DIGITAL VIDEO ESSENTIALS

DVE

DVD™

JKP

Digital Video Essentials

NTSC
Component Video
DVD

Introduction

Joe Kane Productions (JKP) has spent much of it history creating programs aimed at helping consumers obtain a better picture and sound quality from their home entertainment system. Our efforts in this direction started in the late 80's with a laserdisc called *A Video Standard.* It illustrated what was then the state of the art in video delivery to the home. *Video Essentials* followed in the mid 90's, documenting the transition from laserdisc to DVD. Now *Digital Video Essentials* takes us from standard definition component video into the word of high definition. This particular disc was produced in high definition and down converted to NTSC standard definition component video for release on DVD. Parts of DVE have been released in high definition so viewers can see the difference between the formats. Up to date information on how to find DVE in HD is posted on the DVE web site. http://www.digitalvideoessentials.com/

Why is *Digital Video Essentials* Important?

In the early days of color television the pictures looked "good" because sets were installed and set up by professionals. As TV sets became "box" sales, where you took it home and set it up on your own, picture quality was partially determined by what set manufacturers had to do to get your attention on the show floor. They built sets that would scream at you. Of course they often continued to scream at you once you got them home unless you made an effort to readjust them. That's where our programs entered the scene. As we move towards HDTV attention to detail is even more important.

Digital Video Essentials was born out of a series of lectures we were presented to home theater installers, trying to help them understand how to make the most of the coming of HDTV. It was clear their clients also needed help, so we produced DVE.

The Video Canvas

DVE is designed to help viewers understand that video is electronic art, where the display is the canvas on which a story is created. Seeing that story at home requires that the characteristics of your canvas match those used in the production process. Things are complicated a bit by the fact that there are actually three slightly different canvases used in program production. Two of them are the standard definition specifications known as NTSC and PAL. The third system is HDTV and includes the 720 and 1080 line systems.

Setup procedures found in DVE are designed to work in all three formats. You just need to obtain the test patterns in the format being set up. This discs supports the NTSC system. Other discs in the product line support PAL, progressive versions of standard definition and several rates of high definition.

The NTSC DVD has been set for Region 0, meaning that it should play on any DVD player capable of NTSC, any place in the world. We've done the same with the English language PAL disc. There may be other language versions of DVE in either PAL or NTSC that might be coded for a specific region.

What's in DVE?

This disc contain interactive tutorials on three basic topics, the acoustic and visual environment of a high quality system, a bit about audio setup, and a different approach to video setup than we've taken in the past. At the moment the standard definition version of DVE provides the support instructions for the HDTV versions of the program.

Since the much of the program was produced in high definition the majority of the program content is in the widescreen aspect ratio. The image is in a 1.78:1 aspect ratio.

We aimed at designing the program as a journey, a fun ride with rewards at the end of the run.

DVE Menu System:

There are two menu systems in the disc. The upper menu system is called the Program Menu and it can be reached with the Title key. The lower system describes the contents of each individual title. It can be reached by pressing the Menu key on the player's remote control. We often found the Title key missing on remotes so there is a connection in the lower menu system to the Program Menu. This is illustrated in Title 3 of the DVD.

We've designed the menu system with lots of navigation options.

All of the menus are flagged as 1.33:1 in aspect ratio. This was done to make sure the entire contents of the menu system showed up on screen no matter how the DVD player was set up. For those of you who have players that can change the display aspect ratio or provide aspect ratio information about the video you'll find that option popping up every time you call up a menu.

DVE Navigation Tips:

Disc navigation can be unique in individual discs. Of course when you are trying to provide point where you can cut into an interactive program the complexity of the menu system goes up. That's the case for *Digital Video Essentials,* where the menu system has been designed to be highly interactive.

When we first scripted DVE we had ideas of how the menu system might look. They were created and then samples were integrated into Title 3 to illustrate how to use the menu system. Once the program was edited and off to the authoring stage of the program we discovered that some of our original ideas could be simplified so some of the elements in the illustrations got pulled out in the final version. The illustrations in the program don't exactly match the final menus. You'll see the differences when you go from the real menu to the descriptions of the menu in the program.

In an ideal world we'd put everything you needed to use on the first page of the menu system, almost like some of the pull-down menus on web sites. Pick a basic topic and it exposes all of the sub categories of that topic. Unfortunately there is not enough resolution in the standard definition video image to support the level of options we wanted to include in the program. That pushed us into sub-categories for some menu items and multiple pages for others.

In the top level Program Guide Menu, which you can get at by pressing the Title key or top level menu key on the remote control, there are five options listed. Three of the options, Introduction, DVD Navigation, and Playback Options, go directly to their part of the program or in the case of Program Options to a selection of the audio track to be played. The other two, Program Guide and Program Notes, lead you to additional menus. We'll use these names in this description so you'll know where they go in the program.

Most of the menu systems in DVD's don't require you to know much about navigation to get to every point they've listed in the program so we've included some basic instructions on how to get around a more complicated menu system like ours. You may want to read the manual for your DVD player for some additional hints on how to find capabilities in your DVD player.

Some of the choices about functionality in the navigation system were made after the program was assembled so there are some additional hints we'd like to provide. We'll also repeat some of the important instructions found in the disc.

Shortcut #1 The Return key on the remote control.

In going into either Program Guide or Program Notes you'll find that Return is one of the options you can select. Selecting it will take you back up a level in the menu system. You can also go back up a level by pressing the Return key on your remote control without ever highlighting the word Return in the menu.

Shortcut #2 Quickly moving forward to the next menu frame.

Several of the Program Menus items have multiple pages with lots of information in them. The Title index is one example Reference Materials is another. Getting to the next page is as easy as pressing the right arrow key followed by the enter button on the remote. There is no need to scroll through all of the options.

Shortcut #3 Moving among video test patterns.

In going through the video reference test patterns you can advance from one Title to the next just by pressing the skip forward button as you reach the frame of black at the end of most titles. Use the skip back button to go back to prior test patterns.

Shortcut #4 Repeating sequences of test materials.

Individual motion video and audio reference materials have been put in their own chapter. Use the chapter repeat function to make them stay up longer than the time provided in the program. Use the A-B repeat capability if only a small portion of the chapter is to be repeated. In the case of the audio test signals you may want to repeat an entire title.

Shortcut #5 Moving among Program Notes frames.

Use the skip back button to go back among the frames in the program notes. The skip forward as well as the right arrow key will take you forward in the program notes.

Shortcut #6 Finding test patterns in the Reference Material section of the program.

We've provided a list of test materials and their location in the program. The fastest way to get to any one of these patterns is to search for the Title and Chapter in which they are located. Each of the patterns can also be reached through the menu system.

Shortcut #7 Finding the Program Menu system.

Some DVD player remote controls don't provide a Title key or upper menu select key. We've provided an option in the first page of every Chapter menu that will take you to the Program Menu. The disc will also stop on the Program Menu after the introduction to the program.

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12 Green, 75% Amplitude
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18 Vertical Color Bars 100% Saturation
19 Video Black

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3 End JKP Logo

Program Menu: Introduction

Selecting the Introduction option from the opening page of the Program Menu system will play Titles 1, 2 & 3.

Title 1: Opening Banners

All of the opening logos, to include Extron, Swelltone and JKP originated in the 1080p domain. The JKP logo was reedited with the original uncompressed graphics files, inserting the WMV HD logo at the head end. The uncompressed edited files were used when encoding in WMV. This particular section never went to D5 tape and does not have some of artifacts that can be introduced by that tape format.

The majority of the NASA sequence originated in 720p/24 and came to us on D5 from Panasonic. Their variable shutter rate high definition camera was used to shoot the images from the ground. The material from outer space was shot at 1080i/60 and is the only material in the original version of *Digital Video Essentials* that originated in the in

the interlaced domain. The segments we picked were so slow in motion that we were able to convert them to 1080p without a lot of interlaced artifacts. The motion was so slow that we had to speed it up by a factor of three in order to use it this sequence.

Title 2: Digital Video Essentials

This is an introduction to digital video consisting of a brief discussion of the differences between analog and digital, MPEG compression, and copy protection issues. There is a brief overview of program mastering and "True Progressive Mastering." A demonstration of the room environment's importance to both acoustics and visual perception is provided.

We were never able to accomplish "True Progressive Mastering" in the MPEG-2 domain used for this DVD format. The irony of course is the MPEG was first designed as a compressor of progressive images, then adapted to interlaced video. We thought it would be as simple as removing the interlaced adaptors but found anyone doing that wasn't adhering to video format requirements.

"True Progressive Mastering" has been accomplished in the Professional version of *Digital Video Essentials* using Windows Media encoding. It's happened at a time we consider near the end of standard definition delivery of high quality video to consumers.

Title 3: Program Menu

Title three discusses how to navigate *Digital Video Essentials* using the "Program Menu."

Program Menu: DVD Navigation

Selecting the DVD Navigation option from the opening page of the Program Menu system will play Title 4.

Title 4: DVD Navigation

Here your going to find illustrations of the original menu system designed for DVE. The final system is a simplified version of the original. The title and menu functions of DVD players are discussed to help in making this disc's navigation easier to understand. We suggest reading the player's manual to get to know where to find the functions pointed out in this section and we've included additional navigation tips in the introduction to this disc.

There is a lot of material covered in DVE so we arranged the navigation system so that it will take you out of the tutorial after each topic is covered. The menu system will automatically advance to the next topic so all the viewer has to do is press Enter on the remote to continue the progression of topics. Pressing Enter may take you into another layer of the menu system so you'll have to press Enter yet again to continue.

DVD player setup is also described to ensure that it is setup to properly accommodate the display's aspect ratio. We also illustrate different player remotes and how each is used to accomplish a single function. Learning where to find functions on the remote will help in navigating this or any other DVD.

Program Menu: Program Guide

This is where we get into sub-menus. Selecting the Program Guide option in the main menu takes you to a second menu. Options in it include the following:

- -

Program Guide

Room Environment
Audio
Video
Title Index
Reference Materials
Acknowledgments

Return

- -

Any program content that comes off this page will have a header called Program Guide, instead of the Program Menu name we've been using up to this point. It's like page two of the Program Menu system.

Program Guide: Room Environment

Pressing the Room Environment option in the Program Guide menu will take you to yet another option menu. It lets you know you are in the Room Environment option.

- -

Program Guide

Room Environment

Acoustics
Visual

Return

- -

Program Guide, Room Environment, Acoustics

This option takes you to Title 5, Chapter 1.

Title 5: Viewing Room Environment

Chapter 1: Acoustic

We open with a tutorial on room acoustics. Proper placement of speakers, standing waves, room reflections, room treatments, and acoustic computer programs are all described to help in optimizing general audio systems.

Program Guide, Room Environment, Visual

This option takes you to Title 5, Chapter 2.

Chapter 2: Visual

We move on to the look of the room, covering the importance of eliminating ambient light and choosing the décor for a good viewing environment. Room environments for both front projection and rear projection display devices are described in detail.

Program Guide: Audio

Selecting this option takes us to several additional pages of the menu system. All of those options take us to chapters in Title 6

- -

Program Guide

Audio Page 1

DVD Formats
Loudspeaker Placement
Stereo Demonstration

Navigation Pod Return Forward

- -

- -

Program Guide

Audio Page 2

Multi-channel Formats
System Connections
Setting Audio Levels

Navigation Pod Back Return

- -

Title 6: Audio

Chapter 1: DVD Format

This chapter provides an overview of the different audio formats currently available via the DVD medium.

Chapter 2: Loudspeaker Placement

A discussion of loudspeaker placement based on general physics and loudspeaker theory. This chapter also addresses the general misconceptions about when loudspeakers should be heard.

Chapter 3: Stereo

Testing of the stereo system for accuracy is covered. A stereo vs. multi-channel audio demonstration is included.

Chapter 4: Multi-Channel Audio

This chapter goes into more detail regarding speaker placement in multi-channel audio systems. There is a discussion of the monaural center and LFE channels of audio concerning how they should be used and recommended setup.

Chapter 5: System Connections

Certain audio connections are recommended as well as troubleshooting techniques to ensure that the audio system is connected properly. A brief description of testing speaker polarity is provided.

Chapter 6: Setting Audio Levels

This chapter focuses on setting audio levels to system standards utilizing a decibel meter and the test patterns provided on *Digital Video Essentials*. It is important to note that internal test signals produced by receivers and surround processors may not match those coming from the test signals provided in this program. When this does occur calibrate the audio levels based on the DVD as the DVD source produces the audio that is ultimately listened to.

Program Guide, Video

This option takes us to another menu system that picks topics from Title 7

- -

Program Guide

Video

Basics Calibration *(Instructions)*
Troubleshooting
Advanced Calibration
Video System Details

Return

- -

Title 7: Video

Chapter 1: Basic Instructions – Calibration Overview

This chapter provides an overview of the title discussing the necessity of calibrating a display device in order to achieve the best possible picture. The title itself is broken up into categories covering “Basic Instructions,” “Troubleshooting,” “Advanced Instructions,” and “Video System Details.”

Chapter 2: Basic Instructions – Brightness

Chapter two provides an detailed discussion regarding brightness/black level and how to adjust it using the provided PLUGE pattern.

Chapter 3: Basic Instructions – Contrast

This chapter provides detailed information on how to set contrast on a CRT based display device. For detailed information on setting contrast on digital display devices, such as plasmas, DLPs, LCDs, and D-ILAs please view chapter 8.

Chapter 4: Basic Instructions – Color

Chapter four provides a detailed discussion on how to set the color control on various display devices and in various systems.

Chapter 5: Basic Instructions - Tint

This chapter provides information on how to set the tint control.

Chapter 6: Basic Instructions – Sharpness

Chapter six provides a detailed discussion on the purpose and how to set the contrast control.

Chapter 7: Troubleshooting – Brightness

This chapter focuses on checking DC Restoration and setting brightness properly when DC Restoration is poor.

Chapter 8: Troubleshooting – Contrast

Chapter eight provides detailed information on setting contrast on digital display devices and checking for clipping.

Chapter 9: Troubleshooting – Color

This chapter describes color decoding and checking for proper color decoding. It also discusses how to compensate for poor decoding within the user menu adjustments.

Chapter 10: Advanced Calibration – Gray Scale

Chapter 10 provides a detailed description of gray scale, from its origins to the importance of calibration. Illustrations are provided to support descriptions.

Chapter 11: Advanced Calibration – Primary Colors

This chapter provides a description of primary colors and the importance for consistency in creating and accurate image.

Chapter 12: Advanced Calibration – Geometry

Chapter 12 provides a detailed description of Overscan, how it originated, its' importance, and why it should be reduced with current video sources. A brief explanation of scan velocity modulation, or SVM, is also included.

Chapter 13: Advanced Calibration – Finding Qualified Help

This chapter warns against going beyond the user accessible controls in order to correct errors within a display device.

Chapter 14: Video System Details – Component, S, & Composite

Chapter 14 provides a detailed discussion regarding types of cables, the format of video that they carry, and the advantages provided by them. This section is helpful in determining what type of cables to use in a system to maximize system performance.

Chapter 15: Video System Details – Interlaced & Progressive Video

This chapter provides a detailed discussion including illustrations on the differences between interlaced and progressive video.

Chapter 16: Video System Details – Video Processors

This chapter discusses the importance of video processing in displaying images on fixed pixel display devices or high-resolution monitors. It also provides a brief explanation of 2:3 pulldown/detection.

Chapter 17: Video System Details – MPEG Encoding

This chapter briefly discusses the basics of analog and digital compression. Illustrations are provided to provide a better understanding of the system and how it works. The importance of high-resolution progressive source material is emphasized.

Chapter 18: Video System Details – Large Screen Home Theaters

This chapter focuses on building an ideal home theater room utilizing front projection technology. Angle of view, screen materials, light output, room environment, and projector/screen placement are all discussed with accompanying illustrations.

Program Guide, Title Index

This option takes you to a list of all of the titles in the program. Selecting any one of them from that list will take you to the title

Program Guide, Reference Materials

This option takes you to a list of Titles 8 to 17. We're going directly to each one of them in this description.

Audio Test Materials: Titles 8 to 11

Title 8: Audio Test Signals, Dolby and DTS 6.1

Format: Dolby Digital and DTS 5.1 (NTSC and PAL)

Dolby Digital and DTS 5.1 Audio System Check. During this section of the program there are three audio tracks available, DTS 5.1, Dolby Digital 5.1 and Dolby Digital Lt Rt. The tracks are selectable using the Audio Select button on the DVD player's remote control. The player should provide an on screen indication of which track is being played. The Dolby Lt Rt track may show up as Dolby 2.0. Your receiver should be in the Dolby Pro-Logic decode mode when this track is selected.

The Dolby Digital Pro-Logic track stays in step with the multi-channel audio indications on screen by repeating the L-R signal for each of the back surrounds.

Pink noise begins at the head of the chapter and lasts for the duration of the chapter. The level is -30 dBSF for individual channels. The levels at half way points between two speakers have been set so that the acoustic level comes out at the same level as the individual channels.

Audio levels should be set among the channels using band limited pick noise. The important point is to set all of the channels so that they are equal in level. Band limited pink noise is used so that possible tambour differences among speakers will not affect the

level setting process. The –30 dBSF should produce a + 75 dB acoustic level if the volume control is turned up to reference level.

Step Around the Room in 5.1, Band Limited Pink Noise (500 Hz to 2 KHz), 10 seconds per position.

Chapter 1: Left

Chapter 2: Half Left

Chapter 3: Center

Chapter 4: Half Right

Chapter 5: Right

Chapter 6: Half Right Surround

Chapter 7: Right Surround

Chapter 8: Center Back, Between the Surrounds

Chapter 9: Left Surround

Chapter 10: Half Left Surround

Chapter 11: LFE, 40 to 80 Hz noise at -33 dBfs

Chapter 12: Pan Around the Room

This is done once in 30 seconds with Full Bandwidth Pink Noise (20 Hz to 20 KHz), leaving out the LFE channel. Listen for any tambour differences in the speakers. This or any other chapter can be put in a loop if there is a need to repeat this sequence. Starting at the left we are full on to the next speaker every six seconds.

