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EIA STANDARD

EIA/CEA-861-B

A DTV Profile for Uncompressed High Speed Digital Interfaces

EIA/CEA-861-B

(Revision of EIA/CEA-861-A)

MAY 2002

ELECTRONIC INDUSTRIES ALLIANCE

CEA Consumer Electronics Association
A sector of EIA

EIA Electronic Industries Alliance

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(From Project No. 5016, formulated under the cognizance of the CEA R-4.8 DTV Interface Subcommittee.)

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FOREWORD

This standard, EIA/CEA-861B (861B), is based on EIA/CEA-861 (861) that was published in January of 2001 and EIA/CEA-861A (861A) that was published in December 2001. This version adds:

- additional optional video formats
- more detailed discovery information
- short video descriptors so that new video formats can be advertised using 1 byte/format instead of 18-bytes/format
- audio descriptors to describe the various types of audio formats supported by the DTV Monitor
- Speaker allocation information to support multi-channel LPCM audio.
- miscellaneous information into the AVI InfoFrame to support several of the new video formats
- Several new InfoFrames to provide additional information about the source device and stream.

861B is fully backward compatible with 861A. It assumes the same functionality at the physical/link layers as is required to gain the extra functionality of 861A. For example, it relies on the ability of the source device to transmit CEA InfoPackets and the ability of the DTV Monitor to receive them. It supports the transmission of digital audio if the specific interface supports digital audio. Like 861A, 861B is fully backward compatible with 861 and requires the use of a backward compatible version of the interface used with 861 (e.g., DVI1.0). Source boxes designed to 861A or 861B will be able to supply video to an 861 compliant DTV Monitor and source boxes designed to 861 will be able to supply video to an 861A or 861B compliant DTV Monitor. In both of these cases, the system would have the same functionality as if both devices were only 861 devices. However, if both devices are designed to meet this full standard (EIA/CEA-861B), then the enhancements added in this standard and 861A would be available (e.g., aspect ratio information, active format information, native format information, etc.). For this to work, the versions of DVI or Open_LDI that are used with EIA/CEA-861B must have enhancements to carry CEA InfoPackets, but must also be backward compatible (source and destination) with the versions of those specifications referenced in EIA/CEA-861.

The relationship of the various versions of 861 is shown in Figure 1. Note that the potential functionality of each link is set by the lowest version of 861 on either side of the interface. The actual functionality depends on which options are implemented.

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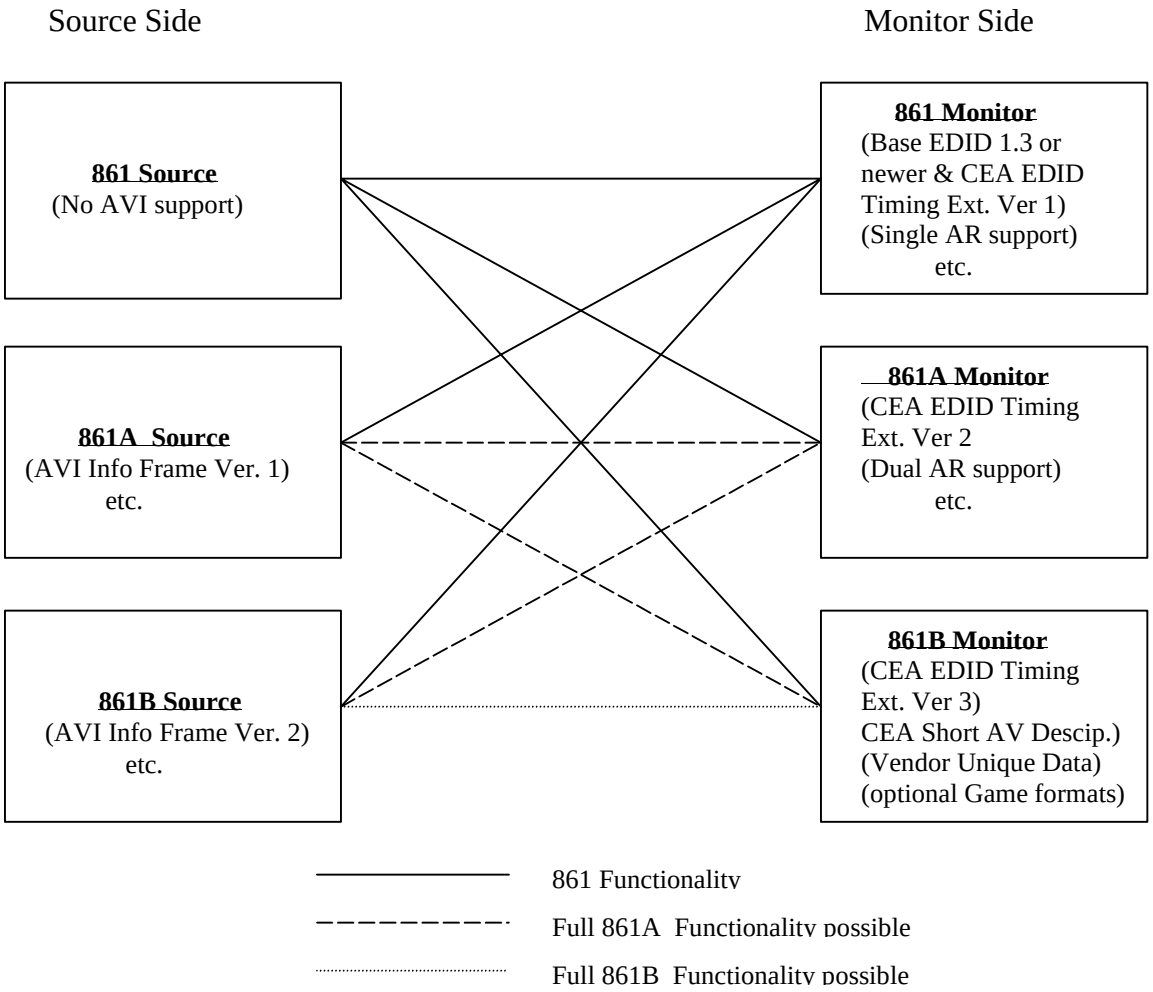

