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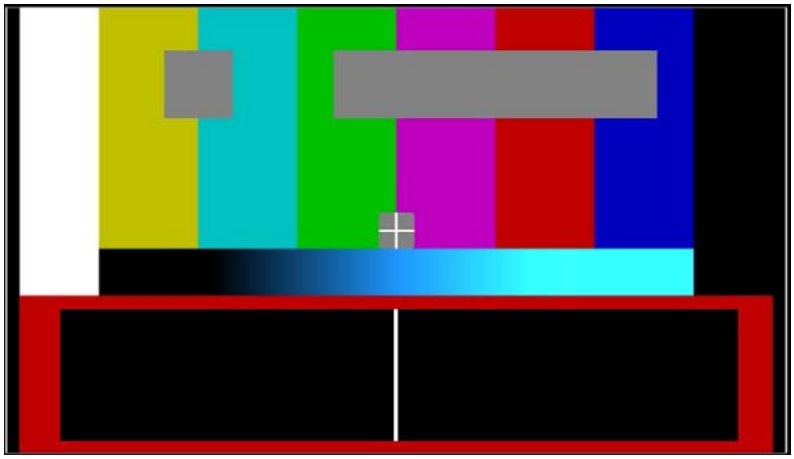

EBU Digital AV Sync and Operational Test Pattern

Date: Feb 2008

Revision : 1.3

Disclaimer.

*This pattern **is not** standardized or recognized by the EBU. This derivative has been developed by LYNX Technik specifically for use within our "Testor" Test Pattern Generators. It is based upon the technical document "EBU Tech 3305" which defines a similar test pattern originally specified for SDTV [625,525] use only.*

LYNX Technik has adapted and enhanced the proposed EBU Tech 3305 pattern for use in both SDTV and HDTV multi-format environments.

1. Introduction

The EBU AV Sync Test pattern has been designed to address a number of test and alignment requirements for audio and video signals in a modern multi-format digital environment. Various elements are contained within a single pattern which enables it to be used for a variety of applications.

2. Pattern Elements

The various pattern elements are shown below in Fig 1.