Title 9: Audio Test Signals, Dolby and DTS 6.1

Format: Dolby Digital and DTS 6.1 (NTSC and PAL)

Dolby Digital and DTS 6.1 Audio System Check. The Dolby Digital Lt Rt will stay in step with the multi-channel audio by repeating the L-R channel for each of the back surrounds. Pink noise begins at the head of the chapter and lasts for the duration of the chapter. Level is -30 dBSF for individual channels. The levels at half way points between two speakers have been set so that the acoustic level comes out at the same level as the individual channels.

Step Around the Room in 6.1, Band Limited Pink Noise (500 Hz to 2 KHz), 10 seconds per position.

Chapter 1: Left

Chapter 2: Half Left

Chapter 3: Center

Chapter 4: Half Right

Chapter 5: Right

Chapter 6: Half Right Surround

Chapter 7: Right Surround

Chapter 8: Half RS and CB

Chapter 9: Center Back

Chapter 10: Half CB and LS

Chapter 11: Left Surround

Chapter 12: Half Left Surround

Chapter 13: LFE, 40 to 80 Hz noise at -33 dBSF

Step Around the Room in 6.1, Full Bandwidth Pink Noise, 20 seconds per position.

Chapter 14: Left

Chapter 15: Half Left

Chapter 16: Center

Chapter 17: Half Right

Chapter 18: Right

Chapter 19: Half Right Surround

Chapter 20: Right Surround

Chapter 21: Half RS and CB

Chapter 22: Center Back

Chapter 23: Half CB and LS

Chapter 24: Left Surround

Chapter 25: Half Left Surround

Chapter 26: LFE, 40 to 80 Hz noise at -33dBfs

Chapter 27: Low Bass in the Left & Right

Chapter 28: Pan Around the Room

This is done once in 30 seconds with Full Bandwidth Pink Noise (20 Hz to 20 KHz), leaving out the LFE channel. The chapter can be put in a loop if the sequence needs to be repeated.

Title 10: Audio Test Signals, System Response

Dolby Digital and DTS 6.1 plus Dolby Lt Rt

Chapters 1-4 of this title provide test patterns for the “Buzz & Rattle Test.” These chapters provide a frequency sweep from 15 Hz to 300 Hz in order to help determine if anything in the room will “Buzz” or “Rattle” at a reference listening level and at a certain frequency. This test should be performed after the output levels and speaker placement have been finalized. At this point if anything does “Buzz” or “Rattle” find the cause of the “Buzz” or “Rattle” and try to minimize it. This may mean anchoring furniture or moving trinkets.

Audio formats included in this disc are Dolby Digital and DTS 6.1 plus Dolby Lt Rt. Use the Audio select button on the remote control to switch among the channels. An indication should come up on screen telling you which option has been selected. Dolby Digital Lt Rt will probably show up as Dolby 2.0

Audio Content:

Chapter 1: Buzz & Rattle Test, 15 Hz to 300 Hz – Left

Chapter 2: Buzz & Rattle Test, 15 Hz to 300 Hz – Center

Chapter 3: Buzz & Rattle Test, 15 Hz to 300 Hz – Right

Chapter 4: Buzz & Rattle Test, 15 Hz to 300 Hz – 6 Main Channels

Chapters 5-8 provide test patterns designed to check aural frequency response of the system using frequency sweep from 15 Hz to 22 KHz. Using a sound level meter in the flat frequency response mode look for level changes over the entire range of frequencies presented in the sweep. The sweeps can also be used to monitor the response of audio processing equipment using audio level meters or an oscilloscope. Make sure any measuring devices used are flat in their response capability over the range provided in the test.

The room itself can be at fault for errors, let alone possible problems with the audio equipment driving the space. It’s a good idea to check the equipment’s capability independent of the room wherever possible and fix it first if it is contributing to the error being measured in the room. Equalizing any errors in response can be accomplished in a number of ways. There are audio equalizer, but they may introduce their own distortion

in the processing of balancing the audio spectrum. There is acoustic treatment that can be added to the room itself to help equalize the audio spectrum.

The goal is to have flat frequency response in the area where the listeners will sit. The larger the area of optimal listening, the more people will be able to hear the same thing. Check with people who specialize audio system setup for additional help.

Chapter 5: Frequency Sweep, 15 Hz to 22 KHz – Left

Chapter 6: Frequency Sweep, 15 Hz to 22 KHz – Center

Chapter 7: Frequency Sweep, 15 Hz to 22 KHz – Right

Chapter 8: Frequency Sweep, 15 Hz to 22 KHz – 6 Main Channels

Chapters 9-16 provide audio materials designed to check the bass management of the system. They provide test signals from 15 Hz to 150 Hz through all channels and each individual channel within the system. As with the frequency sweeps the goal is to achieve flat bass response throughout the 15 Hz to 150 Hz frequency range in the biggest listening area as possible. This may be difficult because lower frequencies tend to have bigger null points - as the larger wavelength of the lower frequencies create standing waves. This is illustrated in the tutorial portion of the program on the first two discs of the DVE-Pro set.

In addition to low bass response in the room these signals check the ability of the audio processing system to properly cross over low bass information in each channel to the subwoofer. The point of cross over from subwoofer and main channel is often user selectable and may depend on the capabilities of the main loudspeakers. In any event the cross over frequency should be well below 150 Hz, with 80 Hz being a common choice in high quality systems.

Audio in the LFE channel should not cross over into any of the main channels.

Chapter 9: Bass Management Test 15 Hz to 150 Hz – 6 Main Channels

Chapter 10: Bass Management Test 15 Hz to 150 Hz – Left

Chapter 11: Bass Management Test 15 Hz to 150 Hz – Center

Chapter 12: Bass Management Test 15 Hz to 150 Hz – Right

Chapter 13: Bass Management Test 15 Hz to 150 Hz – Right Surround

Chapter 14: Bass Management Test 15 Hz to 150 Hz – Back Surround

Chapter 15: Bass Management Test 15 Hz to 150 Hz – Left Surround

Chapter 16: Bass Management Test 15 Hz to 150 Hz – LFE

Title 11: A/V Test Signals, Sound and Vision Timing

Dolby Digital and DTS 6.1 plus Dolby Lt Rt

The idea behind this section is a combination of what is accomplished in the film leader count down clock used to check visual and sound sync in movie theaters plus Using video wipe patterns of luminance and color information for video testing. The audio pop occurs at top dead center of the rotation. At the point of the pop the top 5% of the image area turns white. This can be used as a scope trigger to determine if the audio is in step with the picture.

The transitions about the clock are 75 and 100% chroma and luminance wipes. The idea is to determine if there are any problems with such transitions in video.

The sound used is what the film industry calls the two pop.

This title opens with the pink noise clock. Its purpose is to determine how long it takes the audio to start up after the video. The pink noise is always on. Take note of the position of the clock when you first hear the pink noise when starting this chapter from the menu system. You can also start the chapter, hit pause, then back it up to the first frame of the chapter. Leave it in the still frame mode long enough for the audio decoder to loose sync then hit play. Take note of the position of the clock when the audio starts. This section runs for 5 seconds, which should be long enough for any system to pick up the audio.

The clock pulse or “two pop” is in the center channel during the full band pink noise section. It then moves to the left and right channels when it’s on its own.

Either chapter can be put in a loop if more time is required for the use of the signals, although putting the pink noise clock in a loop should not cause a drop in audio decoding sync.

Chapter 1: Pink Noise Clock

Chapter 2: Luminance & Chroma Clock

Video Test Signals: Titles 12 to 16

Our concept of providing test patterns comes from two points of view. The first finds its origins in the history of television, where test patterns have been used to determine the integrity of the video signal path and calibration of equipment. The second comes from the need of creating simulations of problems that occur in images. The need for this type of test materials comes from the amount of video processing currently employed in displaying program material. That processing involves compression and de-compressing as well as conversion to other rates for display.

We also elected to challenge parameters in the interlaced video domain that have been otherwise off limits. Among them is how much horizontal and vertical detail can we get into the digital video channel. Normal standard definition program production standards filter the horizontal resolution to less than 6 MHz, when the digital channel could carry as much as 6.75 MHz in bandwidth. The vertical is also filtered by about 30% in program production to minimize the visibility of interlaced artifacts when the signal is displayed on an interlaced monitor.

So why are we exceeding either program production practice in our test and demonstration materials? The reason is found in high definition program production. A large percentage of program material currently out on DVD comes from progressive high definition masters, as does our presentation. When that image information is down converted to standard definition interlaced video there is a strong possibility that the detail content goes right out to the limits of the digital video channel.

This is certainly anticipated in many DVD players where the analog output allows all of the capability of the digital channel to be reproduced. Manufacturers designing consumer equipment need a clear reference for what can happen in their equipment when such detail is present. We have made sure that extra detail is present in *Digital Video Essentials.*

Providing that detail has consequences in many applications. Interlaced artifacts are going to be far more visible on interlaced displays. Video processors designed to the limitations of program production practices are probably going to exhibit ringing in the image, if not a great deal of flicker.

Knowing this we've provided filtered and unfiltered versions of some test patterns. That will be pointed out in the introduction of the individual titles.

As much as the tutorial content of this program was down converted from the 1080p master the majority of test patterns were generated in the standard definition component domain. They were generated in the SMPTE RP 187 format of 720 by 486. Where appropriate the test patterns have been created in the progressive domain then converted to the interlaced DVD mastering format without the usual vertical filtering that takes place in progressive to interlaced conversion.

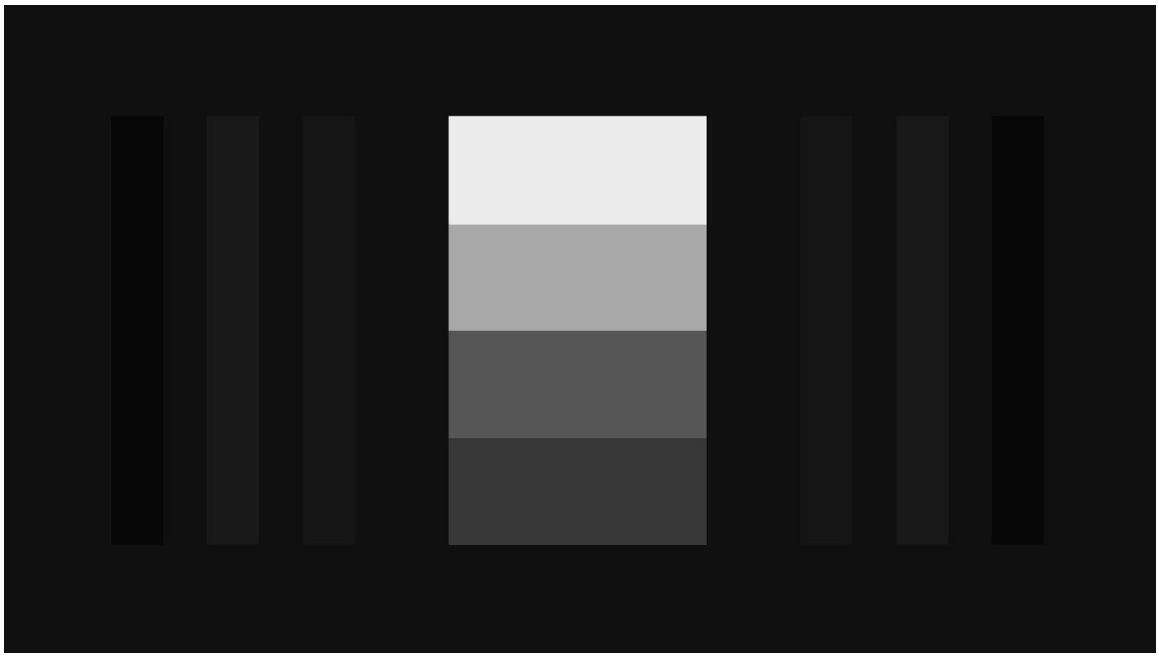
Title 12: Display Setup Patterns

Chapter 1: Title Identification: *Display Setup Patterns*

Title 5 provides a quick reference for evaluating the condition of a display and to some extent the circuits driving it. Included are gray scale, brightness, contrast, color decoding, chroma and luminance response, and a reference for ambient light behind a monitor, should that light be needed with the display.

Chapter 2: DVE PLUGE w/ Gray Scale

Function: To assess/adjust brightness in all types of displays and contrast in a CRT display.



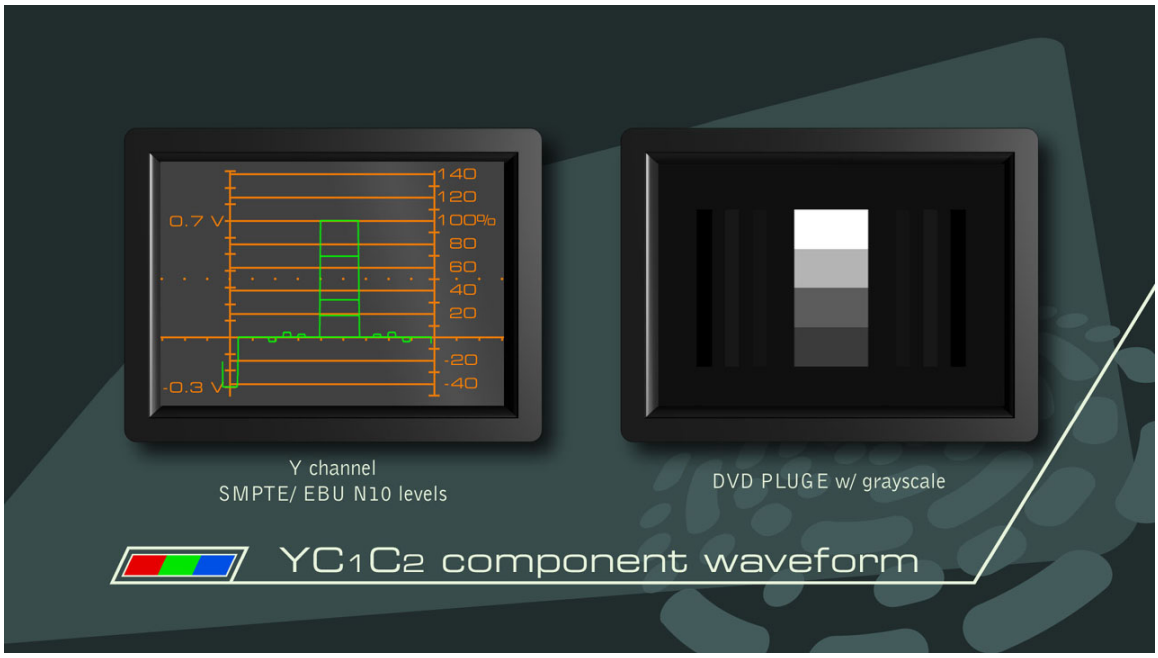
Pattern Layout: The pattern consists of a background at video black, then a symmetrical PLUGE on both the left and right side of the log gray scale in the middle of the pattern. The outer part of the PLUGE contains a -4% black bar on the video black background followed by a +4% bar and +2% bar as you go towards the middle from either side. The gray scale in the middle represents steps of about 18.4%, 32.1%, 69% and 100%. These values were chosen based on the gamma curve of a CRT display and represent a visual progression in light output along that curve.

Descriptions of Use: We've made several changes to the PLUGE patterns from the BBC version that was presented in *Video Essentials*. The original PLUGE was on the left with the gray scale on the right. The PLUGE is now on both sides of the center to provide a greater opportunity to set black, taking image uniformity into a greater account. We've also added a 2% step. Originally it was added to help in setting black level where below black information was being cut off. It later served a function of helping us describe the rate at which a CRT comes out of black. There is almost no difference in level between black and 2% above black.

The DVE PLUGE allows for the brightness control to be set properly on almost any display system. Its general use is illustrated in the tutorial discs of the DVE-Pro package. An important point to make here is that when displayed on a CRT there is almost no difference in level between the 2% above black and black itself. In the description of how to set black we tell you to adjust the Brightness control so that the blacker than black strip and video black background just match in level. You'll note that the resolution of Brightness controls is so poor that if this criteria is met, the 2% above black strip might not be visible. Turn the brightness control up far enough for the 2% strip to be visible and there will be a difference between the blacker than black and video black background. The gamma of a CRT is nearly flat in this area of operation. This is the way all display devices should work. If there is a large difference between the black background and the 2% stripe, at least part of the gamma curve in the display is wrong.

The pattern has a low average picture level (APL) and is used in conjunction with the high APL PLUGE to determine the condition of DC Restoration.

The waveform of the pattern is useful in setting black and white levels in video equipment.



In light bulb driven solid state displays you're not likely to reach the point of absence of light as described in the procedure for setting brightness on a CRT display. What you reach is a digital cut-off, a point where information in the video signal is no longer displayed. Ideally you might think you should put black at cut-off. Where solid-state displays have a gamma curve designed to emulate a CRT we are setting black level one point on the brightness scale above the point of video black being cut off. At this point in the gray scale the gamma curve is nearly flat and there should be little or no light output difference in this extra point of brightness shift. What this provides the viewer is a simulation of the CRT's ability to fully display information in the area of black, making use of some of the dynamic range below black. The light level for this darker part of the picture should be controlled using a combination of screen size and type, and lamp output. Some projectors also have an iris control for even finer control of the ambient level. The tutorial in DVE suggests the ambient level should be below 0.05 ft-L.

The center grayscale allows for a quick determination of the color of gray. Many calibrators use this pattern as a reference for quickly adjusting a grayscale as it allows one to see what is happening to the entire gray scale as adjustments are being made. It can also be used to set the contrast control on a CRT based display. That is also illustrated in DVE. It is not easily used to set the proper upper dynamic range of a solid-state display. With experience you can spot when clipping comes down as far as the 100% of this top rectangle but that doesn't help in knowing how much the contrast has to be backed down to accommodate the entire video dynamic range.