Figure 1 Relationship of Different Versions of 861

It is recommended that devices using the DTV profile defined in this standard incorporate a digital content protection system to ensure interoperability and provide protection for copy-protected content traversing uncompressed, digital, high-speed, baseband interfaces. For DVI 1.0 [2], High-bandwidth Digital Content Protection (HDCP) [4] technology is available for protecting content transmitted across this interface.

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1 INTRODUCTION

This standard defines video timing requirements, discovery structures, and a data transfer structure (InfoPacket) that is used for building uncompressed, baseband, digital interfaces on digital televisions (DTV) or DTV Monitors. A single physical interface is not specified, but any interface implemented must use *VESA Enhanced Extended Display Identification Data Standard* (VESA E-EDID) for format discovery. At the time of this writing, there are two options for transmitting uncompressed digital video to the DTV Monitor. Digital Visual Interface (DVI) and OpenLDI have been available since the initial publication of 861 and allow for 861-functionality. Newer physical interfaces that are expected to be backward compatible with DVI 1.0 and include mechanisms for the transport of CEA InfoPackets, digital audio, and YC_BC_R pixel data are expected to be available soon[1]. These new interfaces can each be used separately to enable the full capabilities of this standard. All interfaces use VESA E-EDID to describe supported video formats in a way that can be discovered by the source device.

1.1 Summary of EIA/CEA-861X Requirements and Capabilities

A high level summary of the various requirements and capabilities of the different versions of 861 is shown below in Table 1. The table is for summary purposes only. Details of the requirements are found in the document text.

[1] Two companies/consortiums submitted responses to an RFI released by CEA in December 2001.

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Table 1 Summary of EIA/CEA-861X Requirements and Capabilities

Source Side (sent in video frames)*	DTV Monitor Side (discovered at pwr up) *
EIA/CEA-861	Support
No AVI InfoFrame support Colorimetry: SMPTE 170M, ITU 601 (or EIA-770.2A), ITU-709 (or EIA-770.3). Quantization Levels: ITU 601; ITU-709.	EDTV: 640x480p, 720x480p; HDTV: 640x480p, 720x480p, and 1280x720p or 1920x1080i. E-EDID (only two 18 byte detail timing descriptors available in base EDID) and CEA EDID Timing Ext. Ver 1 for extra 18-byte descriptors. One preferred Aspect Ratio per video format timing (single AR monitors)
EIA/CEA-861A	Support
AVI Info Frame Ver. 1 Support - Sec. 6.1 - Aspect Ratio, Color, AFD, Bar width, over/under scan. Colorimetry: same as 861, except if a different one is specified in AVI Info Frame.	50Hz Timing Formats added CEA EDID Timing Ext. Ver 2 - Simultaneous support of 16x9 & 4x3 versions of same video timing. (Dual Aspect Ratio DTV) - Several native timing formats can be supported. - First format or AR listed is most preferred. - Basic audio indicator. - Y,Cb,Cr pixel formats.
EIA/CEA-861B	Support
AVI Info Frame Ver 2 – Sec. 6.1.1 Source Product Data InfoFrame (New) -- Sec. 6.2 Audio InfoFrame (new) – Sec. 6.3 MPEG Source InfoFrame (new) – Sec. 6.4	Optional Game/1080p formats CEA EDID Timing Ext. Ver. 3 -- Sec. 7.5 CEA Short Video Descriptors. CEA Short Audio Descriptors Speaker Allocation Data Block Vendor Unique Data Block

* Interface Requirements may have implications on both sides of the interface.

Note 1: Later versions of 861 are backward compatible with earlier versions, so later versions include all of the previous version's requirements and capabilities.

Note 2: If Ver 3 CEA Timing Ext. is implemented, all CEA formats, indicated in E-EDID for that monitor, shall use the Short Video Descriptor, even if they are also required to use 18-byte detailed timing descriptors.

Note 3: If the DTV Monitor has provided a timing descriptor for a particular video format decoded in the source, it is recommended that the source send video across the interface without performing format conversion. If a conversion must be done, it is recommended that the conversion be to a format identified by the display as a 'native format'. If for some reason the source cannot supply that format, the source should supply the next most preferred format, and so on to the last format advertised.

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2 GENERAL

2.1 Scope

This standard includes mechanisms that allow a digital video source (such as a cable or terrestrial set-top box, digital VCR, or DVD player) to supply displayable, baseband, digital video to HDTV Monitors and EDTV Monitors (DTV Monitors), as defined in *CEA Expands Definitions for Digital Television Products* [16].