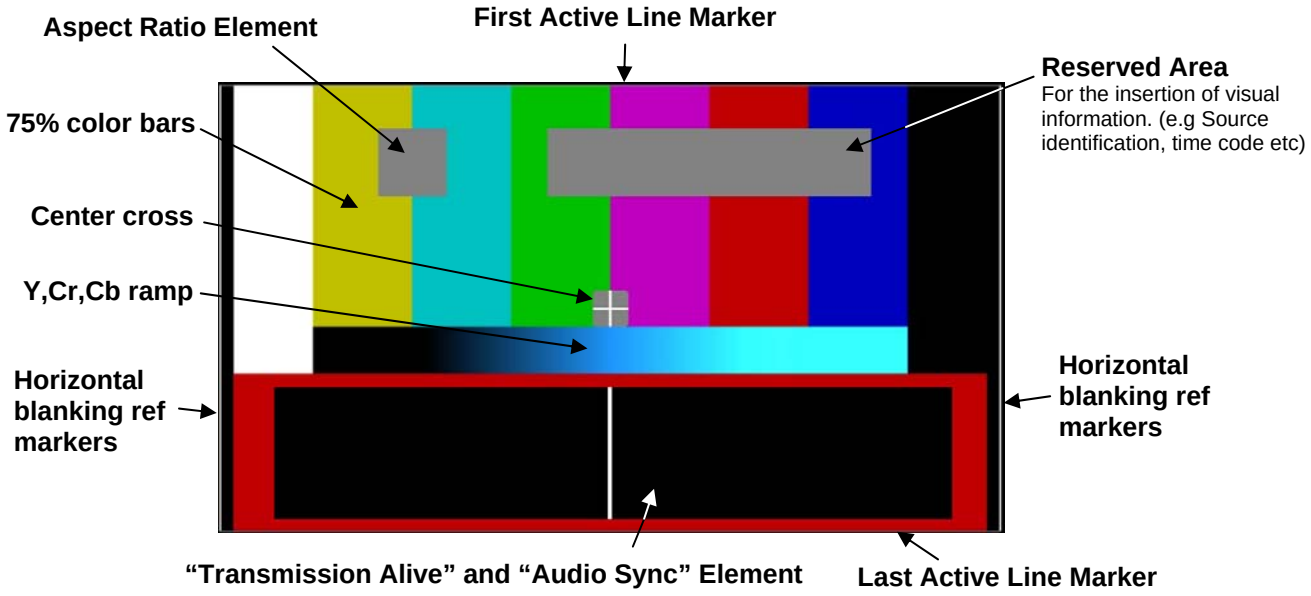

Fig 1. Pattern Elements

2.1. 75% Color Bars

These are standard color bars with peak white level at 75% and all colors saturated to 75%. The uses for this part of the pattern are widely known.

2.2. Aspect Ratio Element

This element of the pattern consists of a grey geometric square in the top left part of the pattern. This can be used to quickly identify the underlying aspect ratio. For example, if the 16:9 source pattern had been 4:3 center cut (through an aspect ratio converter or down converter) then this results in a geometric square. However, if the 16:9 source pattern was converted with a 4:3 "stretch to fill" function then the result is an upright rectangle. See Fig 2.

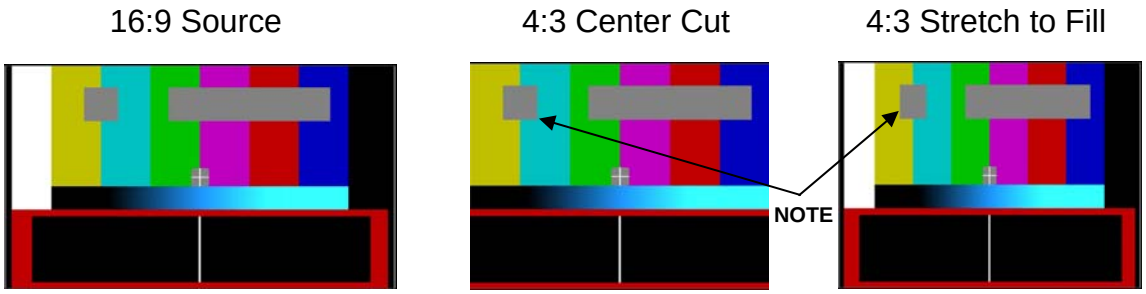

Fig 2. Use of aspect ratio element

Note. *The Testor allows the "Aspect Ratio Element" to be switched off (if required) in this case the grey box used for the center cross can be used as this is also a geometric square on the source pattern.*

2.3. Reserved Area Element

This area of the pattern consists of a grey box which can be used to overlay visual information from an external source such as source identification, station ID, timecode etc. (The Testor internal character generator(s) can be used to generate user text for this area if required)

Note. *The Testor allows the "Reserved Area Element" to be switched off (if required)*

2.4. Center Cross

This part of the pattern marks the image center. It is a geometric square so this can also be used in place of the aspect ratio element to verify the underlying aspect ratio if the video has been converted.

2.5. Y,Cr,Cb Ramp

This is the 10 bit Y,Cr,Cb horizontal ramp which appears light blue on screen. This is slightly different for SDTV and HDTV modes of operation.

2.5.1. SD–SDI (525 and 625 modes of operation)

Consists of 3 components:

- **Y - Ramp** (decimal start value = 254 decimal end value = 768)
- **Cb - Ramp** (decimal start value = 512, decimal end value = 768)
- **Cr - Ramp** (decimal start value = 512, decimal end value = 255)

Fig 3. Y,Cr,Cb ramp for 525 and 625 modes of operation

2.5.2. HD–SDI (720P, 1080i and 1080P modes of operation)

Consists of 3 components:

- **Y - Ramp** (decimal start value = 64 (black) decimal end value = 940 (white))
- **Cb - Ramp** (decimal start value = 512, decimal end value = 960)
- **Cr - Ramp** (decimal start value = 512, decimal end value = 64)

