and the waveform is a Sine Wave.
9. With the Left and Right keys, vary the horizontal frequency and observe the envelope on the screen of the Waveform Monitor.
10. When the frequency increases, the amplitude of the signal will drop and when the envelope is positioned between the pre-positioned cursors, you will be able to read the cutoff frequency of the Device-Under-Test (DUT) on the TG8000 display.

# Principles of the Zone Plate Test Pattern

## Infinite Persistence Example

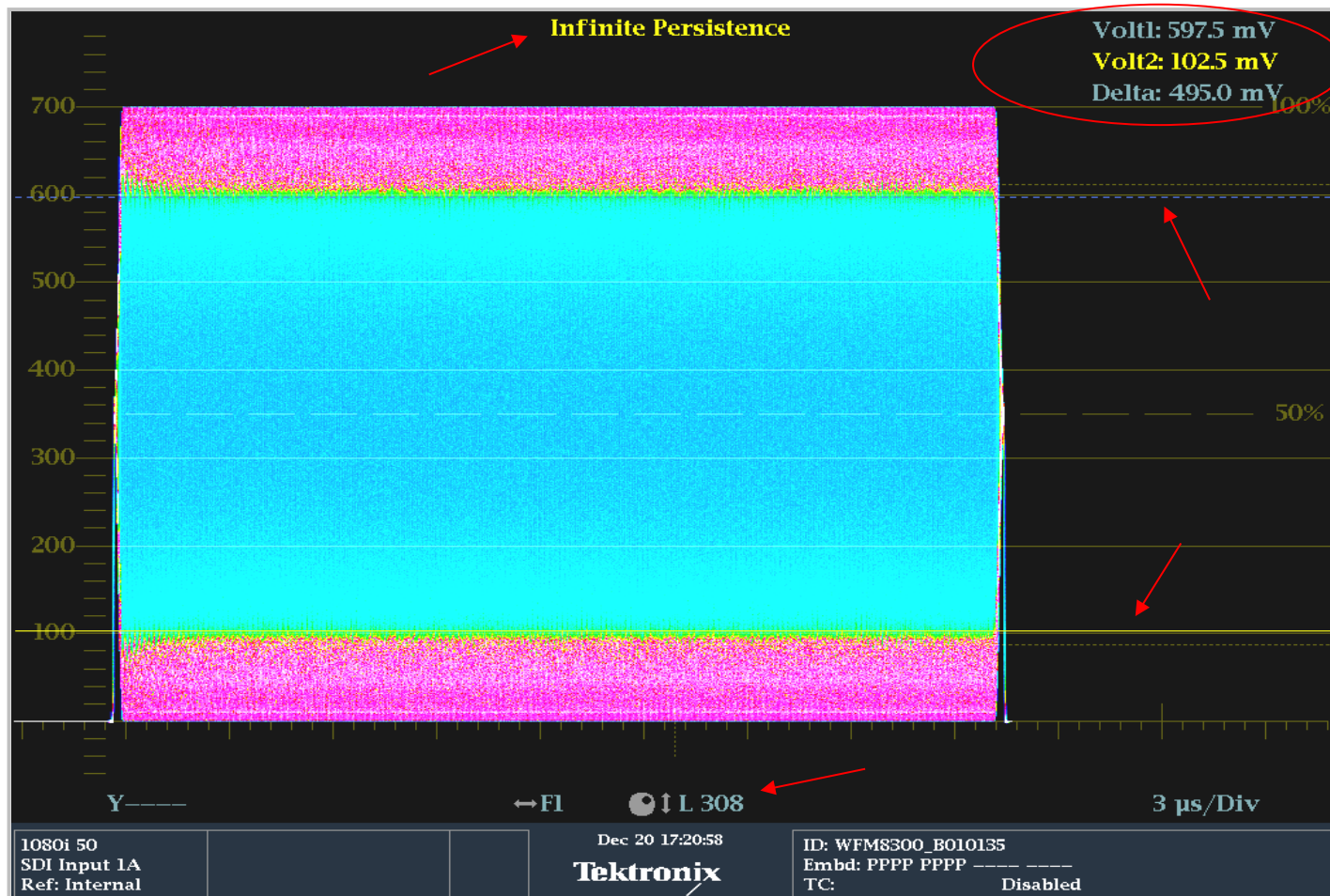
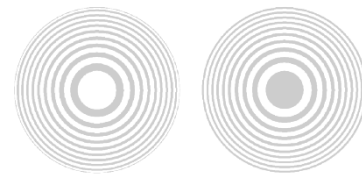


Figure 1. Infinite Persistence

### Figure 1 Notes:

- The position of the +102.5 mV and + 597.5 mV horizontal cursors is 495mV (700mV-3dB).
- The display in "Infinite Persistence" on Y only.
- The measured line: No. 308 (the middle of a 1080-50i picture).
- The display mode 'Pseudo' to better visualize the envelope.
- A WFM8300 was used for this screen shot.
- The measured frequency was 33.6 MHz (generated from the Waveform Monitor for this test)..

[www.tek.com/datasheet/multiformat-video-generator-2](http://www.tek.com/datasheet/multiformat-video-generator-2)