Chapter 3: DVD PLUGE w/White

Function: To assess the quality of DC Restoration in the display.

Pattern Layout: The pattern consists of a peak white area at the top and bottom and center of the image with video black and PLUGE on the left and right sides of the image.

Descriptions of Use: Black level in the image should remain fixed when switching back and forth between the test patterns in Chapters 3 and 4. You may have to look carefully at the area around the PLUGE, factoring out any flair from the bright white or just factoring out the effect it may have on your eyes shutting down, to determine if black is being held at black independent of program content.

Knowing that there are 2 and 4% steps in the PLUGE pattern you can get a rough estimate of how well black is being held at black. Solid-state displays can be designed so there is no shift in black level. A 1 to 2% change is expected in even good CRT displays. In a good viewing environment you wouldn't want anything that changed more than 3 or 4%.

Chapter 4: Needle Pulse

Function: To assess the high voltage regulation and determine the presence of scan velocity modulation.

Pattern Layout: The background of the pattern is split screen with video black on the top and peak white on the bottom. There is a line that travels vertically through the image that is called the needle, it is white at the top section and black at the bottom section. The rise and fall time of the pulse is about 2T or half the maximum rise time the video system will allow.

Descriptions of Use: The pattern was initially developed as a quick look at video bandwidth, which requires its display on a waveform monitor, then became useful in looking at power supply capability and eventually took on the task of helping to spot the presence of scan velocity modulation in CRT displays. It's usefulness as a visual pattern for spotting problems is primarily in CRT displays. Solid-state displays should not have any of the problems for which this pattern will be useful. That's not to say we won't spot something, but it should look good on all of these types of displays.

The needle in the pattern is a vertical line and has the same width from top to bottom. It should be a vertical line in any display. Independent of geometry controls the line may bend on CRT displays as the contrast is increased. This is an indication that the power supply is not able to provide the current being demanded by the position of the contrast control. This is illustrated in the tutorial version of DVE.

The other use of this pattern is to determine the presence of scan velocity modulation.

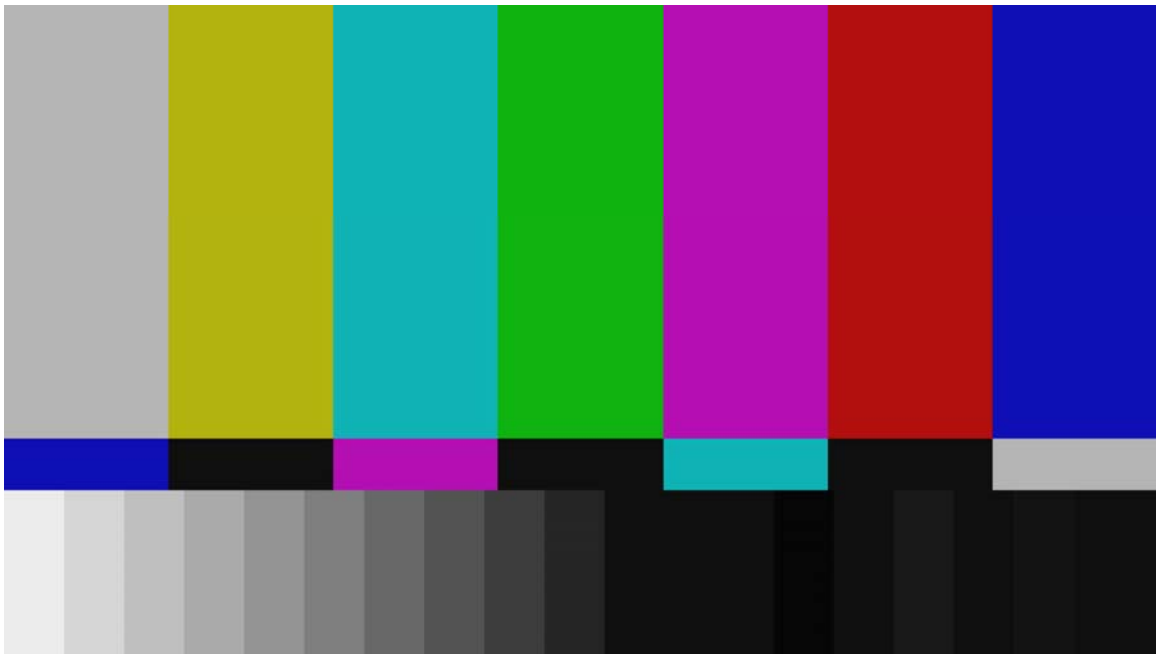
Scan Velocity Modulation, or SVM, is one of the many tricks manufacturers use to get more light out of a picture tube, at the cost of real picture detail. It changes the speed or velocity of the beam as it is scanned from the left to the right side of the picture. In the process, it distorts real picture detail, causing

dark areas of the picture on light backgrounds to be reproduced much larger than normal and light areas on dark backgrounds to be reproduced much smaller than normal. When the beam spends more time "writing" light areas, the phosphors receive more energy and produce more light output. The fact that this will contribute to phosphor blooming, as well as detail distortion seems to be lost on a number of manufacturers calling it a "feature."

Its use for this function is illustrated in the tutorial version of DVE.

Chapter 5: DVE PLUGE w/Gray and Bars

Function: To assess/adjust color decoding.



Pattern Layout: The pattern has many of the elements of the SMPTE color bar pattern with an additional grayscale in the lower left corner to replace the I, Y and Q in the original pattern. The lower right corner maintains the DVE PLUGE with 4% below black, 2% above black, and 4% above black bars.

Descriptions of Use: When possible adjust this pattern by turning each color, red, green, or blue, on and off in order to see the individual red, green, and blue channels. This is a particular requirement of displays incorporating color gamut correction, due to the method by which the correct color gamut is achieved.

Composite/S-Video:

Initially observe the blue channel; isolate blue either by turning off red and green, or with the blue filter. Following the explanation in the tutorial version of *Digital Video Essentials*, adjust the amplitude and phase controls in order to achieve proper results.

Next, assess the red channel. Turn off the blue and green channels of video, or use the enclosed filter. If the red intensity in the magenta patches and red patches match when observed through the filter, decoding in the red direction is accurate. If there is a difference in intensity the decoder is not functioning properly.

Finally, assess the green channel by turning off the blue and red channels. If the green intensity in the cyan patches and yellow patches match when observed through the filter, decoding in the green direction is accurate. If there is a difference in intensity the decoder is not functioning properly.

Component Video:

The same observations apply; however, if there is a Hue or Tint control it controls color balance instead of decoder phase. Hue or Tint is not normally available in component video.

Chapter 6: 75% Color Bars w/ Gray Reference

Function: To assess/adjust color decoding.

Pattern Layout: The pattern consists of a gray background with yellow, cyan, green, magenta, red, and blue rectangles on the top and bottom halves of the image.

Description of Use: This pattern was designed to better serve the function of color decoder calibration across all component and composite video systems plus have areas large enough to make it possible to see around many of the on-screen menu systems in display devices. When it originates in the particular system being calibrated this pattern works for NTSC, PAL, interlaced and progressive video, plus all of the component high definition systems. It is particularly useful when trying to evaluate the conditions of the green and red channels after levels have been properly set in the blue channel.

Composite/S-Video:

Initially observe the blue channel; isolate blue either by turning off red and green, or with the blue filter. Following the explanation in the tutorial version of *Digital Video Essentials*, adjust the amplitude and phase controls in order to achieve proper results.

Next, assess the red channel. Turn off the blue and green channels of video, or use the enclosed filter. If the red intensity in the magenta patches and red patches match when observed through the filter, decoding in the red direction is accurate. If there is a difference in intensity the decoder is not functioning properly.

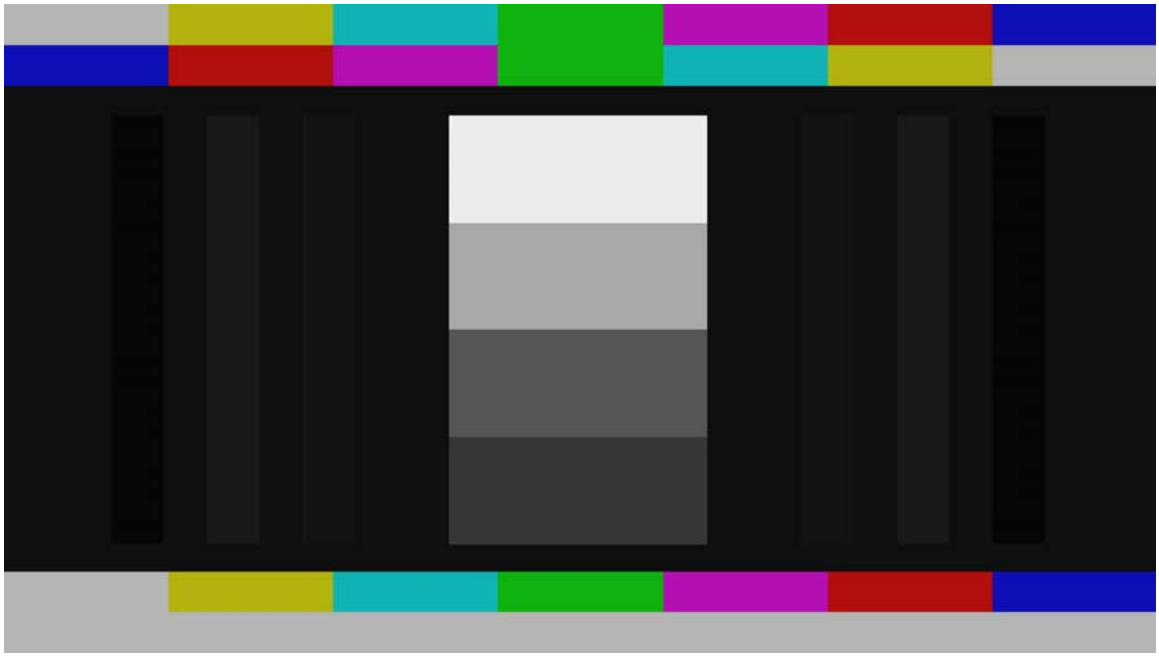
Finally, assess the green channel by turning off the blue and red channels. If the green intensity in the cyan patches and yellow patches match when observed through the filter, decoding in the green direction is accurate. If there is a difference in intensity the decoder is not functioning properly.

Component Video:

The same observations apply; however, if there is a Hue or Tint control it controls color balance instead of decoder phase. Hue or Tint is not normally available in component video.

Chapter 7: Split Bars w/Gray and DVE PLUGE

Function: Combination pattern for assessing and or adjusting black level and color decoding with a reference for video white.



Pattern Layout: The top and bottom of this pattern contains references for color decoding. The bars and gray are at a 75% level. The background of the center portion of the signal is at video black. Three step PLUGE patterns are on either side of a vertical gray scale, located in the middle of the pattern.
PLUGE

The outer part of the PLUGE contains a -4% black bar on the video black background followed by a +4% bar and +2% bar as you go towards the middle from either side. The gray scale in the middle represents steps of about 18.4%, 32.1%, 69% and 100%. These values were chosen based on the gamma curve of a CRT display and represent a visual progression in light output along that curve.

Descriptions of Use: The combination pattern allows you to set black level, make observations about white level, or properly set it on a CRT based display, and asses the decoding of color. At the top of the pattern the patches of 75% saturated color and gray are reversed allowing a comparison of individual colors when observing just the red, green or blue channel. Displaying the decoded signal on a waveform monitor makes it easy to assess or adjust any of the decoder functions. The bottom color and gray combination is also at 75%. This time the color patches are being compared to reference levels for each color.

The DVE PLUGE allows for the brightness control to be set properly on almost any display system. Its general use is illustrated in the tutorial discs of the DVE-Pro package. An important point to make here is that when displayed on a CRT there is almost no difference in level between the 2% above black and black itself. In the description of how to set black we tell you to adjust the Brightness control so that the blacker than black strip and video black background just match in level. You'll note that the resolution of Brightness controls is so poor that if this criteria is met, the 2% above black strip might not be visible. Turn the brightness control up far enough for the 2% strip to be visible and there will be a difference between the blacker than black and video black background. The gamma of a CRT is nearly flat in this area of operation. This is the way all display devices should work. If there is a large difference between the black background and the 2% stripe, at least part of the gamma curve in the display is wrong.

The pattern has a low average picture level (APL) and is used in conjunction with the high APL PLUGE to determine the condition of DC Restoration.

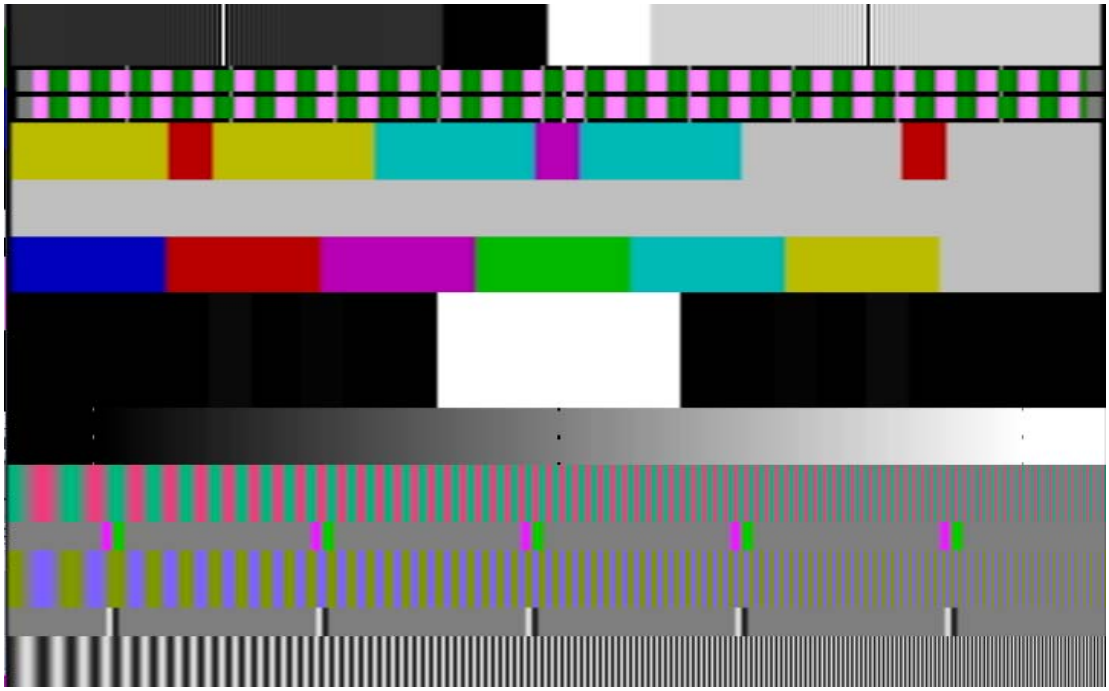
In light bulb driven solid state displays you're not likely to reach the point of absence of light as described in the procedure for setting brightness on a CRT display. What you reach is a digital cut-off, a point where information in the video signal is no longer displayed. Ideally you might think you should put black at cut-off. Where solid-state displays have a gamma curve designed to emulate a CRT we are setting black level one point on the brightness scale above the point of video black being cut off. At this point in the gray scale the gamma curve is nearly flat and there should be little or no light output difference in this extra point of brightness shift. What this provides the viewer is a simulation of the CRT's ability to fully display information in the area of black, making use of some of the dynamic range below black. The light level for this darker part of the picture should be controlled using a combination of screen size and type, and lamp output. Some projectors also have an iris control for even finer control of the ambient level. The tutorial in DVE suggests the ambient level should be below 0.05 ft-L.

The center grayscale allows for a quick determination of the color of gray. Many calibrators use this pattern as a reference for quickly adjusting a grayscale as it allows one to see what is happening to the entire gray scale as adjustments are being made. It can also be used to set the contrast control on a CRT based display. That is also illustrated in DVE. It is not easily used to set the proper upper dynamic range of a solid-state display. With experience you can spot when clipping comes down as far as the

100% of this top rectangle but that doesn't help in knowing how much the contrast has to be backed down to accommodate the entire video dynamic range.

Chapter 8: Combination Pattern

Function: General visual evaluation pattern for a number of important parameters in conveying and displaying video. Individual, full screen versions of each of the test signals represented in this combination can be found elsewhere in the disc.



Pattern Layout: From top to bottom

Sinx/x This is a video bandwidth test pattern. It requires a spectrum analyzer to make full use of its capability. It exercises the majority of the frequencies in the baseband video. It can be found in Title 12, Chapter 35 as a full field test pattern.

Bowtie test pattern at 5 nsec resolution. The Bowtie is named after its appearance on a waveform monitor. It is designed to provide information about the amplitude and timing relationship of the Y Pb and Pr channels in the component video system. It can be found in Title 12, Chapter 29 at a 5 nsec resolution and in Title 12, Chapter 30 at a 1 nsec resolution.

Chrominance to Luminance Delay. This is a visual indication of positioning of color on color with luminance differences in those colors plus a look at color on gray. The full field version of this pattern can be found at Title 6, Chapter 25.

Gray Reference at 75%. This serves as a decoder reference for both the delay pattern above it and the color bar pattern below it. The function of this is best illustrated in the Color Bar pattern with Gray Reference found earlier in this title.

Color Bars at 75%. This is to be used with the gray reference above it for checking the quality of decoding to RGB. The function of this is best illustrated in the Color Bar pattern with Gray Reference found earlier in this title.

PLUGE with a Reference White. This is a wedge out of the PLUGE with Log Gray Scale at the point of the white rectangle. It serves as a reference for black and white levels.

Full dynamic range gray ramp with markers for black, 50% and video white at 100%.