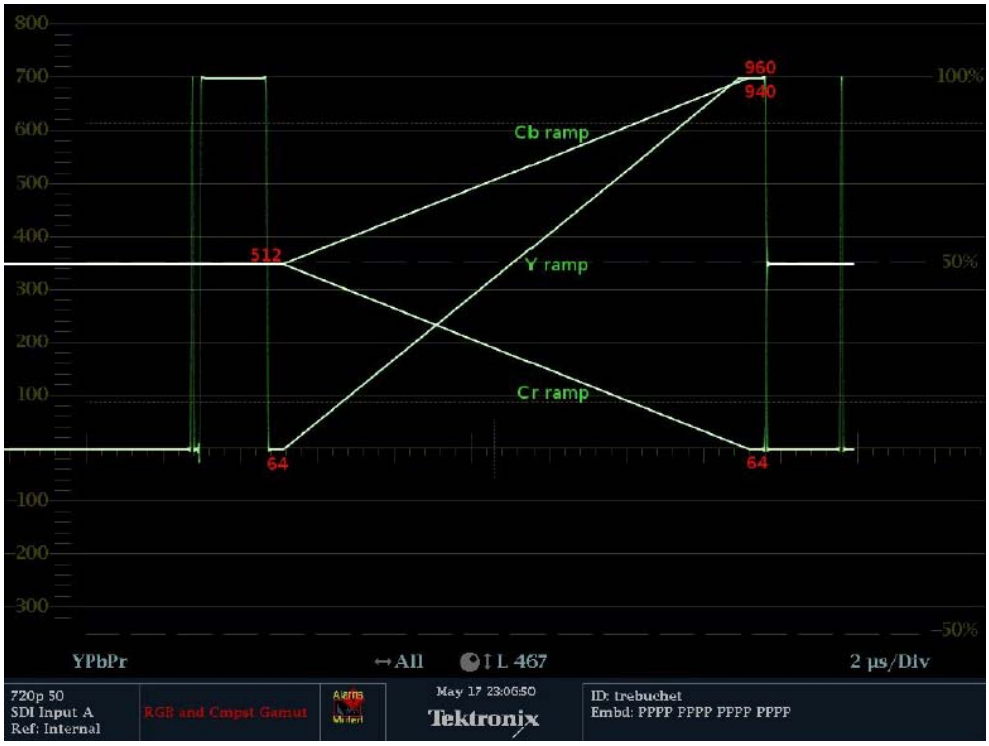

Fig 4. Y,Cr,Cb ramp for HDTV modes of operation

The Y,Cr,Cb ramp element can be used to check transmission path transparency. If a bit is not transmitted correctly the linearity of the ramp is altered or interrupted. The ramp can also be used to check video linearity and maximum luma / chroma levels of downstream equipment.

> ***Note.*** *The chrominance elements of the Y,Cr,Cb ramp may cause RGB Gammut errors on monitoring equipment. If this behavior is not acceptable for some applications then the chrominance components of the ramp can be disabled in the Testor if required (leaving a luma only ramp)*

When in 16:9 mode the horizontal span of the ramp can also be used as a 4:3 extraction reference if required.

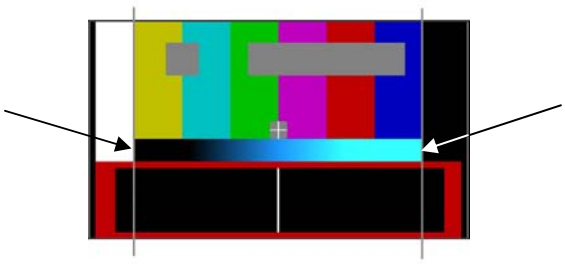

Fig5. Ramp ends used as 4:3 extraction markers

2.6. Transmission Alive and Audio AV Delay Motion Sequences

The bottom third of the test pattern area is for the "Transmission Alive" motion sequence and the "Audio / Video Delay" motion sequence. The Testor allows these sequences to be used individually or together (sequentially)

2.6.1. Transmission Alive

The Transmission Alive element provides a source of continuous video motion (with audio) for visually verifying video and audio transmission paths are free from errors such as freeze frame, dropped frames or intermittent operation. The accompanying audio component is also designed as means to verify correct audio levels and identify left and right stereo channels. The video part of the sequence consists of a horizontal black line moving up and down with linear motion. The audio can be either a preset "Three Level Tone" element or user defined audio frequency and level from the Testor audio generator (user selectable)