The timing requirements for video formats are described along with requirements for video format discovery. Also, a mechanism allowing the source device to discover all supported formats and the preferred formats of a DTV Monitor is described. Four basic video format timings from 861 are defined in this document for countries using 60 Hz. systems. Two are high definition formats (1920x1080i, 1280x720p), one is enhanced definition (720x480p), and the remaining one is standard definition (720X480i). Additionally, six new 60 Hz format timings have been added in this standard (861B). All of these new formats are optional. Their discovery is handled somewhat differently than the previously defined formats due to the desire to reduce the number of bytes used to discover formats and at the same time maintain backward compatibility with 861 and 861A. Several of the vudeo format timings (old and new) are available in two different picture aspect ratios. A method of indicating to the DTV Monitor the picture aspect ratio and colorimetry in which the video should be displayed is included. Several of the new video formats are game formats. These formats have 2880 pixels per line in the transmitted form, but the number of pixels displayed is less (based on a pixel repeat field).

For countries using 50 Hz systems, four similar video format timings from 861A have also been defined in this document. Two are high definition formats (1920x1080i, 1280x720p), one is enhanced definition (720x576p), and one is standard definition (720X576i). Additionally, six new 50 Hz format timings have been added in this standard (861B). All of these new formats are optional. Their discovery is handled somewhat differently than the previously defined formats due to the desire to reduce the number of bytes used to discover formats and at the same time maintain backward compatibility with 861 and 861A. Several of the video format timings (old and new) are available in two different picture aspect ratios. The method of indicating to the DTV Monitor the aspect ratio and colorimetry in which the video should be displayed also applies. Several of these new 50 Hz formats are also game formats.

An additional format added to 861B is a version based on a film frame rate (1920X1080p @ 24Hz). This format is available in only 16:9 picture aspect ratio.

This standard specifies how EDID is used to describe DTV capabilities to source devices. The ability to send colorimetry and picture aspect ratio information to the DTV was added in 861A. 861B adds other types of information that can optionally be sent to the DTV.

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2.2 Normative references

The following standards contain provisions that, through reference in this text, constitute normative provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed in Sec. 2.2.1. If the referenced standard is dated, the reader is advised to use the version specified.

2.2.1 Normative reference list[2]

1. ANSI/SMPTE 170M-1999 Composite Analog Video Signal—NTSC for Studio Applications, 1999.
2. DDWG, "Digital Visual Interface," Revision 1.0, April 2, 1999.
3. ETSI TR 101 154 v1.4.1, *Digital Video Broadcasting (DVB); Implementation Guidelines for the Use of MPEG-2 Systems, Video and Audio in Satellite, Cable and Terrestrial Broadcasting Applications (Annex B),* July 2000.
4. Intel, High-bandwidth Digital Content Protection System, Version 1.0, February 17, 2000.
5. ITU-R BT.601-5, Studio Encoding parameters of digital television for standard 4:3 and wide-screen 16:9 aspect ratios, 1995.
6. ITU-R BT.709-4, Parameter Values for the HDTV standard for production and International Programme Exchange, 2000.
7. Open LVDS Display Interface (Open LDI) Specification," Version 0.95, May 13, 1999.
8. VESA E-EDID™ Standard, *VESA Enhanced Extended Display Identification Data Standard*, Release A, Revision 1, February 9, 2000.
9. VESA E-DDC™ Standard, *VESA Enhanced Display Data Channel Standard*, Version 1, September 2, 1999.
10. VESA Monitor Timing Specifications, *VESA and Industry Standards and Guidelines for Computer Display Monitor Timing*, Version 1.0, Revision 0.8, Adoption Date: September 17, 1998.

2.2.2 Normative reference acquisition

AEIA/CEA Standards

- Global Engineering Documents, World Headquarters, 15 Inverness Way East, Englewood, CO USA 80112-5776; Phone 800-854-7179; Fax 303-397-2740 URL global.ihs.com; Email global@ihs.com

ANSI/EIA Standards: United States of America

- American National Standards Institute, Customer Service, 11 West 42nd Street, New York NY 10036; Phone 212-642 4900; Fax 212-302-1286 URL www.ansi.org; Email sales@ansi.org

[2] In some instances, only specified sections of a standard may be normative. References listed below shall take precedence over references within these listed references.

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ANSI/SMPTE Standards

- Society of Motion Picture and Television Engineers, 595 W. Hartsdale Avenue, White Plains, NY 10607-1824, Phone 914-761-1100, Fax 914-761-3115

  URL www.smpte.org

DDWG

- Contact Digital Display Working Group (DDWG); Attn: DDWG Administrator; M/S JF3-361; 2111 NE 25th Avenue, Hillsboro, OR 97124-5961, USA; Fax: (503)264-5959; Email: ddwg.if@intel.com; URL: www.ddwg.org

HDCP

- Contact Digital Content Protection, LLC; EMail: info@digital-cp.com; URL: www.digital-cp.com

ITU Standards

- International Telecommunications Union, Place des Nations, CH-1211 Geneva 20, Switzerland; Phone +41 22 730 5111; Fax +41 22 733 7256
  URL www.itu.sh/publications/bookstore.html; Email itumail@itu.int

OpenLDI

- Contact National Semiconductor: WWW.National.com/appinfo/fpd

VESA Standards

- Contact Video Electronics Standards Association, 920 Hillview Court, Suite 140, Milpitas, CA 95035, USA; telephone: (408) 957-9270
  URL www.vesa.org.