Reduced Amplitude Pr Sweep with a 50% Flat Field Luminance Background. The amplitude of the sweep is about 75% of full color level. The sweep starts at about 0.25 MHz and runs out to 2.875 MHz. The flat field in the luminance makes it easier to see the excursions of the color signal. Full field and split field versions of these patterns can be found in Title 11.

Pb plus Pr Amplitude and Frequency Markers. The markers are placed at 0.5 MHz intervals in the chroma sweep. The bandwidth of the marker is about 0.5 MHz. The amplitude of the marker represents the amplitude of the chroma signal at 0.5 MHz. In a visual inspection compare the amplitude of the markers with the amplitude of the signal at any point along the sweep.

Reduced Amplitude Pb Sweep with a 50% Flat Field Luminance Background. The amplitude of the sweep is about 75% of full color level. The sweep starts at about 0.25 MHz and runs out to 2.875 MHz. The flat field in the luminance makes it easier to see the excursions of the color signal. Full field and split field versions of these patterns can be found in Title 11.

Luminance Amplitude and Frequency Markers. The markers are placed at 1.0 MHz intervals in the luminance sweep. The bandwidth of the marker is about 1.0 MHz. The amplitude of the marker represents the amplitude of the luminance signal at 0.5 MHz. In a visual inspection compare the amplitude of the markers with the amplitude of the signal at any point along the sweep.

Reduced Amplitude Luminance Sweep. This 75% amplitude sweep starts at 0.5 MHz and extends out to about 5.75 MHz. The sweep is centered around the 50% luminance level to match the chroma sweeps. Full field and split field versions of these patterns can be found in Title 11.

Description of Use: This pattern was assembled because one full field will tell you a lot of what you need to know about a video path. The Sinx/x and Bowtie patterns were designed for use with instrumentation. The others work for both visual inspection and

instrumentation. Any of the parameters being tested with this pattern can be individually tested with other patterns in the program.

Chapter 9: 20% V Window w/ DVE PLUGE

Function: To assess and adjust the lower end of the grayscale while observing brightness levels.

Pattern Layout: The pattern consists of the DVE PLUGE on the left and right side of a 20% amplitude vertical window box set against a black background.

Descriptions of Use: This pattern is to be used with an optical comparator or color analyzer for setting the low end of a gray scale. It is far enough above black so most meters will see its level. This level may be to low for use in setting display devices such as CRT projectors that don't do well in tracking gray. This pattern, in conjunction with the 100% Window are there for setting gray on a set that does a good job of tracking gray. The PLUGE is included as a reference for black level.

Chapter 10: 100% V Window w/ DVE PLUGE

Function: To assess and adjust the upper end of the grayscale while observing brightness levels.

Pattern Layout: The pattern consists of the DVE PLUGE on the left and right side of a 100% amplitude vertical window box set against a black background.

Descriptions of Use: This pattern is to be used with an optical comparator or color analyzer for setting the high end of a gray scale. This level may be above the useful gray scale tracking range of display devices such as CRT projectors. This pattern, in conjunction with the 20% Window are there for setting gray on a set that does a good job of tracking gray. The PLUGE is included as a reference for black level.

Chapter 11: 40% V Window w/ DVE PLUGE

Function: To assess and adjust the lower end of the grayscale while observing brightness levels.

Pattern Layout: The pattern consists of the DVE PLUGE on the left and right side of a 40% amplitude vertical window box set against a black background.

Descriptions of Use: This pattern is intended to be used in setting the lower end of the gray scale when either light output or gray scale tracking do not permit the use of a 20% Window. It is also useful for a quick check on gray scale tracking on sets that are adjusted using the 20 and 100% Windows. The PLUGE is included as a reference for black level.

Chapter 12: 80% V Window w/ DVE PLUGE

Function: To assess and adjust the upper end of the grayscale while observing brightness levels.

Pattern Layout: The pattern consists of the DVE PLUGE on the left and right side of an 80% amplitude vertical window box set against a black background.

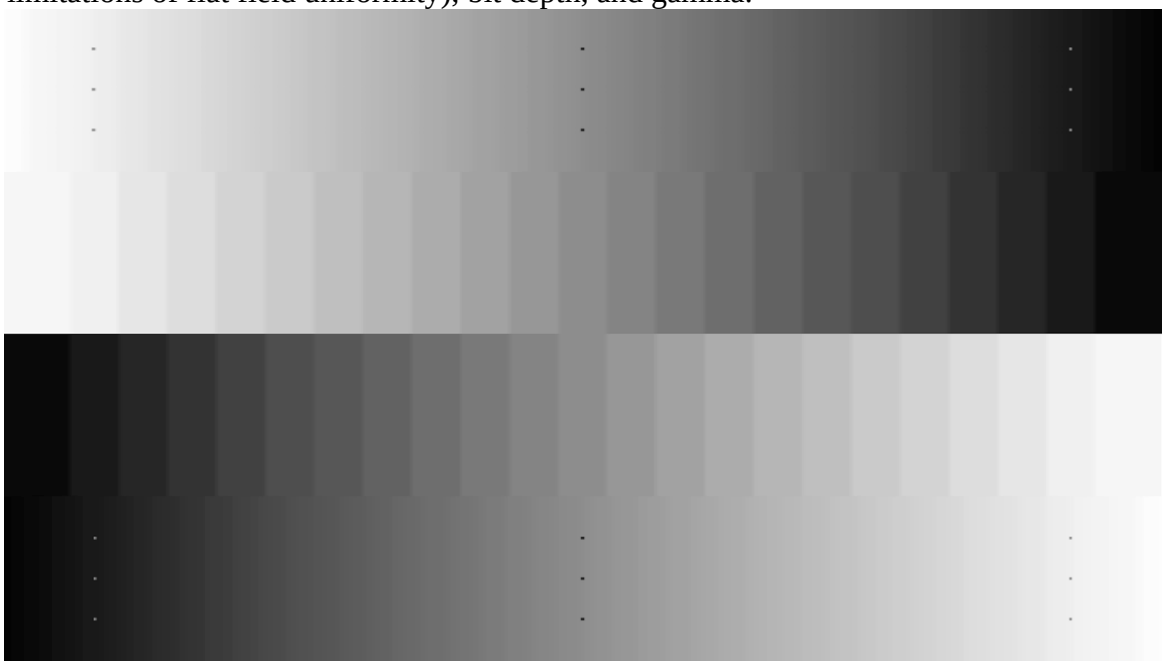
Descriptions of Use: This pattern is intended to be used in setting the upper end of the gray scale when gray scale tracking does not permit the use of a 100% Window. It is also useful for a quick check on gray scale tracking on sets that are adjusted using the 20 and 100% Windows. The PLUGE is included as a reference for black level.

Chapter 13: 20% V Window w/ DVE PLUGE

This pattern is repeated for ease of access in making gray scale measurements and adjustments.

Chapter 14: Reverse Gray Ramps & Steps

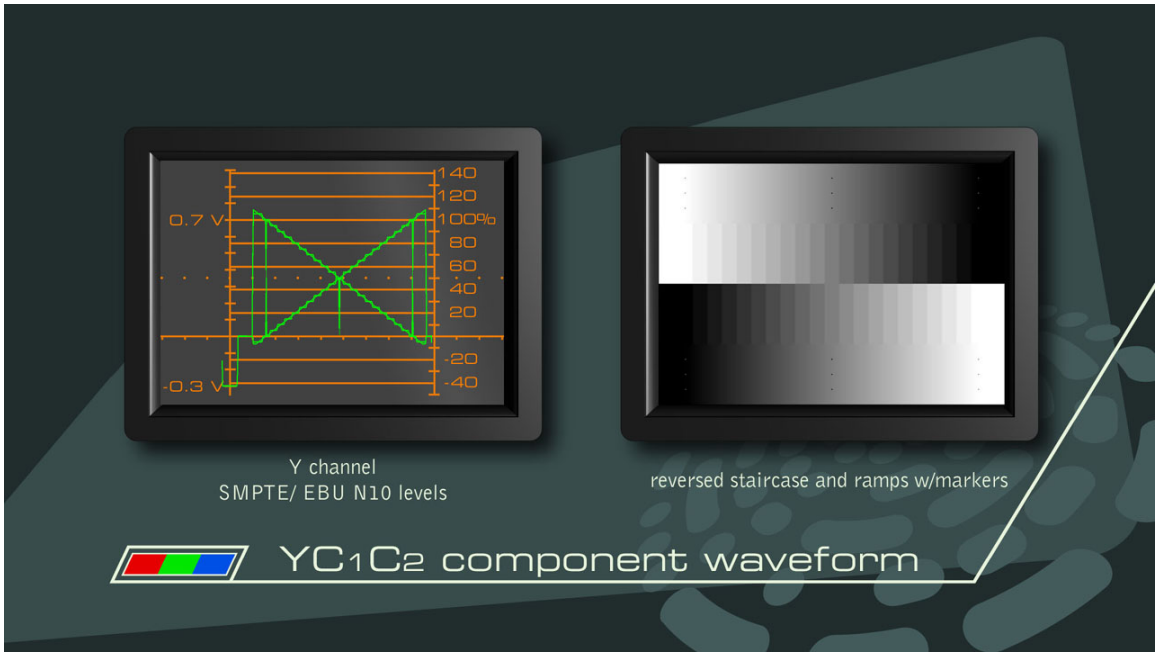
Function: To assess/adjust brightness, contrast, gray scale tracking (within the limitations of flat field uniformity), bit depth, and gamma.



Pattern Layout: The top and bottom portion of this pattern consists of a gray ramp. The inner portion of the pattern contains gray steps. The twenty-two steps extend from 5% below black to 5% above white, with the ramps extended out to the limits of the digital

video system. Markers, which appear as three vertical dots, are placed at video black, 50% and 100% video.

Descriptions of Uses: This pattern was initially designed to exercise the entire dynamic range of the digital video system. In this application it is useful in determining if video equipment can pass the complete dynamic range of the signal. In a solid-state display it will make it easy to spot any clipping that may take place at the upper end of the dynamic range. It's the pattern of choice when setting the contrast control on a digital display.



While the Reverse Gray Ramps and step can be used to set black level as well as white, we still favor the PLUGE pattern for setting black level on any display.

Unlike the analog CRT digital displays do not go into blooming. As the contrast is turned up the brighter portions of the video signal hit a clipping circuit, the maximum capability to pass video. Any video information that is going to get to the display must be below the clip point in level. It's sort of like a speed governor on a car. It's drivable at any speed below the maximum point set in the governor. If the contrast is turned up chances are that part of the video signal will be pushed into this clipping circuit. Whatever detail is in that portion of the video signal will be turned into a flat white with no detail. The contrast control must be turned down until the detail re-appears. Run the contrast control up to see if the steps start to blend together.

There may be circumstances where turning the contrast control down on the display device will not pull the video out of the clip. This is often an indication that some device ahead of the display is running into its own digital clip.

It is important to have a waveform monitor to check the video at various stages in the video path to determine that it is not being clipped at either end of the dynamic range.

The full active video signal extends from about –48 mVolts to +760 mVolts with black at 0 Volts and white at 700 mVolts.

This pattern is also capable of revealing information about the bit depth of video processing. Look at the ramps in the pattern. These should appear smooth from black to above white. If there are vertical lines or noise in any areas of the ramps, the system more than likely does not have enough bit depth to properly handle the video signal.

Chapter 15: Reverse Shallow Gray Ramps

Function: To assess the dynamic range available from a particular system. It is a logical follow-up to the gray scale adjustment while serving a slightly different function than the Reverse Gray Ramps with Steps.

Pattern Layout: The pattern consists of three sets of cross ramps. The top ramps have excursions about video white of ±50 mVolts. The above white level does not extend to the peak capability of the video system. The middle set goes from video black to video white or 0 volts to 700 mVolts, and the bottom set has excursions about video black of about ±50 mVolts. The background is at video black. The center quarter of the line time in the shallow ramps is at either black or white.

Descriptions of Use: The shallow ramps at the top and bottom of the pattern were designed to isolate the areas of video dynamic range where systems usually go wrong. The middle portion of the pattern provides the video black to white range. This pattern was designed for use with a waveform monitor. It may also be useful in setting contrast on digital display.

Chapter 16: Reference for Maximum Ambient Light

Function: To assist in judging the intensity of a D6500 bias light placed behind the TV set.

Pattern Layout: The important part of the pattern for the purpose of judging the maximum ambient light to be behind the monitor is the gray window. There is also a PLUGE pattern as part of the signal.

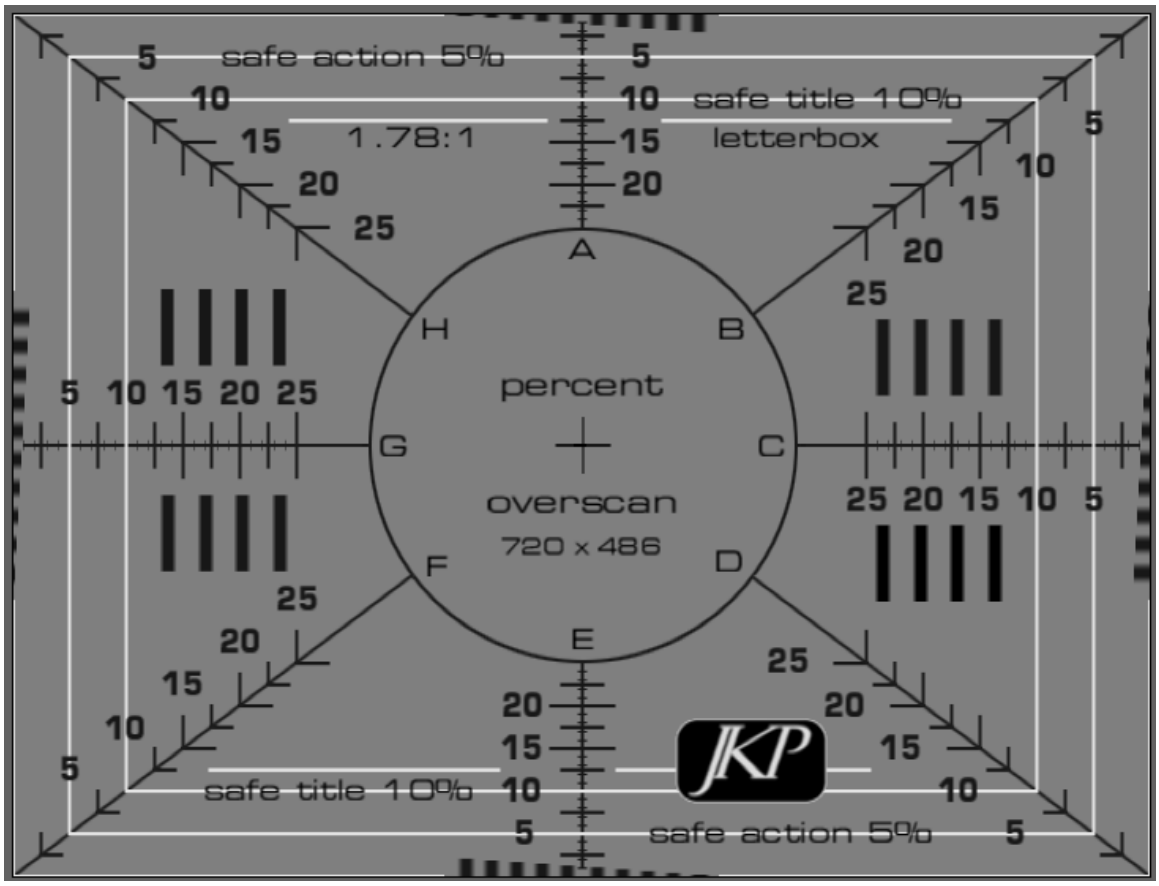
Description of Use: With the display properly calibrated for black and white levels use this pattern to assess the maximum amount of light that is visible behind the display from the primary viewing position. The level of the window is based on the gamma curve of a CRT display, being placed at a video level that should produce about 10% of the peak white capability of the monitor. In other words if the monitor is set for 30 foot-Lamberts for 100% video, this pattern should fall at about 3 foot-Lamberts. If the gamma of the display being used does not follow the CRT curve then the light output from this pattern will most likely not be 10% of the peak white.

Sit back in the viewing position and look at the level of light coming from this pattern then compare it to the level of light behind the set. If the set and the light are at the right color of gray the color of the two should match.

The amount of light behind the set is part of Human Factors. Many people like the light behind the set to be below the 10% point. There is also a point where the set is dim enough or occupies a large enough portion of your field of view that ambient light is not needed or is not desirable.

Chapter 17: 1.33 Overscan Pattern

Function: Reference for the active video area of the picture with markers for pixel count at the four edges and percent markers used to determine the amount of picture information being displayed. The pattern was created as 720 by 486 in NTSC and 720 by 576 in PAL. The geometry is set for the 1.33 aspect ratio option of each system dimension. The rise time of the markers in the pattern, against a gray background make this pattern ideal for spotting artificial image “enhancement” that might be taking place in the video processing.



Pattern Layout: There is a drawing of the HD version of this test pattern that provides general descriptions of transitions. Beyond that all horizontal rise times are filtered to about 3 pixels.

Description of Use: The Overscan pattern shows how much picture information is being displayed on your set. It has been built to the program production standards as specified in the SMPTE Recommended Practice (RP) document number 187 for the NTSC version of the pattern. The document specifies that the active picture is 720 by 486 in digital video. The specification for DVD is 720 by 480. That suggests that at least six lines in the vertical direction are going to be lost between the production format and the DVD itself. In the horizontal direction DVD players may not show the entire width of the picture. We see as few as 704 pixels from some players. It so happens that 704 by 480 is one of the ATSC rates for DTV.