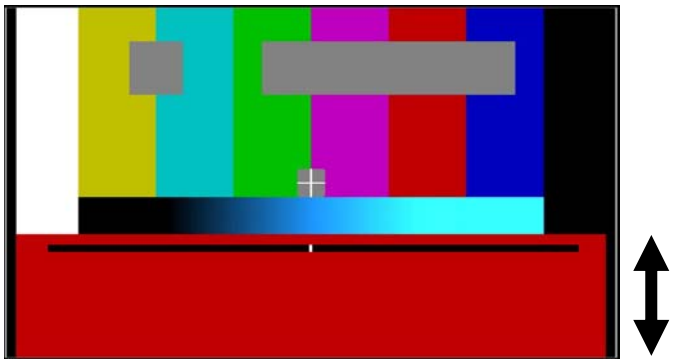

Fig6. Transmission Alive element

The vertical bar will move up and down within the defined area for 8 cycles within the areas specified below (approx 18 seconds)

- 625 > between line 218 (531) and line 299 (612)
- 525 > between line 187 (448) and line 254 (515)
- 720P > between line 515 and line 719
- 1080i > between line 388 (951) and line 539 (1102)
- 1080P > between line 776 and line 1081

2.6.2. Three Level Audio Reference

The cycling audio element can also be accompanied by a three level test tone *(user selectable)*. This tone is designed to verify the audio levels as well as providing a means to identify the left and right channels in stereo pairs.

Test Signal and level Definitions

- **Permitted Maximum Signal (PMS)**
  Sine wave signal at 1020Hz 9dB above the alignment level (0 dBFS) which is equivalent to the maximum program signal level.

- **Alignment Signal (AS)**
  Sine wave signal at 1020Hz at a level of -9 dBFS, which is used to align the international sound program connection.

- **Measurement Signal (MS)**
  Sinewave signal 1020Hz -12 dBFS below the alignment signal which can be used to check audio monitoring equipment calibration at the lower end of the audio scale.

  Note. *The line will be in motion for at least 18 seconds as defined in the audio timing diagram (Fig 7). The velocity of the moving line and total number of cycles is determined by the video format selected. Refer to 2.8 Motion Cycle Durations and fig 11 for more details*

The Three Level Tone preset can be disabled and replaced with a fixed continuous tone from the Testor's internal audio generator if required. *(Default is the Audio Generator)*