2.3 Informative References

The following documents contain information that is useful in understanding this standard. Some of these documents are drafts of standards that may become normative references in a future release of this standard.

2.3.1 Informative document list

11. ANSI/SMPTE Standard 253M (1998), Standard for Television—Three-Channel RGB Analog Video Interface.
12. ANSI/SMPTE Standard 274M (1998), Standard for Television—1920X1080 Scanning and Analog and Parallel Digital Interfaces for Multiple-Picture Rates.
13. ANSI/SMPTE Standard 293M (1996), Standard for Television—720X483 Active Line at 59.94 Hz Progressive Scan Production—Digital Representation.
14. ANSI/SMPTE 296M (2001), Standard for Television—1280 X720 Scanning, Analog and Digital Representation and Analog Interface.
15. ATSC Standard A/52, Digital Audio Compression (AC-3) Standard, December 20, 1995.
16. CEA Press Release; *CEA Expands Definitions for Digital Television Products*; August 31, 2000.

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17. DVD Forum, *DVD Specifications for Read-Only Disc, Part3, Video Specifications*, Version 1.0, August 1996.
18. DVD Forum, *DVD Specifications for Read-Only Disc, Part 4, Audio Specifications*, Version 1.0.
19. EIA/CEA-770.2-C, *Standard Definition TV Analog Component Video Interface*, August 2001.
20. EIA/CEA-770.3-C, *High Definition TV Analog Component Video Interface*, August 2001.
21. EIA/CEA-849A, *Application profiles for EIA-775A compliant DTVs*, 2001
22. EIA/CEA-861, *A DTV Profile for Uncompressed High Speed Digital Interfaces*, January 2001.
23. EIA/CEA-861A, *A DTV Profile for Uncompressed High Speed Digital Interfaces*, December 2001.
24. ETSI TR 101 154 v1.4.1, *Digital Video Broadcasting (DVB); Implementation Guidelines for the Use of MPEG-2 Systems, Video and Audio in Satellite, Cable and Terrestrial Broadcasting Applications,* July 2000.
25. IEC61937 *Digital Audio - Interface for non-linear PCM encoded audio bitstreams applying IEC60958*, First Edition, 2000.
26. IEC60958-1 *Digital Audio Interface - Part 1: General*, First Edition, 1999.
27. IEC60958-3 *Digital Audio Interface - Part 3: Consumer Applications*, First Edition, 1999.
28. ISO/IEC 11172-3:1993, *Information Technology - Coding of moving pictures and associated audio for digital storage media at up to about 1.5 Mbit/sec*, Part 3: Audio, 1993.
29. ISO/IEC 13818-3, *Information Technology - Generic coding of moving pictures and associated audio information, Part 3: Audio*, Second Edition, 1998-04-15.
30. ISO/IEC 14496-3, *Information Technology - Coding of audio-visual objects, Part 3: Audio, Amendment 1: Audio Extensions*, 2000-09-15.
31. ITU-R BT.1358, *Studio Parameters of 625 and 525 Line Progressive Scan Television Systems*, 1998.
32. ITU-R BT.470–6, *Conventional Television Systems*, 1998.
33. ITU-R BT.656–4, *Interfaces for Digital Component Video Signals in 525-line and 625-line Television Systems Operating at the 4:2:2 Level of Recommendation*, 1998.
34. ITU-R BT.711–1, *Synchronizing Reference Signals for the Component Digital Studio*, 1992.
35. VESA DDC/CI Standard, *VESA Display Data Channel Command Interface (DDC/CI) Standard*, Version 1, August 14, 1998.
36. VESA DI-EXT, *Display Information Extension Block (DI-EXT™) for E-EDID,* Release A, August 21, 2001.
37. VESA E-EDID™ Implementation Guide, *VESA Enhanced Extended Display Identification Data—Implementation Guide*, Version 1.0, June 4, 2001.
38. VESA GTF Standard, *VESA Generalized Timing Formula Standard*, Version 1.1, September 2, 1999.

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ITU Standards

- International Telecommunications Union, Place des Nations, CH-1211 Geneva 20, Switzerland; Phone +41 22 730 5111; Fax +41 22 733 7256
  URL www.itu.sh/publications/bookstore.html; Email itumail@itu.int

SMPTE Standards

- Society of Motion Picture & Television Engineers (SMPTE), 595 West Hartsdale Avenue, White Plains, NY 10607; Phone 914-761-1100; Fax 914-761-3115
  URL www.smpte.org; Email smpte@smpte.org

VESA Standards

- Contact Video Electronics Standards Association, 920 Hillview Court, Suite 140, Milpitas, CA 95035, USA, telephone (408) 957-9270, www.vesa.org.

2.4 Definitions

For the purposes of this document, the following definitions apply.

Active Format Description — A data structure that describes what portion of the picture actually contains useful information (i.e., letterbox and sidebars [bars] are not considered useful information). It is standardized in DVB, and is partially adopted in this standard. Note that the use of the term “active” in this definition is not consistent with the use of this term in other portions of this standard and most of the other documents referenced by this standard.