The SMPTE RP-187 is specific about the location of the center of the image and that's where you'll find the center of this Overscan pattern. What this means in setting up the TV is that the center of the Overscan pattern should go in the center of the screen. Depending on how much of the horizontal and vertical information is cut off by the DVD player, and which edge of the image is lost you may not see as much information on one edge as the other. Overscanning the image may be necessary to cover up the fact that more is lost on one side rather than the other. In most cases you shouldn't have to push the image out beyond the 2.5% markers.

We are suggesting that not all DVD players will show this signal the same way and this is what we are finding. As an example, six lines in the vertical direction will probably get lost from the 486 of our original pattern to the 480 of the DVD. Six lines might come off the top and none off the bottom or six lines could come off the bottom and none off the top or it could be one and five or two and four or three and three. We've seen all of the combinations in various DVD players. In the horizontal direction the difference between 720 and 704 can come from either side, although it usually comes off each side equally.

The PAL DVD format is better specified than NTSC. In the case of PAL both the program production and DVD format are the same, 720 by 576. That doesn't say that all PAL DVD player manufacturers conform to that number but at least the specifications are consistent.

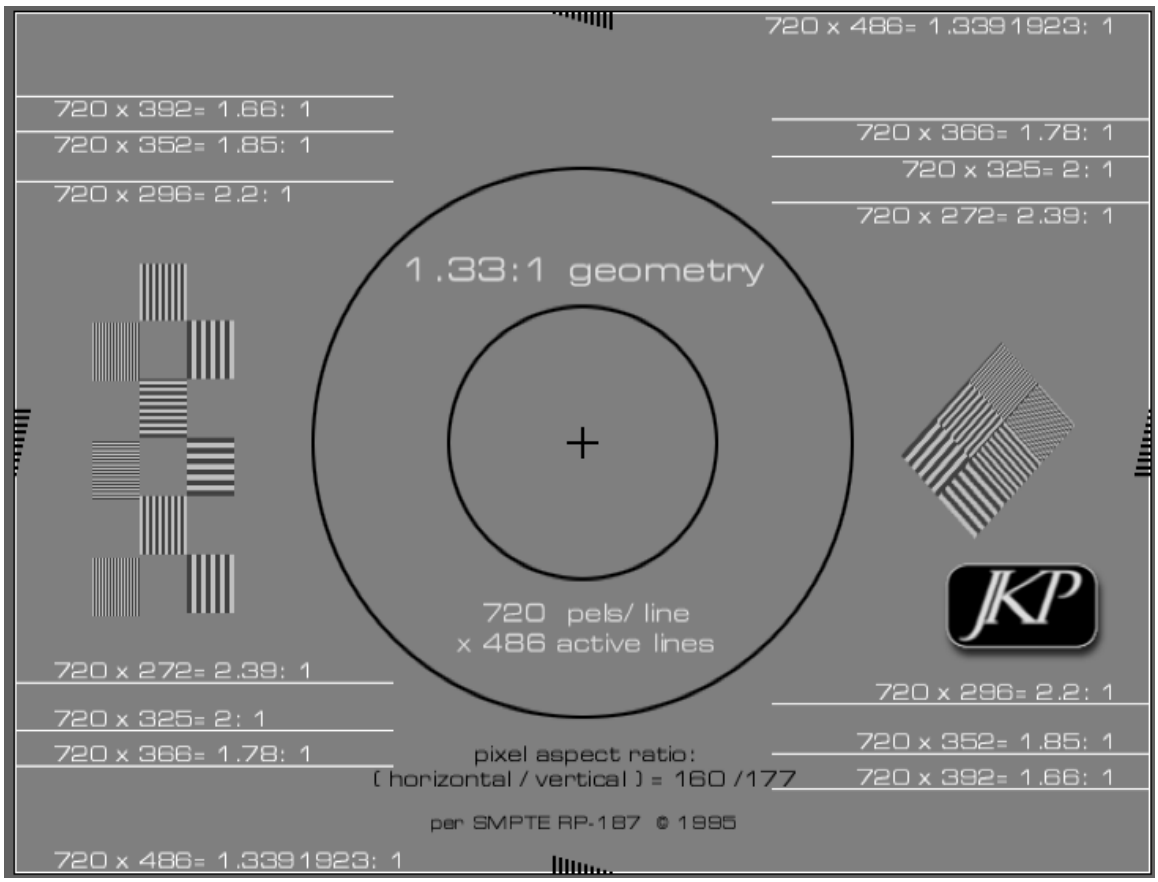
Why is there a difference between the number used for the NTSC production format and the DVD player format, and or the ATSC format of 704 by 480? The reason is that the digital format for production was based on our analog system. In the vertical direction the analog system has 482 and ½ active lines in the picture. Additional lines were added to the digital video count to accommodate closed captioning. When MPEG encoding came along for digital video it worked on even multiples of 16. The number 480 is the closest multiple of 16 to the production format of 486.

In the horizontal direction the number 720 for digital samples includes all of the analog formats. Some of the analog formats only go out to 713 or less. The two numbers that are even multiples of 16 for MPEG are 704 and 720. In the PAL world the number 576 fell right into their production standard. It's an even multiple of 16 as is 720.

The pattern is also designed to assist in determining how accurately image detail is being reproduced in the picture from the point of view of distortion in the image. This distortion comes in the form of extra edges being added to the picture. It's part of the "Sharpness" function. When the Sharpness control is set too high it introduces noise into the overall picture and produces ringing on sharp edges in the picture. The ringing is much easier to spot than the noise so we focused on that parameter in designing a test pattern. In 1988 we came up with the Overscan pattern with sharp edges on a gray background. The pattern served the purpose of setting sharpness and observing the condition of TV set overscan. The gray background in the pattern made it easy to see the ringing in the picture and easier to identify noise in the picture.

Chapter 18: 1.33 Aspect Ratio Pattern

Function: Provide 1.33 image and pixel aspect ratio information following the SMPTE RP-187 document. The horizontal lines in the image that marks the position of various image aspect ratios within the 1.33 frame have a width of 1 vertical line.



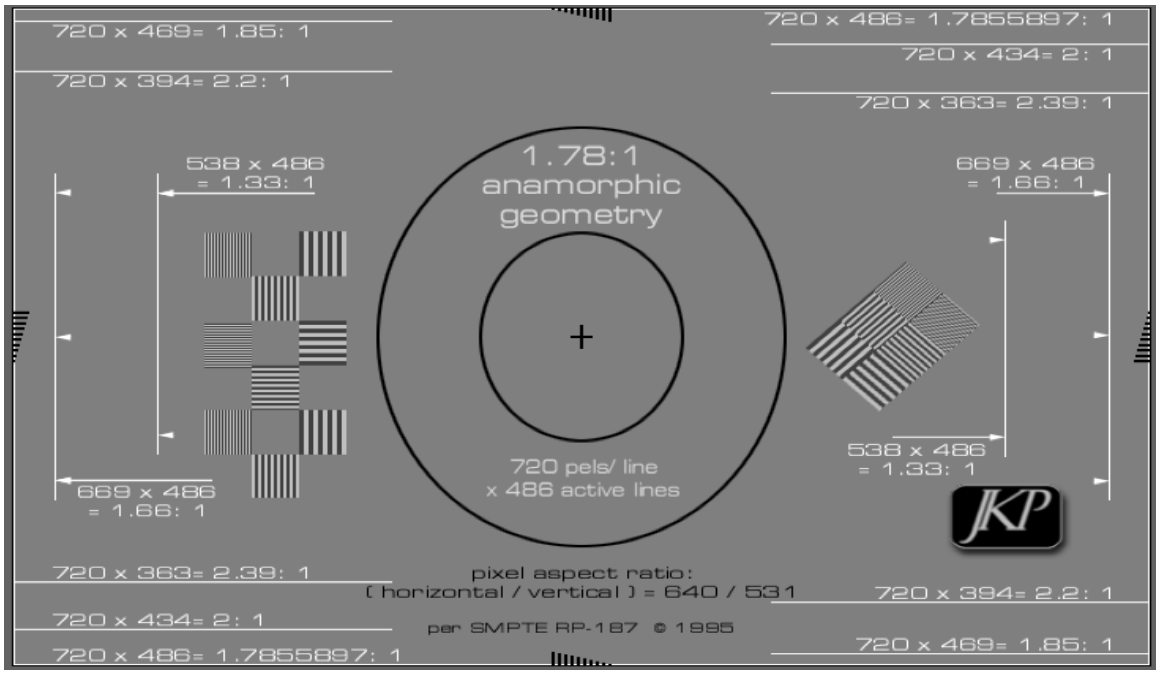
Pattern Layout: There is enough geometry information in each of these sets of patterns to recognize the basic 1.33:1 or 1.78:1 intention. The resolution wedges come from the SMPTE RP-133. There is a 10-pixel count in the center of each edge of the pattern.

Description of Use: The primary use of this pattern is in locating the image positions of other aspect ratios within the two video aspect ratios of 1.33 and 1.78.

This pattern is frame based and is one of several patterns in the program with full progressive video resolution. It will likely challenge the capability of many processors to up convert it to a true progressive image. If you see flicker in the progressive output of a processor it is most likely not set up to handle this much vertical detail. There should be no flicker in the progressive output if the processor can deal with full vertical resolution in the interlaced image.

Chapter 19: 1.78 Aspect Ratio Pattern w/ 1 Line Vertical Resolution

Function: Provide 1.78 image and pixel aspect ratio information following the SMPTE RP-187 document. The horizontal lines in the image that marks the position of various image aspect ratios within the 1.33 frame have a width of 1 vertical line.



Pattern Layout: There is enough geometry information in each of these sets of patterns to recognize the basic 1.33:1 or 1.78:1 intention. The resolution wedges come from the SMPTE RP-133. There is a 10-pixel count in the center of each edge of the pattern.

Description of Use: The primary use of this pattern is in locating the image positions of other aspect ratios within the two video aspect ratios of 1.33 and 1.78. The set of patterns is frame based and is one of several patterns in the program that will challenge up conversion of interlaced standard definition signals. There should be no flicker in the progressive version of either of these vertical resolutions.

Chapter 20: 1.78:1 Convergence and Geometry

Function: The name of the pattern certainly goes a long ways in describing the purpose of the pattern. The aspect ratio is 1.78:1.

Pattern Layout: Overscan markers are placed at 2.5%. There is a white boarder defining the outside edges of the active picture area. There are horizontal and vertical distance markers fro measuring linearity. Except at the outside boarders of the pattern the boxes are square.

Description of Use: The original design of this pattern was for CRT based projectors where geometry was set up in the green channel followed by converging the other two colors. Markers were placed on the horizontal and vertical axis to make it easier to measure linearity. White boarders were placed at the outside edge of the active video so you would know the limits of the active video area. In solid-state displays it serves a geometry function. Variations on this pattern can be found in Titles 7, 8 and 9.

Chapter 21: Video Black

Function: Provide an easily accessed source of video black. Look for vertical or horizontal tilt in the signal.

Pattern Layout: Video Black

This is something that can be used on a video screen for a long time without fear of harming any of the display characteristics. This is also just ahead of a Title boundary. Use the Skip Forward or Play button to jump to the next title. Not all DVD players are capable of easily jumping a Title boundary. You may have to try other navigation options or use the Program Menu to move forward to the next title.

Any flat field pattern can be used to look for vertical or horizontal tilt. This is a circumstance where the amplitude of the signal is not the same from one side of the picture to another. Visually spotting tilt can be encumbered by flat field uniformity. It's best to check such a thing out on a waveform monitor.

Title 13: Video Test Signals, Picture Resolution

Introduction

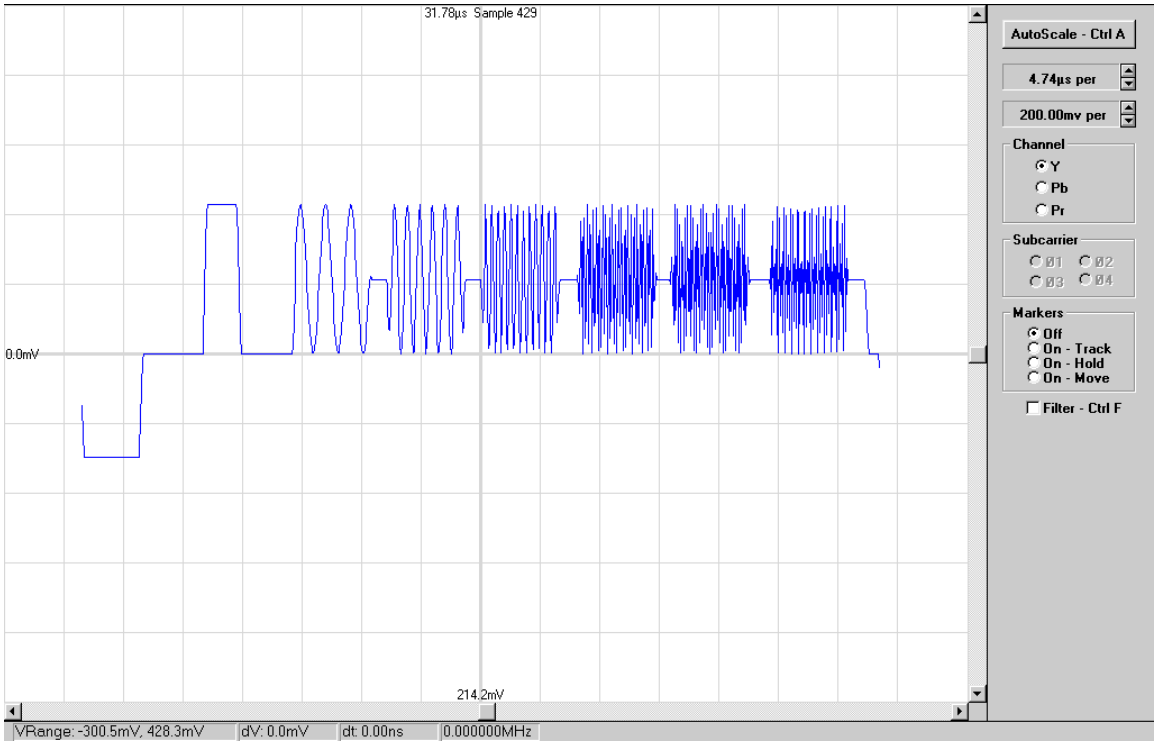
There have been many discussions regarding the capability of the DVD format. Specifically, these discussions focused on image resolution and display capability. Back in the days of over the air, analog television; the 6 MHz channel bandwidth limited the video bandwidth to 4.18 MHz. Using the rule of 80 horizontal lines of resolution per picture height for each MHz of bandwidth, analog video being transmitted is limited to about 330 horizontal lines of resolution per picture height.

In 1978 the laserdisc format was introduced. Initially horizontal resolution was still limited to 330 lines because production standards were not going much beyond what could be transmitted. By the early 1980's we were capable of recording video with about a 6 MHz bandwidth or about 480 lines of resolution. By the mid-1980's laserdisc mastering had caught up to this capability and using the video input to home monitors an image from laserdisc could look much sharper than anything being transmitted.

At about the same time the world of program production was shifting to digital. Part of the requirements of the digital video system was to preserve the current quality that could be obtained in the analog world. In doing so a video sampling rate of about 13.5 MHz

was established for both PAL and NTSC. According to a mathematician by the name of Nyquist in order to recover the Fourier components of a periodic waveform it is necessary to sample that waveform more than twice as fast as the highest frequency you wanted to recover.

In short, if we have a sampling frequency of 13.5 MHz, the highest frequency we can have in the video is 6.75 MHz. It turns out that video is made up of waveforms that are not periodic or predictable. The designers of our digital video system therefore limited the practical, usable bandwidth to less than 6 MHz. Most video sweep patterns do not go above 5.75 MHz for this reason. Chroma sweeps are limited to half that bandwidth or about 2.875 MHz. That does not mean you cannot go higher in frequency, but you will get into trouble when you do. The image information above 6 MHz range will not be accurate.

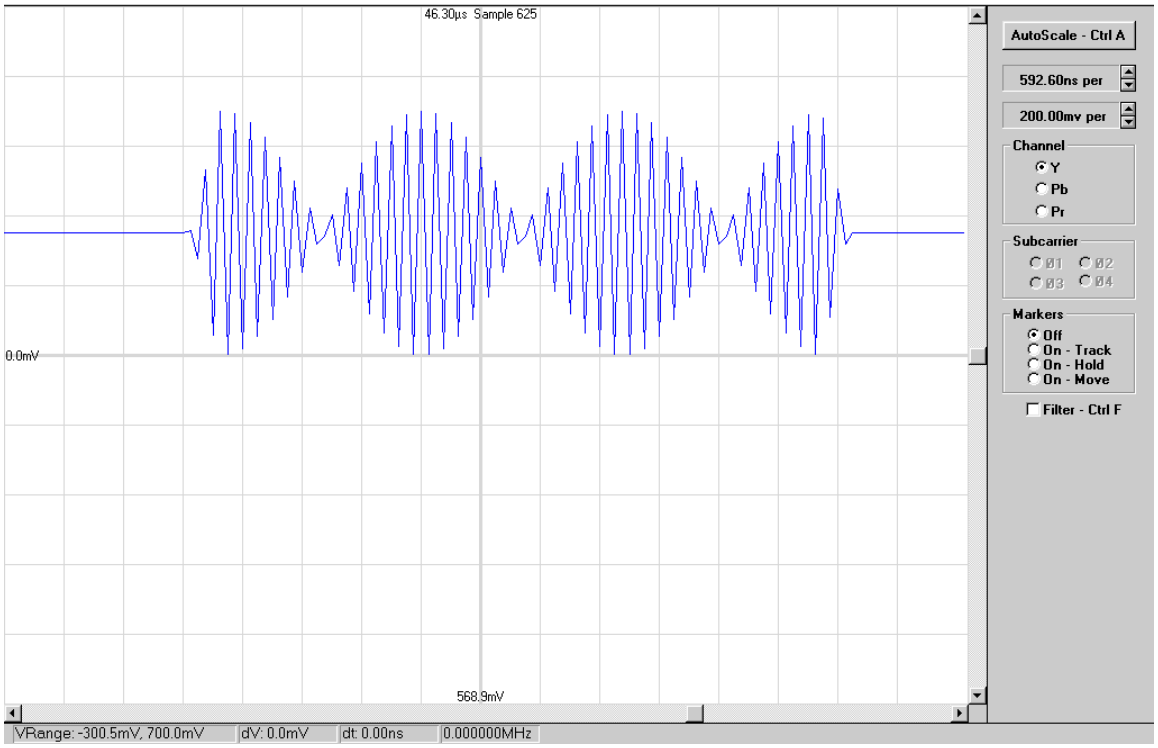


Above: High frequency Multiburst, 5.75 MHz to 6.75 MHz

Let us discuss what occurs when approaching Nyquist, meaning going out to the limit allowed by the sampling frequency. Again, the limit is 6.75 MHz for a sampling frequency of 13.5 MHz in standard definition and 37.5 MHz for a 75 MHz sampling frequency in HD. Since the source video is 4:2:2, the two chroma channels have half the bandwidth of the luminance channel.