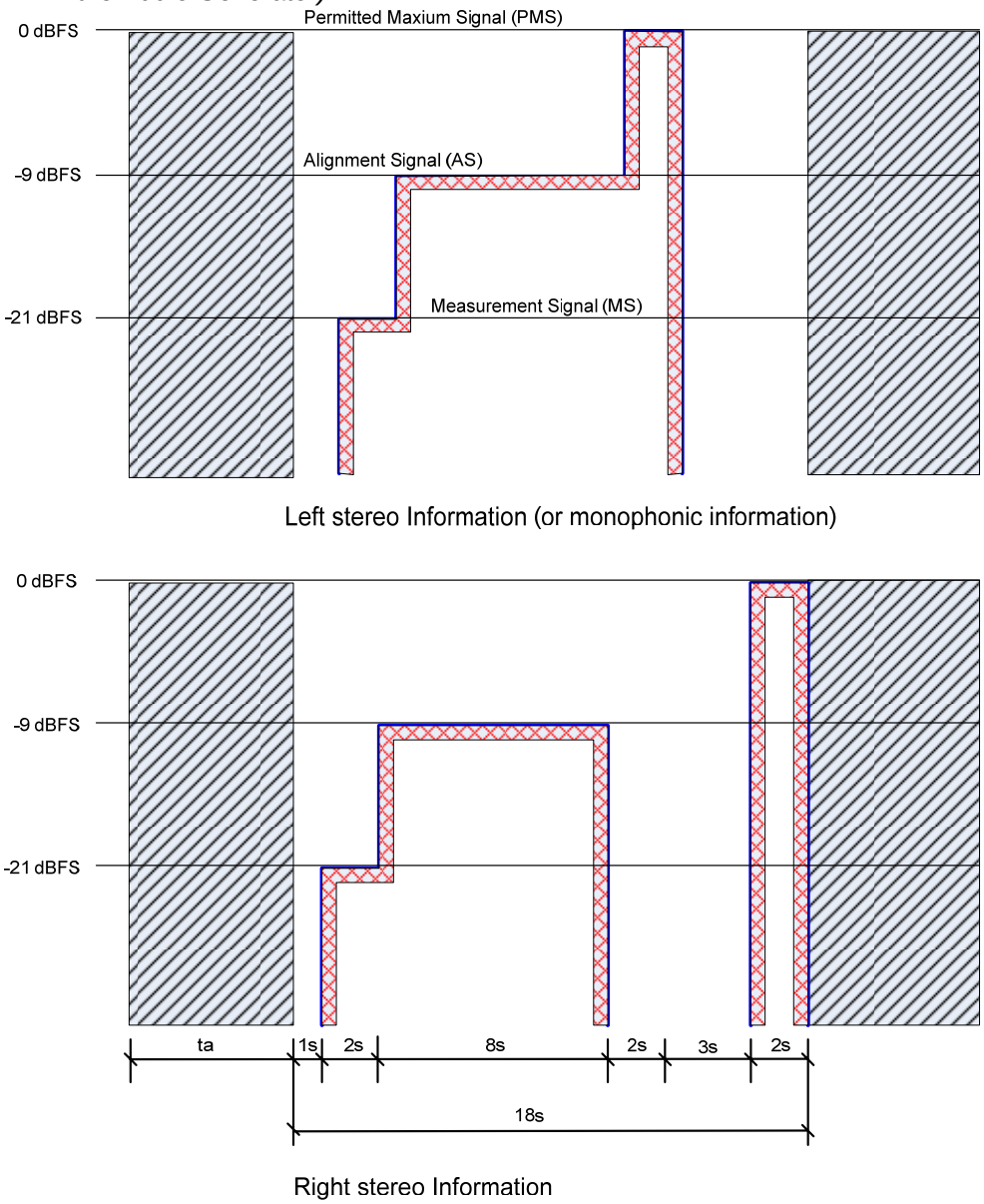

Fig 7. Three Level Tone level and timing chart

2.7. Motion Sequence 2 (Audio / Video Delay Test)

This sequence is used to verify the audio / video timing relationship and provides a simple audio / visual reference which provides for [approximate] timing verification by human eye and ear. The pattern may also be recorded and replayed (using step or jog functions) to make a more accurate timing assessment. (+/- 1 field)

The motion sequence consists of two black bars which move towards each other with linear motion and meet in the horizontal center of the screen (with audio silence). When they meet a narrow vertical white bar is displayed [one video frame duration] accompanied by 1KHz audio pulse [one frame duration]. This repeats 6 times for one complete "Motion Sequence 2" cycle. (Fig 8)

The Motion Sequence 2 cycle will immediately follow the Motion Sequence 1 cycle if the Testor is set to use both motion sequences *(default)*

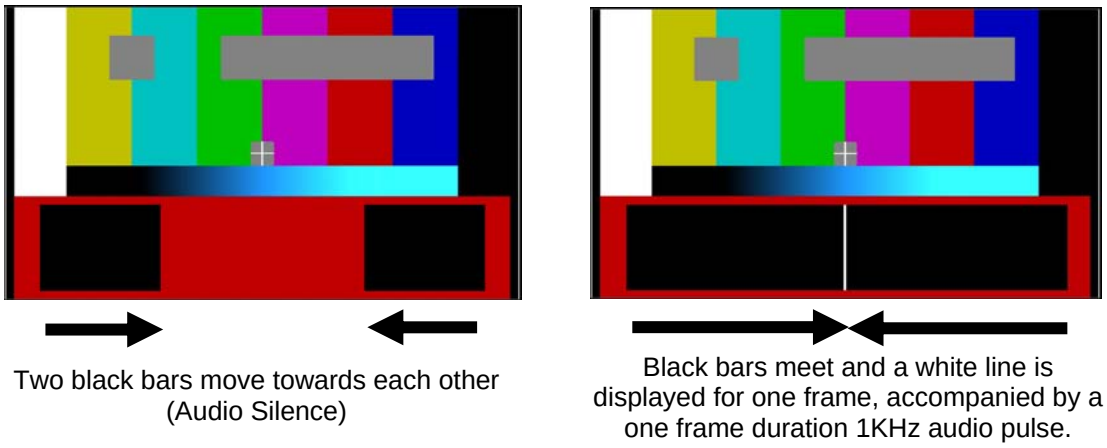

Fig 8. Motion Sequence 2.