Auxiliary Video Information — Additional information (defined in this standard) related to the video being sent from a source device to a DTV Monitor.

A/V — Audio and Video.

Bars — Region of the display screen that is being driven or scanned at either zero luminance or at a uniform luminance; or regions of a picture that are intended to be driven (e.g., matrix addressed) or scanned (e.g., CRT) at either zero luminance or at a uniform luminance. In other words, it is the portion of the picture that does not contain useful information.

Basic Audio — Uncompressed, two channel, digital audio. Exact parameters are determined by the interface specification used with this standard (e.g., 2 channel IEC60958 LPCM, 32, 44.1, and 48 kHz sampling rates, 16 bits/sample).

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Byte	8 bits of data.
CEA Timing Extension	The E-EDID Standard [8] defines a tag (02_{16}) that allows for an extension to be added with additional timing formats. When EIA/CEA-861 was written, the format of this "Additional Timing Data Block" was still being determined by VESA. Subsequent to the adoption of EIA/CEA-861, the tag for this timing extension was assigned to CEA for use in EIA/CEA-861A and subsequent editions. This standard (861B) specifies new requirements for the use of this timing extension (see Section 7.1.3).
Digital Television (DTV)	A device that receives, decodes, and presents audio and video material that has been transmitted in a compressed form. The device can be a single unit or it can be constructed from a number of individual components (e.g. a digital terrestrial set top box and an analog television).
DTV Monitor	Defined in this standard to be an EDTV, HDTV, or SDTV Monitor. A DTV Monitor can also be any combination of these terms. A DTV with an uncompressed video input is also considered a DTV Monitor.
Dual Aspect Ratio DTV Monitor	A DTV Monitor that simultaneously supports both picture aspect ratios of a video format timing (e.g., 720X480p). Simultaneous support is signified by listing both formats in the EDID data structure at the same time.
EDTV Monitor	A video monitor capable of displaying 720x480p in 16:9 or 4:3 aspect ratios.
Frame Format	The timing associated with a single frame of video.
HDTV Monitor	A video monitor capable of displaying 1920X1080i or 1280X720p video in its native format on a 16:9 screen. An HDTV Monitor must also have EDTV Monitor capabilities.
InfoFrame	A substructure within the CEA InfoPacket. InfoFrames are specific to the type of information (e.g., Audio InfoFrame). Various InfoFrames are described in Section 6.
InfoPacket	A data transfer structure for sending miscellaneous information from a source device to a DTV monitor over an 861B interface. This structure first appeared in 861A. The general structure is shown in Annex G.
Multi-channel LPCM Audio	Multi-channel Linear Pulse Code Modulation (i.e., uncompressed) digital audio with more than two channels.

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Native Display Device Aspect Ratio	Ratio of maximum width to height dimension of the addressable portion of a physical display device screen.
Native Format	A Native Format is a video timing/format that a display device is designed to handle without having to perform a timing or scaling conversion. The number of "native" formats is dependent upon the design of the display device. Each device declares its native format or formats through EDID.
Picture	That portion of an uncompressed video signal, a compressed video stream, or a sequence on a display that constitutes a single displayable image (i.e., the addressable picture elements). For the purposes of this standard, picture refers to a single video frame in the uncompressed video signal.
Picture Aspect Ratio	Ratio of width to height dimension of the picture as delivered across the uncompressed digital interface, including any top, bottom, or side bars. Only two Picture Aspect Ratios are specified for this interface, 16:9 and 4:3.
Preferred Picture Aspect Ratio	In a Dual Aspect Ratio DTV Monitor, the preferred aspect ratio of a given Video Format Timing (e.g., 720X480p) is the aspect ratio of the format listed before the Video Format with the same Video Format Timing in the EDID data structure (see Section 7). This would be the picture aspect ratio that would be displayed if a DTV Monitor were to receive a Video Format Timing with no accompanying picture aspect ratio information (i.e., no AVI sent from source).
Preferred Format	The preferred format is the video format listed first in the EDID data structure. Although there may be more than one native format, the one most preferred by the DTV Monitor is listed first.
RGB	A general representation of an analog or digital component video signal, where R represents the red color, G represents green, and B represents blue; and each component is sampled at a uniform rate (4,4,4). For the purpose of this standard, the signal is digital.
SDTV Monitor	A video monitor capable of displaying 720X480i video in at least one of two aspect ratios, 16:9 or 4:3.
Video Format	A video format is sufficiently defined such that when itis received at the DTV Monitor, the DTV Monitor has enough information to properly display the video to the user. The definition of each format includes a Video Format Timing, the Picture Aspect Ratio, and a Colorimetry Space.

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Video Format Timing The waveform associated with a video format. Note that a specific Video Format Timing may be associated with more than one Video Format (e.g., 720X480p@4:3 and 720X480p@16:9).

YC_BC_R A general representation of a digital component video signal, where Y represents luminance, C_B represents the color blue, and C_R represents red; The color component may be sub-sampled at half the rate as luminance (4:2:2) or may be sampled at a uniform rate (4:4:4). For the purposes of this standard, it may be considered a digitized form of Y, P_B, P_R.