The term 4:2:2 reveals that the sampling frequency for the Y channel is about 4 times the standard definition color subcarrier and that the sampling frequency for the two color difference channels is about twice the color subcarrier.

In standard definition analog theory, digital video produced in PAL and NTSC should not have much information above 6 MHz. If it does, it should be filtered out in the conversion to analog. It is filtered out because it might not be accurate. We have provided examples in this disc.

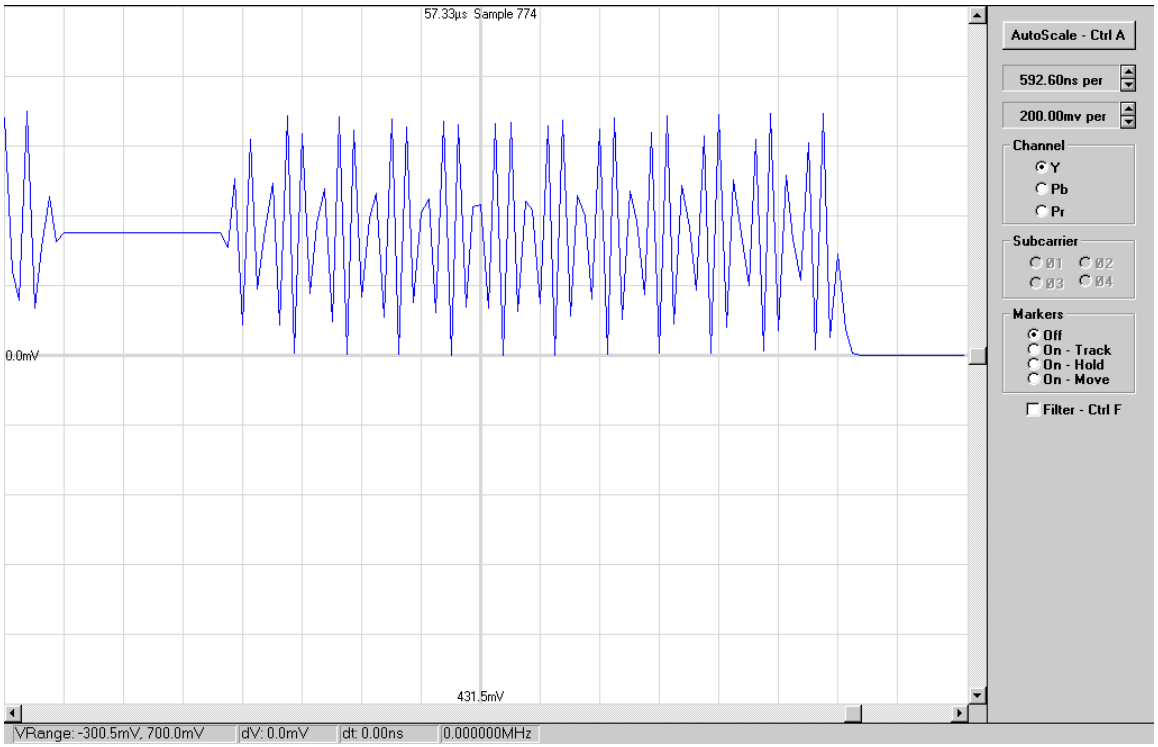


Above: Waveform distortion that occurs at 6.5 MHz

That said it is the digital signal that goes down on the DVD. If there is frequency information between 6 MHz, the analog limit imposed by program production, and 6.75 MHz, the theoretical upper limit according to Nyquist, then that information could be on the disc and therefore used as picture information. This is where DVD player manufacturers come up with the claim of 540 lines of resolution where the post-production community will tell you that the maximum resolution is 480 lines.

Many DVDs are mastered from video that has been down converted from an HD source and these conversions usually accept any and all information out to 6.75 MHz. Some DVD players make all of this information available at the analog output. Manufacturers of DVD players evaluated by Joe Kane Productions have claimed that they have designed their video amplifiers to reach the 3 dB point at 8.5 MHz. This would then yield a flat frequency response at 6.75 MHz. Thorough testing has concluded that these players are down by no more than .1 dB at 6.75 MHz. This can go either way but the upper end of the frequency range is more likely to be included when the digital information from the disc is up converted to 480p, 720p or 1080i inside the player. We certainly know of DVD players where the interlaced output is much better than the progressive output and other players where the digital output is much better than any of the analog outputs. If a DVI or HDMI output is provided this information should be included at full amplitude.

In designing test patterns we are aware of the potential of the player, and are therefore testing frequency space that standard definition production people might consider unusable.



Above: Waveform distortion that occurs at 5.75 MHz

We refer to patterns being vertical or horizontal. These names indicate the direction in which the transitions take place. A vertical Multiburst has a lot of horizontal lines in it. The transitions are in the vertical direction.

Chapter 1: Title Identification: *Picture Resolution*

Chapter 2: SMPTE RP 133

Function: The pattern describes image dimensions, resolution and black and white image limits. It was initially designed for medical diagnostic imaging tests but has been adapted in any number of high-resolution applications.

Pattern Layout: Horizontal and vertical resolution wedges in the center and outside corners of the image with gray steps and sub steps at black and white. There are square boxes for geometry and printing for focus and detail. The bright horizontal and vertical wedges are 100% modulation, meaning that they go from black to white. They are one two and three pixels or lines in size. The dim wedges are all one pixel or line in size

followed by a one-element transition into the next step. They represent 1%, 2% and 3% modulation levels. The transition in the center of the black square goes to 5% above black and the transition in the white square goes to 95% white. The pattern does not have any image content above white or below black. In the horizontal line of one on then one off the lines that are on exist in only one field of the video signal.

Description of Use: The name SMPTE RP 133 comes from the SMPTE Recommended Practice document number 133. It describes a general pattern layout that can be adapted to any video rate and aspect ratio. The one-line transitions in the resolution wedges are good for spotting the ability of an upconverter to spot a true progressive source signal. This area will either flicker or be all white or all black in a processor that will not recognize a true progressive source. The black on white bar and the white on black bar are used to look for image streaking. The crosshatch will provide a quick look at image geometry. The letters and numbers will provide a reference for image focus at the outside parts of the picture.

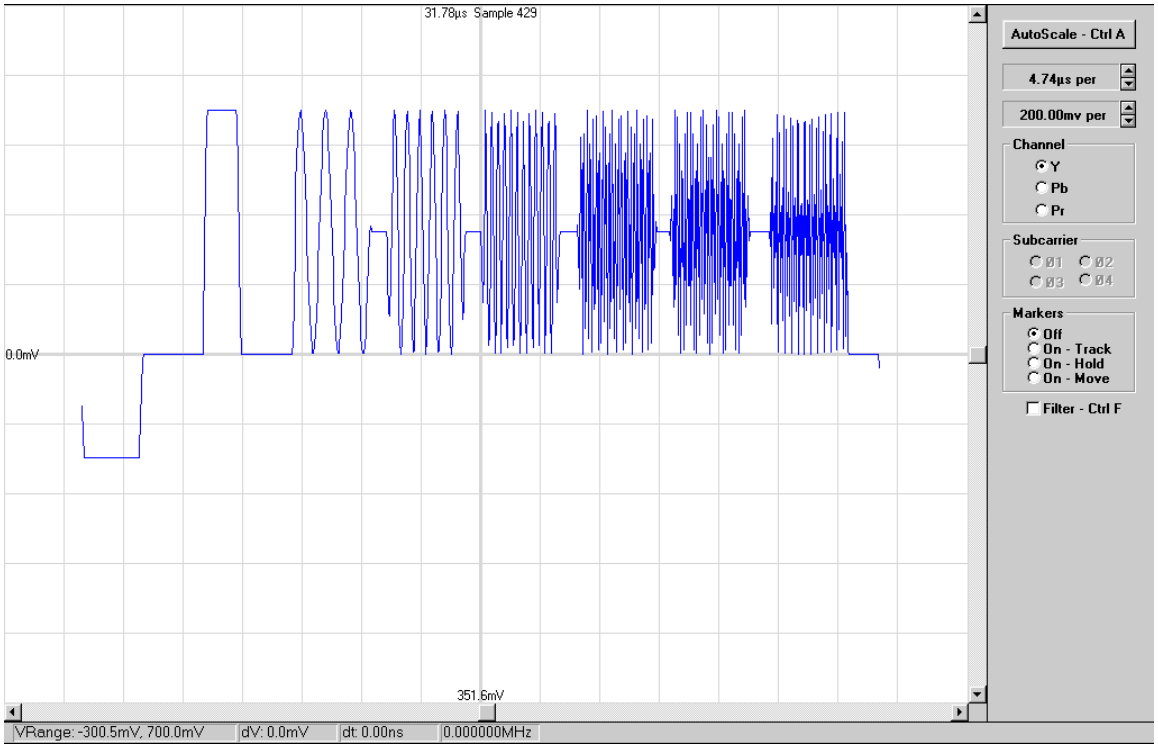
Chapter 3: Vertical Multiburst in a Split Field

Function: A look at vertical image resolution from a progressive test pattern.

Pattern Layout: Vertical image resolution is provided in a progressive pattern that is not filtered in the vertical direction when converted to interlace. Full resolution means one line on and one line off. In the top right the lines that are on fall into field one of the interlaced signal. The lines that are on, in the bottom left, fall into field two of the interlaced signal. In the half resolution wedges two lines are on and two lines are off. The one-third resolution is three lines on and three lines off. The same extends up to five lines on and five lines off. The left and right wedges are out of phase with each other and reversed in position in the pattern.

Description of Use: The pattern is here to help look at vertical resolution of interlaced video and the consequences of converting it to a progressive image. As the pattern went down on the disc the amplitude of all of the bars is 700 mVolts. The interlaced output of many DVD players will exhibit a fall off in amplitude in just displaying an interlaced signal. It is also likely that image processing, where the interlaced signal is converted to progressive, will also roll off vertical response. The full resolution wedges may also be fully on or fully off or flicker if the processor cannot recognize a frame based still image.

Chapter 4: Multiburst, Horizontal, 0.5 to 5.75 MHz, Full Amplitude w/Amplitude Markers

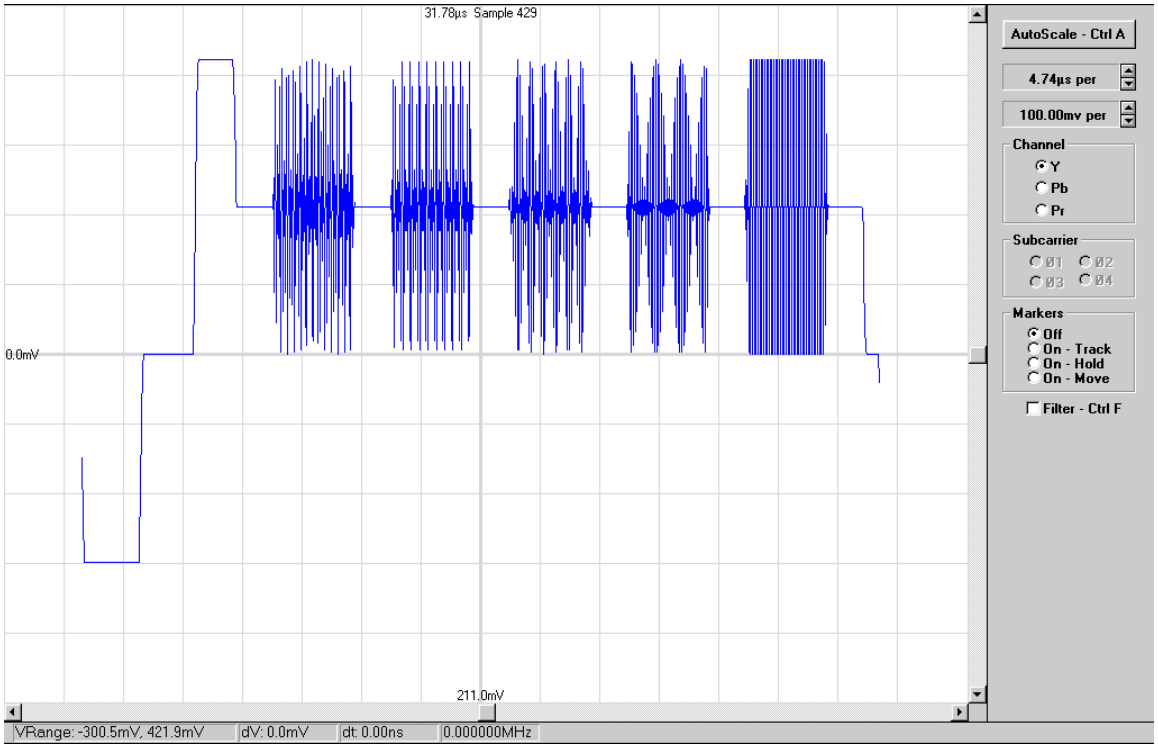


Function: Check frequency response of the analog video bandwidth with full amplitude frequency bursts.

Pattern Layout: From left to right there is a low frequency amplitude marker followed by six frequency bursts. They are 0.5 MHz, 1.0 MHz, 2.0 MHz, 4.0 MHz, 4.8 MHz, and 5.75 MHz. The amplitude is 100% or 700 mVolts, with a gray reference of 50% or about 350 mVolts.

Description of Use: Here we are checking the analog bandwidth at full amplitude. It is possible that frequency response will change depending on amplitude so we need to look at both sets of circumstances. Observations of amplitude can be made on a display by looking at the luminance intensity of the transitions. Where possible the signal should be checked on a waveform monitor prior to being connected to the display. This will help isolate video signal path and display problems.

Chapter 5: Multiburst, Horizontal, 5.75 to 6.75 MHz, Full Amplitude w/ Amplitude Markers



Note that the amplitude in this waveform is 100 mVolts per vertical division.

Function: Check frequency response of upper portion of the digital video bandwidth with full amplitude frequency bursts.

Pattern Layout: From left to right there is a low frequency amplitude marker followed by five frequency bursts. They are 5.75 MHz, 6.0 MHz, 6.25 MHz, 6.5 MHz, and 6.75 MHz. The amplitude is 100% or 700 mVolts, with a gray reference of 50% or about 350 mVolts.

Description of Use: Here we are checking the upper portion of the digital video bandwidth at full amplitude. It is possible that frequency response will change depending on amplitude so we need to look at both sets of circumstances. Observations of amplitude can be made on a display by looking at the luminance intensity of the transitions. Keep in mind the phase distortion that is in the original signal.

Chapter 6: Luminance Sweep, 0.5 to 5.75 MHz, Full Amplitude, w/ Frequency and Amplitude Markers

Function: Check luminance frequency response of the component analog video bandwidth with a full amplitude continuous frequency sweep from 0.5 MHz to 5.75 MHz.

Pattern Layout: The markers at the top and bottom of the pattern are 700 mVolts in amplitude and are positioned at 1 MHz intervals. There are five markers, indicating MHz values from 1 to 5. The amplitude of these markers is 700 mVolts, centered about a 350 mVolt background. Each marker is the same width so that its' amplitude will remain fixed as the frequency of the sweep in the center of the pattern increases. The sweep signal does contain phase errors as shown in the reduced amplitude waveform.

Description of Use: The amplitude of the sweep signal should remain fixed or flat across the band. A waveform monitor should be used to check the video path and observations can be made on the display for an idea of how well it is responding to changes in frequency.

Chapter 7: Chroma Sweep for Pb & Pr 0.25 to 2.875 MHz, Reduced Amplitude, w/ Amplitude and Frequency Markers

Function: Check reduced amplitude frequency response in the Pb and Pr channels with a flat field in the Y channel.

Pattern Layout: Amplitude and frequency markers are at the top and bottom of the picture. The position of the markers is at 0.5 MHz intervals in the sweep signal. The amplitude is 420 mVolts.

Description of Use: Inspect the Pb and Pr channels independent of the Y channel at reduced amplitude. Look for crosstalk of chroma into the Y channel, especially after video processing.

Chapter 8: Video Black

Function: Provide an easily accessed source of video black. Look for vertical or horizontal tilt in the signal.

Pattern Layout: Video Black

This is something that can be used on a video screen for a long time without fear of harming any of the display characteristics. This is also just ahead of a Title boundary. Use the Skip Forward or Play button to jump to the next title. Not all DVD players are capable of easily jumping a Title boundary. You may have to try other navigation options or use the Program Menu to move forward to the next title.

Any flat field pattern can be used to look for vertical or horizontal tilt. This is a circumstance where the amplitude of the signal is not the same from one side of the picture to another. Visually spotting tilt can be encumbered by flat field uniformity. It's best to check such a thing out on a waveform monitor.

Title 14: Video Test Signals, System Evaluation

Chapter 1: Title Frame: *System Evaluation*

This title is designed to allow for the evaluation of white field uniformity, full field grayscale, color primaries/secondaries, and color decoding.