2.7.1. Motion Sequence 2 – Audio / Video Timing.

The generation of the synchronized audio pulse is linked to the frame start of the appropriate video frame where the white vertical line is displayed. The resulting fade in / fade out and duration of the sound pulse is shown in Fig 9.

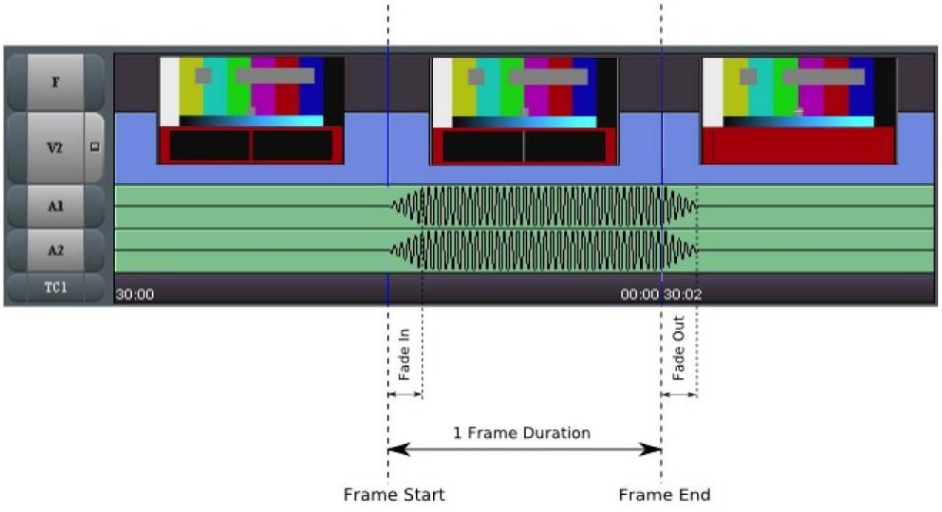

Fig 9. Motion Sequence 2 audio / video timing

2.7.2. Fade in and Fade out

The duration of the fade in and fade out depends on the maximum dBFS level of the 1KHz audio sync pulse. If the "Three Level Test Tone" is selected as the associated audio then the level of the 1Khz sync pulse is fixed at -9dBFS. If the audio generator in the Testor is the associated audio then the audio level and frequency can be user defined. (Factory default is -9dBFS).

The table and diagram below (fig 10) shows three examples of the audio sync pulse fade in / fade out duration. The rise and fall times are constant. The fade in and fade out duration depends on the FS Level range.

(e.g. FS level start = -60dBFS to FS level end = -9dBFS therefore the total range is 51dBFS)

FS Level Start [dBFS]	FS Level End [dBFS]	FS Level Range [dBFS]	Fade in / out [ms]
-60	-9	51	7.52
-60	-12	48	5.33
-60	-18	42	2.66