2.5 Symbols and abbreviations

861	EIA/CEA-861
861A	EIA/CEA-861A
861B	EIA/CEA-861B (this standard)
AFD	Active Format Description
ANSI	American National Standards Institute
A/V	Audio/Video
AR	Aspect Ratio
AV/C	Audio/Video Control
AVI	Auxiliary Video Information
CPU	Central Processing Unit
DBS	Direct Broadcast Satellite
DDWG	Digital Display Working Group
DSC	Digital Still Camera
DTV	Digital Television
DVC	Digital Video Camera
DVD	Digital Versatile Disk
D-VHS	Digital VHS
DVI	Digital Visual Interface [2]
E-DDC	Enhanced Display Data Channel
E-EDID	Enhanced Extended Display Identification Data Standard
EDTV	Enhanced Definition Television
EIA	Electronic Industries Alliance
EUI	Extended Unique Identifier
HDCP	High-bandwidth Digital Content Protection [4]
HDD	Hard Disk Drive
HDTV	High Definition Television
IEC	International Electrotechnical Commission
IEEE	Institute of Electrical and Electronics Engineers
ISO	International Organization for Standardization
ITU	International Telecommunications Union
LAN	Local Area Network
lsb	least significant bit
LVDS	Low Voltage Differential Signaling

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MPEG Moving Picture Experts Group
msb most significant bit
MTS Monitor Timing Specification (a specific VESA standard)
OpenLDI Open LVDS Display Interface [7]
OSD On-Screen Display
OUI Organization Unique Identifier
SDTV Standard Definition Television
SMPTE Society of Motion Picture & Television Engineers
STB Set-Top Box
VESA Video Electronics Standards Association

2.6 Compliance Notation

As used in this document, *"shall"* and *"must"* denote mandatory provisions of the standard. *"Should"* denotes a provision that is recommended but not mandatory. *"May"* denotes a feature whose presence does not preclude compliance and implementation of which is optional. *"Optional"* denotes items that may or may not be present in a compliant device.

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3 OVERVIEW

This document describes requirements on DTV Monitors that include an uncompressed, baseband, digital video interface. These requirements apply to any baseband digital video interface that makes use of VESA E-EDID (structures for discovery of supported video formats) [8] and supports 24-bit RGB at the proper timing. The 60 Hz/59.94 Hz video timings originally defined in 861 are based on analog formats already standardized in EIA-770.2-C [19] and EIA-770.3-C [20]. A preferred physical/link interface is not specified in this standard. See the annexes on how to apply this standard to the individual interfaces available at the time of this writing. Digital Visual Interface (DVI 1.0) [2] and OpenLDI 0.95 [7] were available at the time 861 was first published and can be used to enable an 861-level of functionality. This standard has been enhanced several times since its original release in January 2001. To take advantage of these enhancements, the physical interface also needs a way to transport CEA InfoPackets, digital audio, and YC_BC_R pixels from the source device to the DTV Monitor. Several systems are being developed to take advantage of these enhancements[1].

Enhanced Extended Display Identification Data (E-EDID) was created by VESA to enable plug and play capabilities of monitors. This data, which would be stored in the DTV Monitor, describes video formats that the DTV Monitor is capable of receiving and rendering. The information is supplied to the source device, over the interface, upon the request of the source device. The source device then chooses its output format, taking into account the format of the original video stream and the formats supported by the DTV Monitor. The source device (e.g., STB) is responsible for the format conversions necessary to supply video in an understandable form to the DTV Monitor.

This standard adds the DTM Monitor's ability to describe other capabilities in addition to supported video formats (e.g., digital audio). In those cases, the same basic mechanism applies (i.e., the source device reads EDID data in the DTV Monitor to determine its capabilities and then the source device only sends what the DTV Monitor can understand).

3.1 General Requirements

All systems mentioned above (DVI 1.0, Open LDI 0.95, etc.) require 640x480p (VGA) as base-level support. Therefore, any DTV Monitor complying with this standard shall support 640x480p [10]. Additionally, any DTV Monitor complying with this standard shall also support 720X480p or 720X576p in one of the two picture aspect ratios (4:3 or 16:9) as defined in Section 4.5 or Section 4.9. Additionally, any HDTV Monitor complying with this standard shall also support either 1920x1080i or 1280x720p (with a 16:9 picture aspect ratio) as defined in Sections 4.3 and 4.4 or Sections 4.7 and 4.8.[3]

[3] Note that this implicitly allows any source device (intended to supply content to such a DTV Monitor) to only support 720X480p (720X576p for 50 Hz systems) or 640X480p. For the source device to be able to supply high definition content to any HDTV Monitor, it must be capable of supporting 1920x1080i and 1280x720p since the HDTV Monitor may support only one of the two formats. It implies that, in some cases, the source device (e.g., STB) would need to convert the video from the format at its input (e.g.,

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Formats for 720X480i and 720X576i are also defined in this standard, and are optional. Since these formats were defined in 861 and 861A, the method used to list these formats in EDID can be similar to the method used for the 720X480p, 720X576p, 1920X1080i, and 1280X720p formats. 13 other basic timing formats have been defined in this version of the standard (861B). The method for listing these formats in EDID is new in 861B and will be described in Sections 7 and 7.5.