Flat Fields

Chapters 2 to 16 are all about evaluating image uniformity or an ability to deal with particular levels. All of these patterns are useful with a waveform monitor and or vectorscope.

The transition from a 100% flat field to a 100% Window is aimed at CRT displays as a look at their ability to maintain a consistent light output level between the two. In this case a light meter is also necessary.

Chapter 2: 20% Flat Field

Chapter 3: 40% Flat Field

Chapter 4: 60% Flat Field

Chapter 5: 80% Flat Field

Chapter 6: 100% Flat Field

Chapter 7: 100% Vertical Window

Function: To assess and adjust the upper end of the grayscale while observing brightness levels.

Pattern Layout: The pattern consists of the DVE PLUGE on the left and right side of a 100% amplitude vertical window box set against a black background.

Description of Use: Use this pattern with the 100% Flat Filed to determine how well the light output of the display remains fixed between the two patterns. A light meter that measures a small area within the 100% Vertical Window is required.

Chapter 8: Full Field 100% Red

Chapter 9: Full Field 100% Green

Chapter 10: Full Field 100% Blue

Chapter 11: Full Field 75% Red

Chapter 12: Full Field 75% Green

Chapter 13: Full Field 75% Blue

Chapter 14: Full Field 75% Cyan

Chapter 15: Full Field 75% Magenta

Chapter 16: Full Field 75% Yellow

Full Field Color Bar Patterns

The color bar patterns in the following four chapters can help make it easier to inspect color decoding capability from Y Pb Pr to RGB. They are intended for use with a waveform monitor. The 100% bars provide a 700 mVolt excursion, making them easy to inspect. Some circuits may have trouble with 100% bars so the 75% bars are also available.

Chapter 17: Horizontal Color Bars 100% saturation

Chapter 18: Vertical Color Bars 100% saturation

Chapter 19: Video Black

Function: Provide an easily accessed source of video black. Look for vertical or horizontal tilt in the signal.

Pattern Layout: Video Black

This is something that can be used on a video screen for a long time without fear of harming any of the display characteristics. This is also just ahead of a Title boundary. Use the Skip Forward or Play button to jump to the next title. Not all DVD players are capable of easily jumping a Title boundary. You may have to try other navigation options or use the Program Menu to move forward to the next title.

Any flat field pattern can be used to look for vertical or horizontal tilt. This is a circumstance where the amplitude of the signal is not the same from one side of the picture to another. Visually spotting tilt can be encumbered by flat field uniformity. It's best to check such a thing out on a waveform monitor.

Title 15: Video Test Signals, 1.33 Patterns

The general purpose of this title is to provide patterns in the 1.33:1 aspect ratio. The title is flagged as 1.33 and players capable of automatically switching between 1.33 and 1.78 should go to 1.33 during this title.

Once you skip forward beyond Chapter 3 the title will play in its entirety, ending on the opening still for chapter 10, "Video Black". Any of the chapters in this title can be put in a loop to prevent it from going into the next chapter.

Chapter 1: Title Frame: 1.33 Patterns

Chapter 2: 1.33:1 Linear, Full Amplitude, w/ Circles & Markers, White

Function: Set geometry and convergence in the 1.33 aspect ratio.

Pattern Layout: Overscan markers are placed at 2.5%. There is a white boarder defining the outside edges of the active picture area. There are horizontal and vertical distance markers for measuring linearity. Except at the outside boarders of the pattern the boxes are square.

Description of Use: The original design of this pattern was for CRT based projectors where geometry was set up in the green channel followed by converging the other two colors. Markers were placed on the horizontal and vertical axis to make it easier to measure linearity. White boarders were placed at the outside edge of the active video so

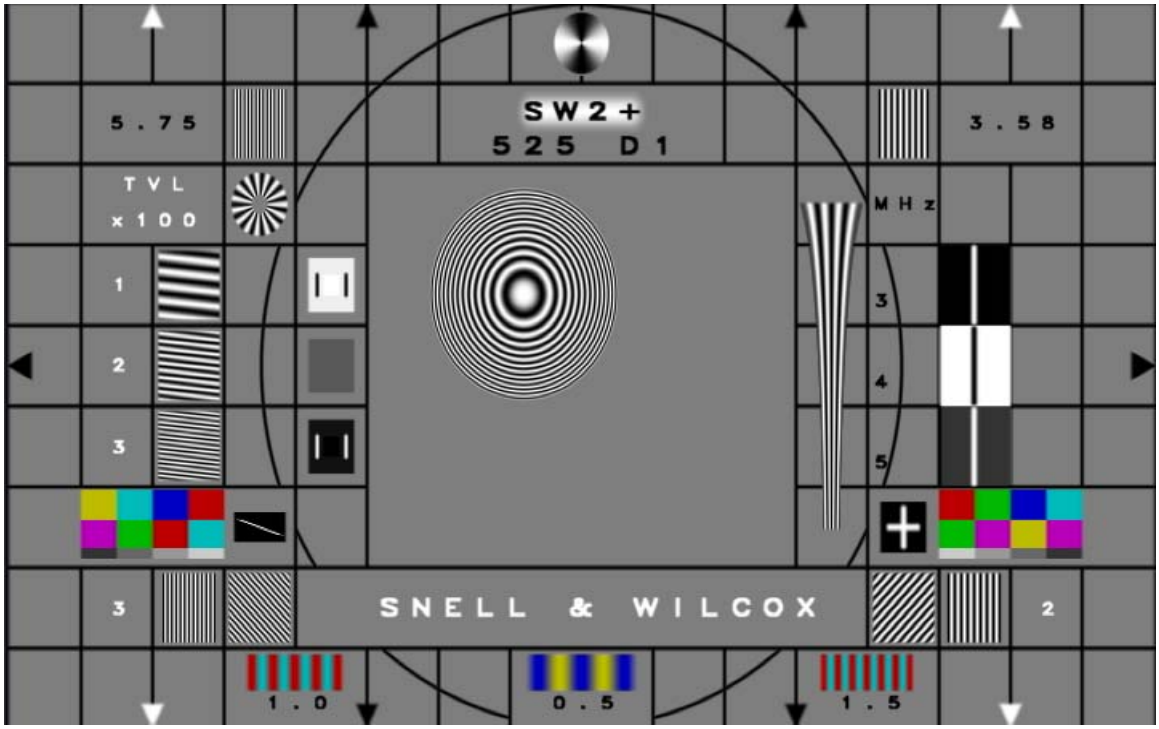
you would know the limits of the active video area. In solid-state displays it serves a geometry function.

Chapter 3: 1.33:1 Aspect Ratio, 1.78 Letterboxed, w/ Circles & Labels Inside the 1.78:1 Area

Function: Set up geometry and convergence for program material that is letterboxed within a 1.33 video source but being displayed on a 1.78 monitor.

Pattern Layout: Circles and markers are placed inside the 1.78 area of the 1.33 raster. The arrows outside of the 1.78 area point at the 1.78 boarders within the 1.33 raster.

Snell and Wilcox Zone Plate Test Patterns



Above: Chapters 4 to 6 use the Snell & Wilcox Zone Plate test pattern as the base pattern. The rate and type of motion is changed in each. We'll present a basic description of the general information in the pattern prior to describing the motion in each of the chapter descriptions.

Function: The Zone Plate Test Pattern is designed to show image motion at various rates within a static background. The background provides basic information about video path performance.

Pattern Layout & Description of Use: The pattern is based on the digital video production format of 720 by 486 with a pixel aspect ratio described in the SMPTE RP187 document for a 1.33 aspect ratio picture. Details in the pattern are designed to conform production standards of a video bandwidth for composite PAL video even though you are working with the NTSC pattern. The transmitted bandwidth of an NTSC signal goes out to 4.18 MHz but this test pattern contains a 4.43 MHz burst, the color carrier frequency of PAL.

The pattern is named 525 D1 indicating that it is generated in the 4:2:2 digital component format used by the D1 tape recording format.

References are included for black and white levels, horizontal and diagonal resolution, geometry and horizontal rise and fall times.

There are three chroma with luminance bursts at the bottom of the pattern. The center pattern, labeled 0.5 is primarily in the Pb channel. The two outside bursts, labeled 1.0 and 1.5 are primarily in the Pr domain. Their bandwidths are in the order of chroma bandwidth specifications for a transmitted composite video signal. Even at that, they can often be useful at looking at the chroma bandwidth of a video path.

As for motion, the patterns in the NTSC version are grouped into three sets of three. The larger groups are type of motion such as diagonal, horizontal, and vertical. Each category of motion has three rates, film rate or 2 – 3, frame rate and field rate. There are only two rates of motion for the PAL test patterns, frame and field.

There is a programmed 10-frame pause in all of the motion as it hits one of the boundaries of the area of motion. During that pause the test pattern is presenting progressive frames of information.

In any motion detection processing it is important to see what happens to the fixed information in the image when motion is detected. It is not unusual to see motion being added to the still material as the quality of the motion material improves.

Chapter 4: Snell & Wilcox Zone Plate, Diagonal Motion, 2/3 Rate

Pattern Layout: The motion rate is 2 – 3 until it hits the side bar. There is a 10-frame pause at each stop. This is usually long enough to break the 2 – 3 count of most processors. The 10-frame pause should be seen as a 2 – 2 still or a frame still. The chapter is 15 seconds long.

Description of Use: This pattern is used primarily in looking at video processors to see if they can find the 2 – 3 sequence in the test pattern, or how fast they can acquire the 2 – 3 after it is broken at each stop. We have evaluated a number of processors that cannot find the 2 – 3 in this test pattern but can often find it in continuous 2 – 3 motion of images. There is continuous 24 frame demonstration material in Title 17 that will be helpful in determining that set of circumstances.

Chapter 5: Snell & Wilcox Zone Plate, Diagonal Motion, Frame Rate

Pattern Layout: The motion rate on the generator was set to 2 – 2 or complete frames in two fields when this pattern was generated. There is a 10-frame pause at each stop. The pause should be seen as a 2 – 2 still or a frame still. The chapter is 15 seconds long.

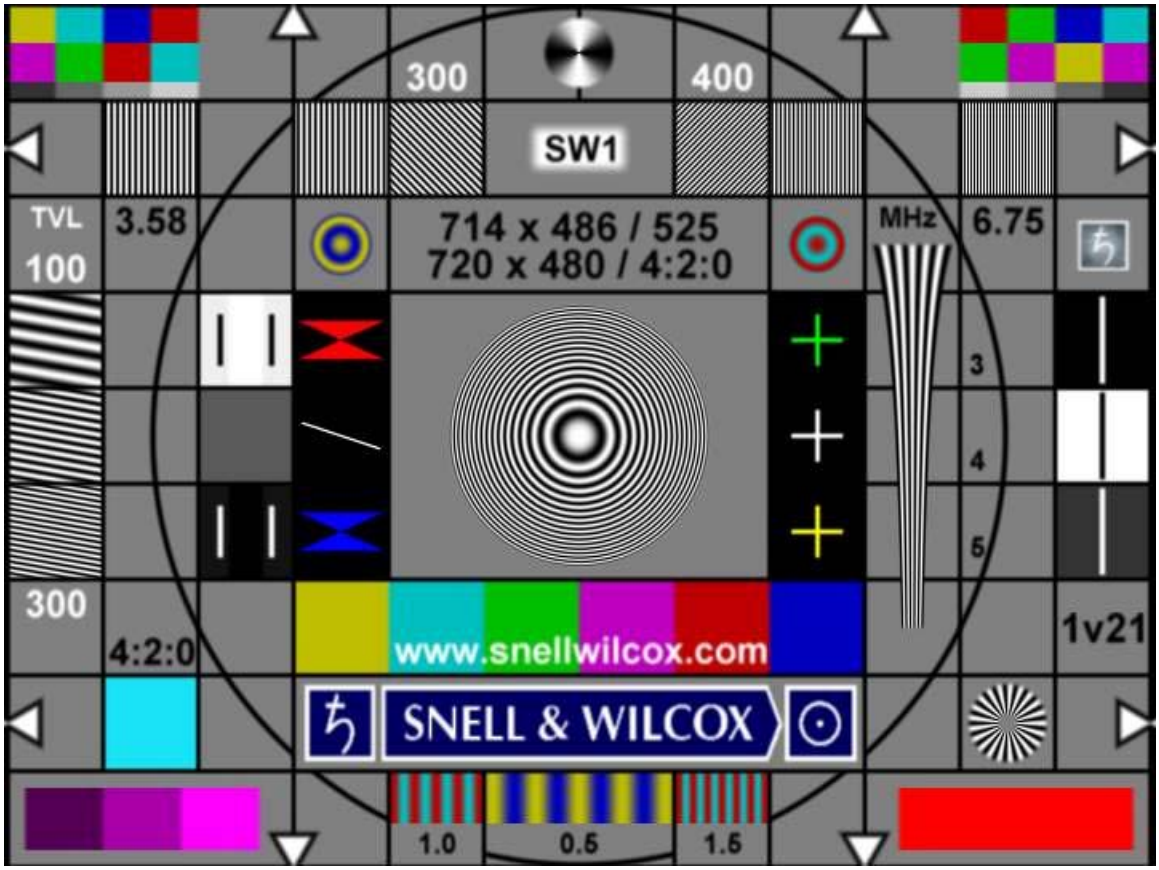
Description of Use: We have included the diagonal motion in this disc, at a frame rate, to be consistent with material that has been presented in the past. We are not convinced that the diagonal motion in the frame rate position of the generator is actually frame related, although processors do often treat it differently than field rate diagonal. In any event we have never detected it as 2 – 2 by any processor, where we have seen lots of processors that can find the 2 – 2 in either horizontal or vertical movement.

Chapter 6: Snell & Wilcox Zone Plate, Diagonal Motion, Field Rate

Pattern Layout: The motion in this section is updated in each field.

Description of Use: Interlaced video is difficult for any processor in converting the image to progressive video. Look for the types of artifacts being introduced. This certainly makes a case for doing away with interlaced video.

Chapter 7: Snell & Wilcox MPEG Test Pattern



Function: The primary reason this pattern is included in this program is for inspection of MPEG decoding, in particular the conversion from 4:2:0 to 4:2:2, otherwise known as the "chroma bug".

Pattern Layout: The pattern has been modeled after the S&W Zone Plate test pattern, with some updates reflecting the bandwidth capability of the digital video system. Specifically that includes the 6.75 MHz burst. The pattern has been generated in the MPEG domain and is therefore "MPEG Perfect" or at least void of any encoding errors. The box labeled 4:2:0 alternates between yellow and cyan in each successive field. The S&W symbol on the right side rotates. The pattern is specifically formatted for the DVD format of 720 by 480, rather than 720 by 486. The size of the three color bursts has been increased from the S&W Zone Plate pattern but the frequencies remain the same. Take note of the dark area at the left and right edges of the pattern; it is showing the difference between the 720 pixel wide area and the 714 pixel area.

Description of Use: The chroma wedges to the left of the concentric circles and the color concentric circles to the left and right of the image size labels are used to inspect for the chroma bug. In proper decoding they should be smooth. When decoding is not right there are dark horizontal areas in that part of the image.

Chapter 8: Black Stretch

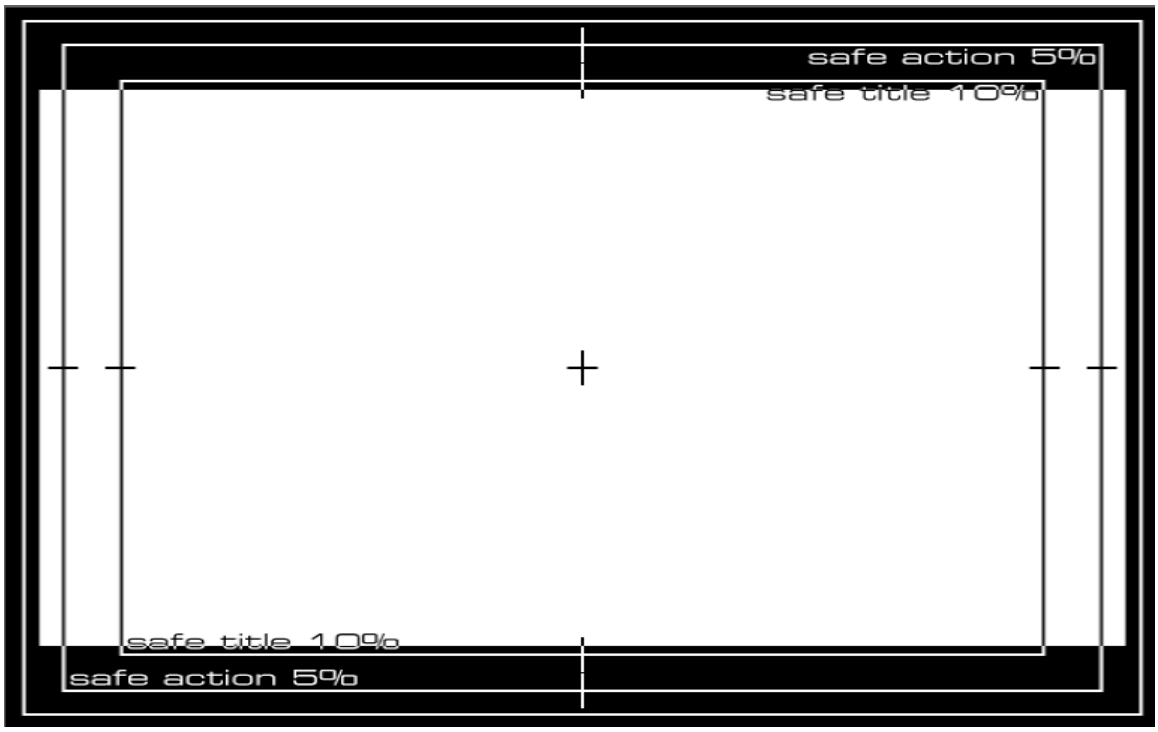
Function: Evaluate a display's capability of properly reproducing areas of the image that are just above black independent of the levels of image content around black.