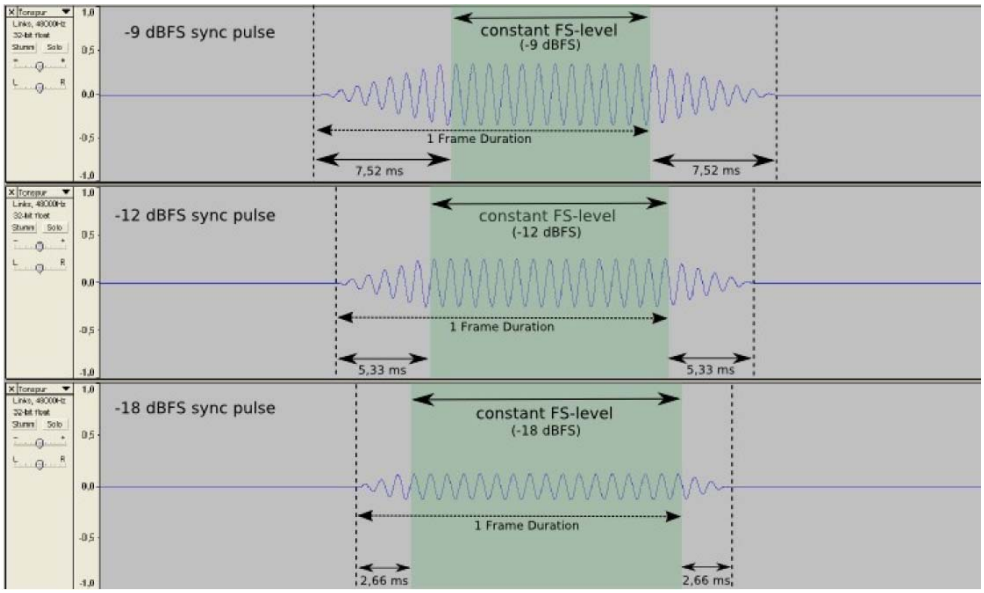

Fig 10. Examples of fade in fade out time vs audio level

2.8. Motion Cycle Durations

The number of cycles for each motion element and the duration is determined by the selected video format. Please refer to the table below:

Video Standard	"TX Alive" Sequence Cycles	Duration (Frames) One cycle	"AV Delay" Sequence Cycles	Duration (Frames) One cycle
525	6	61	6	46
625	4	72	6	46
720P	4	89	6	42
1080i	5	68	6	42
1080P	2.5	134	6	42

Fig 11. Motion Cycle Durations

2.9. Horizontal Blanking Markers

Two white marker pulses are inserted at the beginning and end of each line denoting analog and digital blanking positions. These can be used to verify the horizontal blanking size / timing as well as overall picture size, picture blanking and relative position on a display device. **Note:** *HDTV formats only have Digital blanking markers* (Fig 12).

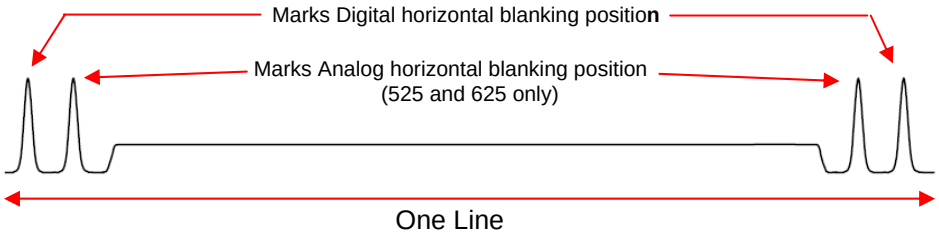

Fig 12. Horizontal Blanking Markers

2.10. Active Line Markers

The first and last active line of each field (or frame) are colored white. The white line signal starts with the first Horizontal Blanking Marker Pulse and ends with the last Horizontal Blanking Marker Pulse.

This is useful to determine if all active lines are present in a video image or to verify vertical blanking size and position or image size and relative position on a display device.

3. Flexible Elements

LYNX Technik has implemented some flexibility in the adoption of this pattern within its Testor Test Pattern Generators and certain pattern elements can be changed depending on user preferences and applications.

Aspect Ratio Element:	ON / OFF *(default ON)*
Reserved Area Element:	ON / OFF *(default ON)*
Ramp Mode:	Luma Ramp / Chroma Ramp *(default Chroma Ramp)*
Motion Sequence:	Transmission Alive + AV Sync Test *(default)* or, Transmission Alive ONLY or, AV Sync Test ONLY
Audio Sequence:	Three Level Test Tone or, Adjustable Sinewave Generator *(default)*

4. Further Reference

4.1. EBU

Please refer to EBU Tech 3305 for details on the SDTV Standard of this pattern which was used as the basis for this derivative.

4.2. Testor SD and HD Multi-format Test Generator.

Please refer to the Testor Reference manual for details on the use and configuration of the Testor Test Pattern Generators with this pattern (Manual rev 1.8 and higher)

Reference Manuals can be freely downloaded from the product pages on the LYNX Technik AG website:

www.lynx-technik.com