The physical/link standards in Annexes B & C do not support transport of closed captioning (EIA/CEA-608-B and EIA/CEA-708-B), therefore the source device must undertake any processing of these elements. Specifically, if closed captioning is to be displayed, it must be decoded by the source device, inserted into the video and displayed as open captions. Similarly, System Information, program information, events, service descriptors, etc., if they are displayed, must be graphical information inserted into the video by the source device. Control of closed captioning settings, programs, events, etc. are a feature of the source device, not supported by this interface and beyond the scope of this standard.

Furthermore, content advisory user menus, settings and blocking must be accommodated in the source device, and is beyond the scope of this standard.

Table 2 summarizes display requirements specified by this standard. Incorporated in the same table are recommendations for source devices. These recommendations are based on the CEA's Definitions for Digital Television Products [16]. In the table, the CEA term *tuner* refers to a device that decodes a digital video signal that has been modulated onto an RF carrier and outputs video. To comply with this standard a source device does not have to be a tuner.

720X480i) to one of the formats supported by the DTV over this interface (e.g., 720X480p). For additional guidance for source devices see Table 2 and Section 7.2.5.

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Table 2. 861/861A Video Format Timing Requirements and their Relation to CEA Definitions

60 Hz Systems

CEA Definition	Video Format	EDTV Monitor (Display)	HDTV Monitor (Display)	EDTV Tuner (Source)	HDTV Tuner (Source)
SDTV	720x480i @ 60 Hz	o	o	o	o
EDTV	640x480p @ 60 Hz	✕	✕	✔*	✔*
EDTV	720x480p @ 60 Hz	✕	✕		
HDTV	1280x720p @ 60 Hz	o	✕*	o	✔
HDTV	1920x1080i @ 60 Hz	o		o	✔

50 Hz Systems

CEA Definition	Video Format	EDTV Monitor (Display)	HDTV Monitor (Display)	EDTV Tuner (Source)	HDTV Tuner (Source)
SDTV	720x576i @ 50 Hz	o	o	o	o
EDTV	640x480p @ 60 Hz	✕	✕	✔*	✔*
EDTV	720x576p @ 50 Hz	✕	✕		
HDTV	1280x720p @ 50 Hz	o	✕*	o	✔
HDTV	1920x1080i @ 50 Hz	o		o	✔

Legend

✕	Required by this standard
✕*	Either one of the two formats is required, the other is optional
✔	Recommended by this standard and implied by CEA DTV definitions
✔*	Either one of the two formats is recommended, the other is optional
O	Optional

The formats in Table 3 are new in 861B and are optional for all CEA DTV definitions.

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Table 3. New 861B Video Format Timings (all optional)

60 Hz Systems[4]	50Hz Systems	Film
720(1440)X240p @ 60 Hz	720(1440)X288p @ 50 Hz	1920X1080p @ 24 Hz
(2880)X480i @ 60 Hz	(2880)X576i @ 50 Hz	
(2880)X240p @ 60 Hz	(2880)X288p @ 50 Hz	
1440X480p @ 60 Hz	1440X576p @ 50 Hz	
1920X1080p @ 60 Hz	1920X1080p @ 50 Hz	
1920X1080p @ 30 Hz	1920X1080p @ 25 Hz	

[4] Parentheses indicate instances where pixels are repeated to meet the minimum speed requirements of the interface. For example, in the 720X240p case, the pixels on each line are double-clocked. In the (2880)X480i case, the number of pixels on each line, and thus the number of times that they are repeated, is variable, and is sent to the DTV monitor by the source device.

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4 VIDEO FORMATS AND WAVEFORM TIMINGS

Timing for the uncompressed digital video interface to the DTV Monitor shall support the base format of 640x480p @ 60 Hz.

For 50 Hz systems, the DTV Monitor shall support an additional video format timing of 720X576p @ 50 Hz in at least one of two picture aspect ratios, 4:3 or 16:9. For 60 Hz systems, the DTV Monitor shall support an additional video format timing of 720X480p @ 60 Hz in at least one of two picture aspect ratios, 4:3 or 16:9.

An HDTV Monitor shall support the timing requirements for 1280X720P, 1920X1080i, or both, at the frequency appropriate for its country, 50 Hz or 60 Hz.

The 720X576i @ 50 Hz and 720X480i @ 60 Hz formats are optional and were available in 861 and 861A. All of the formats listed in Table 3 are new and are optional.

To support the 720X480i, 720X576i, 720X240p or 720X288p video formats, the pixels are double clocked for each line to meet the minimum speed requirements of the interface. Thus, 720X480i is referred to as (1440)x480i in Table 4, 720X576i is referred to as (1440)x576i, 720X240p is referred to as (1440)X240p, and 720X288p is referred to as (1440)X288p. Additionally, the “2880” formats ((2880)X480i, (2880)X240p, (2880)X576i, and (2880)X288p) each represent a family of formats in which the pixels are repeated a number of times. The number of times that the pixel is repeated is sent to the DTV Monitor by the source device.

For 60 Hz systems, the DTV Monitor shall be capable of displaying either 59.94 or 60 Hz (frame rate for progressive scan and field rate for interlaced scan) for the formats that it supports. Therefore, the 59.94 Hz and 60 Hz versions of a video format timing shall be considered the same video format with slightly different pixel clocks.