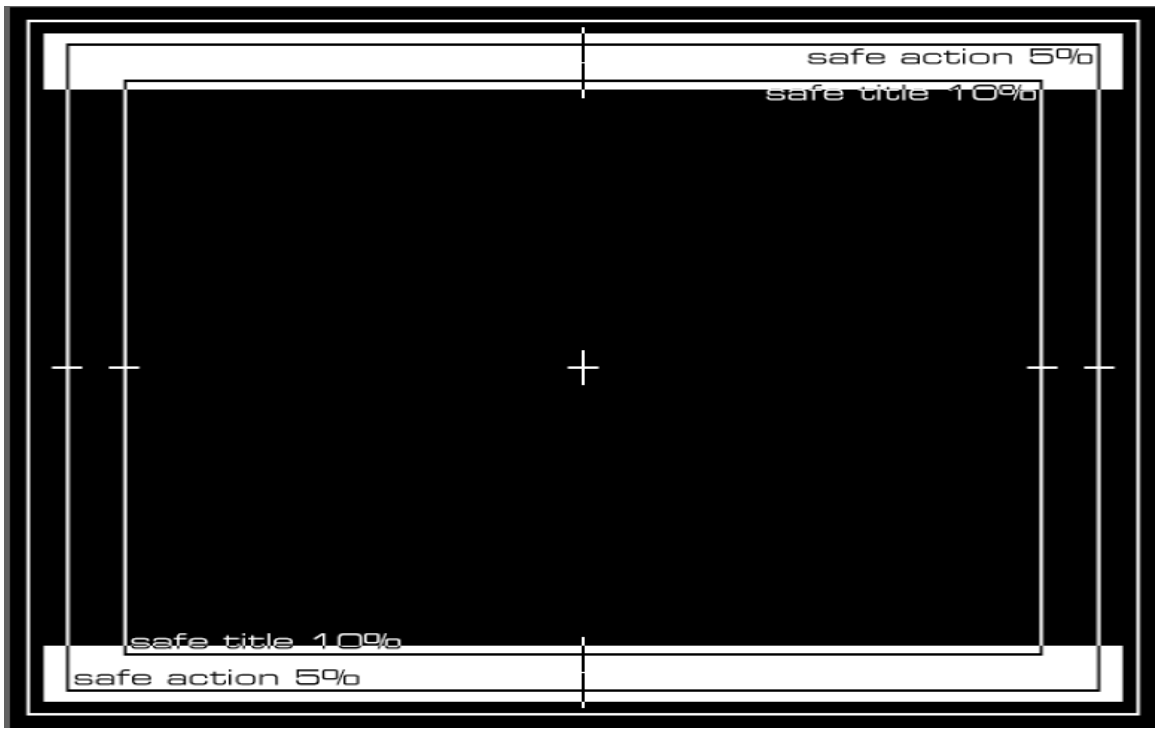
Pattern Layout: In the left half of the picture there is a fixed area where we placed a PLUGE. We then change the other areas of the picture in steps, bringing the background up gradually as the right side of the image is taken from black to white. Once the background reaches 100% it is taken back down again to black. The sequence is repeated within the chapter.

Description of Use: Black stretch is independent of DC Restoration. It is something that happens in certain displays just above black, where that area of the picture is sometimes stretched to make it more visible, depending on the average picture level. It should not be happening.

The signal has also been known to completely disrupt the imaging capability of a number of solid-state display devices.

Chapter 9: Bounce





Function: In CRT sets this pattern is used to check the high voltage regulation. The flash in the pattern has also been known to upset the general display capability of some solid-state imagers.

Pattern Layout: There is a black background with white Safe Title and Safe Action Markers. Light is alternately flashed between the majority of the image and the top ad bottom edges of the image. The pattern bounces between a high average picture level and a moderate average picture level.

Description of Use: In looking at high voltage regulation the lines of the Safe Action and Safe Title should remain unaltered by the change in position of the flashed light. If the high voltage regulation is less than ideal distortions like the image size changing or the lines bending will be revealed.

A number of video processors smear the vertical color information in order to cover up this error. If that is happening you should be able to see it in the color wedges at the top and bottom of the pattern.

We have noticed that the chroma in the upper left and right edges of the image can cause problems with some of the early analog component TV sets that anticipate a wide horizontal blanking interval. It shows up as in color streaking in the image. Many DVD players will widen the horizontal blanking in their analog output to avoid this problem.

Chapter 10: Video Black

Function: Provide an easily accessed source of video black. Look for vertical or horizontal tilt in the signal.

Pattern Layout: Video Black

This is something that can be used on a video screen for a long time without fear of harming any of the display characteristics. This is also just ahead of a Title boundary. Use the Skip Forward or Play button to jump to the next title. Not all DVD players are capable of easily jumping a Title boundary. You may have to try other navigation options or use the Program Menu to move forward to the next title.

Any flat field pattern can be used to look for vertical or horizontal tilt. This is a circumstance where the amplitude of the signal is not the same from one side of the picture to another. Visually spotting tilt can be encumbered by flat field uniformity. It's best to check such a thing out on a waveform monitor.

Title 16: Video Test Signals, 1.78 Patterns

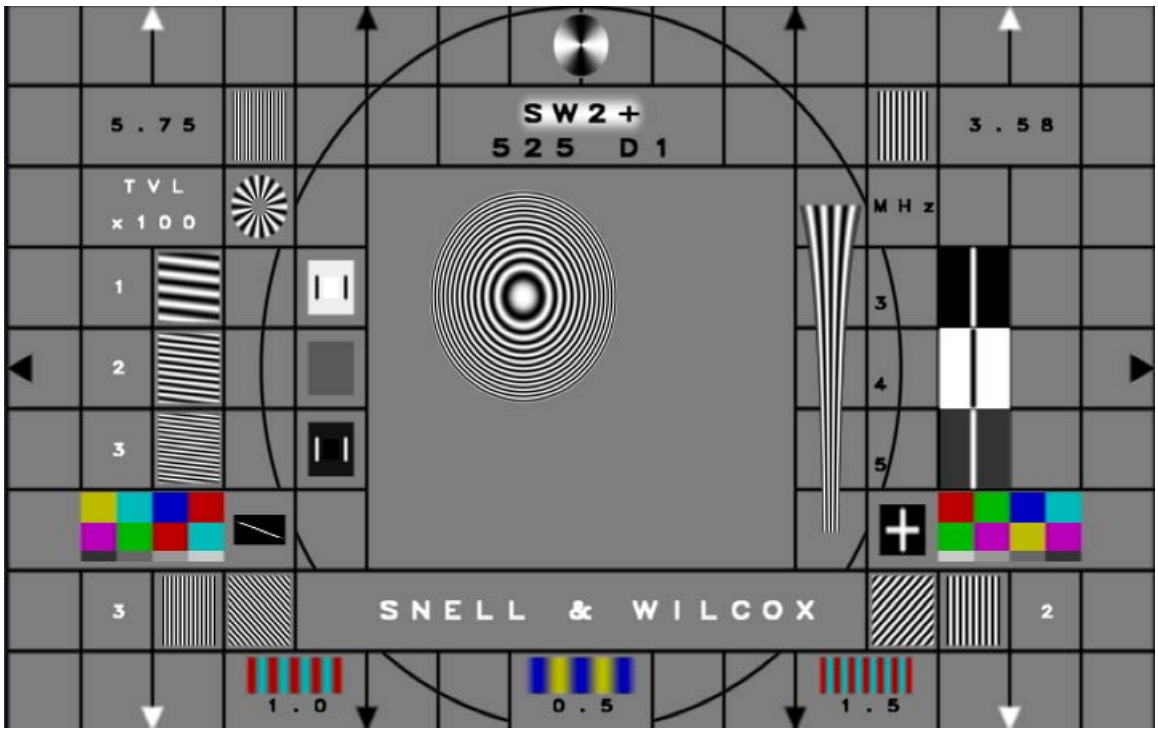
The general purpose of this title is to provide motion pattern in the 1.78:1 aspect ratio. The title is flagged as 1.78 and players capable of automatically switching between 1.33 and 1.78 should go to 1.78 during this title.

Once you skip forward beyond Chapter 1 the title will play in its entirety, ending on the opening still for Title 17. Any of the chapters in this title can be put in a loop to prevent it from going into the next chapter.

Chapter 1: Title Frame: *Anamorphic Motion Patterns*

This is the only still pattern in the title. Press Skip Forward or Play to continue.

Snell and Wilcox Zone Plate Test Patterns



Chapters 2 to 4 provide motion options for the widescreen version of the Snell & Wilcox Zone Plate test pattern. The rate of motion is changed in each. We will present a basic description of the general information in the pattern prior to describing the motion in each of the chapter descriptions.

Function: The Zone Plate Test Pattern is designed to show image motion at various rates within a static background. The background provides basic information about video path performance.

Pattern Layout & Description of Use: The pattern is based on the digital video production format of 720 by 486 with a pixel aspect ratio described in the SMPTE RP187 document for a 1.78 aspect ratio picture. Details in the pattern are designed to conform production standards of a video bandwidth for composite PAL video, containing a 4.43 MHz burst, even though we are working with the NTSC pattern.

The pattern is named SW2+, 525 D1, indicating that it is generated in the 4:2:2 digital component format used by the D1 tape recording format. The pixel aspect ratio conforms the SMPTE RP187 for the 1.78 aspect ratio.

References are included for black and white levels, horizontal and diagonal resolution, geometry and horizontal rise and fall times.

There are three chroma with luminance bursts at the bottom of the pattern. The center pattern, labeled 0.5 is primarily in the Pb channel. The two outside bursts, labeled 1.0 and 1.5 are primarily in the Pr domain. Their bandwidths are in the order of chroma

bandwidth specifications for a transmitted composite video signal. Even at that, they can often be useful at looking at the chroma bandwidth of a video path.

As for motion, the patterns in the NTSC version are grouped into three sets of three. The larger groups are type of motion such as diagonal, horizontal, and vertical. Each category of motion has three rates, film rate or 2 – 3, frame rate and field rate. There are only two rates of motion for the PAL test patterns, frame and field.

There is a programmed 10-frame pause in all of the motion as it hits one of the boundaries of the area of motion. During that pause the test pattern is presenting progressive frames of information.

In any motion detection processing it is important to see what happens to the fixed information in the image when motion is detected. It is not unusual to see motion being added to the still material as the quality of the motion material improves.

Chapter 2: Snell & Wilcox Zone Plate, Diagonal Motion, 2/3 Rate

Pattern Layout: The motion rate is 2 – 3 until it hits the side bar. There is a 10-frame pause at each stop. This is usually long enough to break the 2 – 3 count of most processors. The 10-frame pause should be seen as a 2 – 2 still or a frame still. The chapter is 15 seconds long.

Description of Use: This pattern is used primarily in looking at video processors to see if they can find the 2 – 3 sequence in the test pattern, or how fast they can acquire the 2 – 3 after it is broken at each stop. We have evaluated a number of processors that cannot find the 2 – 3 in this test pattern but can often find it in continuous 2 – 3 motion of images. There is continuous 24 frame demonstration material in Title 17 that will be helpful in determining that set of circumstances.

Chapter 3: Snell & Wilcox Zone Plate, Diagonal Motion, Frame Rate

Pattern Layout: The motion rate on the generator was set to 2 – 2 or complete frames in two fields when this pattern was generated. There is a 10-frame pause at each stop. The pause should be seen as a 2 – 2 still or a frame still. The chapter is 15 seconds long.

Description of Use: The diagonal motion is included in this disc, at a frame rate, for consistency with material that has been presented in the past. We are not convinced that the diagonal motion in the frame rate position of the generator is actually frame related, although processors do often treat it differently than field rate diagonal. In any event we have never seen it detected as 2 – 2 by any processor, where we have seen lots of processors that can find the 2 – 2 in either horizontal or vertical movement.

Chapter 4: Snell & Wilcox Zone Plate, Diagonal Motion, Field Rate

Pattern Layout: The motion in this section is updated in each field.

Description of Use: Interlaced video is difficult for any processor in converting the image to progressive video. Look for the types of artifacts being introduced. This certainly makes a case for doing away with interlaced video.

Chapter 5: A/V Timing Clock

General Description of Use:

The audio is in Dolby Digital 6.1 plus Dolby Lt Rt

The idea behind this chapter is a combination of what is accomplished in the film leader count down clock used to check visual and sound sync in movie theaters plus Using video wipe patterns of luminance and color information for video testing. The audio pop occurs at top dead center of the rotation. At the point of the pop the top 5% of the image area turns white. This can be used as a scope trigger to determine if the audio is in step with the picture.

The transitions about the clock are 75 and 100% chroma and luminance wipes. The idea is to determine if there are any problems with such transitions in video.

The sound used is what the film industry calls the two pop.

This chapter opens with the pink noise clock. Its purpose is to determine how long it takes the audio to start up after the video. The pink noise is always on. Take note of the position of the clock when you first hear the pink noise when starting this chapter from the menu system. You can also start the chapter, hit pause, and then back it up to the first frame of the chapter. Leave it in the still frame mode long enough for the audio decoder to loose sync then hit play. Take note of the position of the clock when the audio starts. This section runs for 5 seconds, which should be long enough for any system to pick up the audio.

The clock pulse or “two pop” is in the center channel during the full band pink noise section. It then moves to the left and right channels when it is on its own.

Either chapter can be put in a loop if more time is required for the use of the signals, although putting the pink noise clock in a loop should not cause a drop in audio decoding sync.

Title 17: Audio and Video Demonstrations

Chapter 1: Title Frame: Audio and Video Demonstrations

The contents of this title, in both NTSC and PAL versions, came from down conversions from the 1080p/24 program master. Some of the materials used in the program edit originated at 720p/24 and were upconverted for editing.

Our original goal for *Digital Video Essentials*, in all of its versions, was to provide "True Progressive Mastering". In part this means that the image on the disc would have much more vertical detail than is available from an interlaced image. In doing the down conversion from the 1080p/24 master to both NTSC and PAL we decided to use a minimum amount of vertical filtering, which would normally be in place to compensate for the fact that the image is in the interlaced domain.

Vertical filtering is normally employed, even if the signal originates in the interlaced domain, to reduce the visibility of interlaced artifacts when the signal is displayed on an interlaced monitor.

As much as there is about 30% more vertical detail in our images than might otherwise be available in a true interlaced image, many video processors, up converters in particular, are designed with the idea that the extra detail will not be there. As a result, their output will display a significant amount of vertical ringing on our images.

The source materials for this title all originated in the HD domain and were converted to 1080p/24 for editing. They were then down converted to interlaced NTSC, adding the 2 – 3 sequence to set them up to 60-field video. The PAL conversion was done by slowing the PAL recorder down to 24 frames and doing a frame for frame transfer of the 1080p/24 master. Once recorded the PAL player was sped back up to its normal 25 frame per second speed. The video runs faster in PAL than in NTSC because of the speeding up from 24 to 25 frames. The audio has been pitch shifted so that the pitch sounds the same as in the NTSC. The information is just presented faster.

Chapter 2: Montage of Images

The video used in this sequence was shot with the Panasonic variable shutter rate high definition camera. We picked material that had been done at 24p to make it easy to convert to our 1080p/24 frame edit. The graphics were delivered in 1080p/24. We had made specific requests for full amplitude detail right out to Nyquist. At the time of the production it was the only we knew how to challenge the capability of 1080p.

This is one of the areas of the program where people are reporting a lot of vertical edge enhancement. We have found that most of this is being introduced by the video processing not being capable of dealing with some much information in that domain.

Chapter 3: Restaurant Sequence 1.78

This film sequence was shot by Allen Daviau in early July 2001 on the best 35 mm film stock available at the time from Eastman Kodak. The transfer was done on a Spirit DataCine. This is the image in the correct aspect ratio.

Chapter 4: Restaurant Sequence 1.33 in a 1.78 frame

This film sequence was shot by Allen Daviau in early July 2001 on the best 35 mm film stock available at the time from Eastman Kodak. The transfer was done on a Spirit DataCine. It was conformed for 1.78:1 but protected to the full image aspect ratio of 1.33. The 1.33 transfer was done within a 1.78 raster so we could illustrate the importance of the aspect ratio.

Chapter 5: Room Audio Sequence

The people in the room ambience sequence were shot on film on the same day as the restaurant sequence. They were filmed against a black background. The rooms were built in graphics nearly two years later and the people keyed into the room. We photographed our subjects against a black background as an experiment. Normally key shots are done with blue or green backgrounds. In small spaces the blue or green backgrounds light up the characters, making it difficult to generate a good key. We decided to go back to luminance keying, as was done in the early days of black and white TV. After doing this we found that there isn't any current equipment that can do a good job of keying on a luminance background. Therefore the keying errors are easy to spot. Otherwise this material is included for flesh tones and detail.

Chapter 6: Model w/Chip Chart

Our model with chip chart carries over from the 1.33 version of her in *Video Essentials*. In DVE Jennifer was photographed using an older film stock, one with a lot of grain. We've electronically removed the grain from her face but left it in the other parts of the picture. The presence of the grain can make this material difficult to encode.

Program Guide, Acknowledgements

This option in the Program Guide menu takes you to the program credits in Title 18.

Title 18: Acknowledgements

Chapter 1: Credits

The credits are run as a slide show. Navigation in this chapter is done with the Pause, Play, and Search buttons. The Skip function will jump to Chapters 2 and 3.

Chapter 2: FBI Warning

We’re tired of seeing poor composite video graphics in other programs for this warning so we created our own. It was mastered at 1080p and down converted for use in this DVD.

Chapter 3: JKP Log

This is the short version concluding the running video portion of the program

Program Menu, Program Notes

This is a series of frames that is used to illustrate important point made in the program.

Program Notes:

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