The new 861B low-resolution progressive video format timings can consist of one of several frame formats (i.e., 1440X240p, 2880X240p, 1440X288p, and 2880X288p). These frame formats differ only by one or two scan lines in the vertical blanking interval. For that reason, they are treated as the same video format with a slight variation in the parameters (i.e., handled in a way similar to the 59.94Hz/60Hz formats). For this reason, if a DTV Monitor declares support of one of these video formats of a specific picture aspect ratio (through EDID), then it shall support all variations of that video format of the same picture aspect ratio. The mandatory and optional formats defined in this standard shall comply with the timing parameters in Table 4 and the timing diagrams that follow. DTV Monitors shall be able to accept video whose pixel clock is accurate to within 0.5% of the clock frequency shown in Table 4.

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Table 4. Timing Parameters for the Uncompressed Digital Video Interface

Output Formats (~59.94 Hz)					(Hz)	(kHz)	(MHz)						
Format	V active	Int/Prog	Total Lines	V blanking[1]	V Freq	H Freq	Pixel Freq	H total	H active	H blanking	Aspect[2]	Display[3]	Reference
1	480	Prog	525	45	59.940	31.469	25.175	800	640	160	4x3	CRT/Dig	MTS [10]
2,3	480	Prog	525	45	59.940	31.469	27.000	858	720	138	4x3,16x9	CRT/Dig	770.2 [19]
4	720	Prog	750	30	59.939	44.955	74.175	1650	1280	370	16x9	Dig	770.3 [20]
5	1080	Int	1125	22.5	59.939	33.716	74.175	2200	1920	280	16x9	CRT	770.3 [20]
6,7	480	Int	525	22.5	59.940	15.734	27.000	1716 [4]	1440 [4]	276	4x3,16x9	CRT	770.2 [19]
8,9	240	Prog	262	22.0	60.054	15.734	27.000	1716 [4]	1440 [4]	276	4x3,16x9	CRT	770.2 [19]
8,9	240	Prog	263	23.0	59.826	15.734	27.000	1716 [4]	1440 [4]	276	4x3,16x9	CRT	770.2 [19]
10,11	480	Int	525	22.5	59.940	15.734	54.000	3432 [4]	2880 [4]	552	4x3,16x9	CRT	770.2 [19]
12,13	240	Prog	262	22.0	60.054	15.734	54.000	3432 [4]	2880 [4]	552	4x3,16x9	CRT	770.2 [19]
12,13	240	Prog	263	23.0	59.826	15.734	54.000	3432 [4]	2880 [4]	552	4x3,16x9	CRT	770.2 [19]
14,15	480	Prog	525	45	59.940	31.469	54.000	1716	1440	276	4x3,16x9	CRT/Dig	770.2 [19]
16	1080	Prog	1125	45	59.939	67.432	148.350	2200	1920	280	16x9	Dig	
Output Formats (~60 Hz)[5]					(Hz)	(kHz)	(MHz)						
Format	V active	Int/Prog	Total Lines	V blanking[1]	V Freq	H Freq	Pixel Freq	H total	H active	H blanking	Aspect[2]	Display[3]	Reference
1	480	Prog	525	45	60.000	31.500	25.200	800	640	160	4x3	CRT/Dig	MTS [10]
2,3	480	Prog	525	45	60.000	31.500	27.027	858	720	138	4x3,16x9	CRT/Dig	770.2 [19]
4	720	Prog	750	30	60.000	45.000	74.250	1650	1280	370	16x9	Dig	770.3 [20]
5	1080	Int	1125	22.5	60.000	33.750	74.250	2200	1920	280	16x9	CRT	770.3 [20]
6,7	480	Int	525	22.5	60.000	15.750	27.027	1716 [4]	1440 [4]	276	4x3,16x9	CRT	770.2 [19]
8,9	240	Prog	262	22.0	60.115	15.750	27.027	1716 [4]	1440 [4]	276	4x3,16x9	CRT	770.2 [19]
8,9	240	Prog	263	23.0	59.886	15.750	27.027	1716 [4]	1440 [4]	276	4x3,16x9	CRT	770.2 [19]
10,11	480	Int	525	22.5	60.000	15.750	54.054	3432 [4]	2880 [4]	552	4x3,16x9	CRT	770.2 [19]
12,13	240	Prog	262	22.0	60.115	15.750	54.054	3432 [4]	2880 [4]	552	4x3,16x9	CRT	770.2 [19]
12,13	240	Prog	263	23.0	59.886	15.750	54.054	3432 [4]	2880 [4]	552	4x3,16x9	CRT	770.2 [19]
14,15	480	Prog	525	45	60.000	31.500	54.054	1716	1440	276	4x3,16x9	CRT/Dig	770.2 [19]
16	1080	Prog	1125	45	60.000	67.500	148.500	2200	1920	280	16x9	Dig	
Output Formats (~50 Hz)					(Hz)	(kHz)	(MHz)						
Format	V active	Int/Prog	Total Lines	V blanking[1]	V Freq	H Freq	Pixel Freq	H total	H active	H blanking	Aspect[2]	Display[3]	Reference
17,18	576	Prog	625	49	50.000	31.250	27.000	864	720	144	4x3,16x9	CRT/Dig	BT1358[31]
19	720	Prog	750	30	50.000	37.500	74.250	1980	1280	700	16x9	Dig	296M[14]
20	1080	Int	1125	22.5	50.000	28.125	74.250	2640	1920	720	16x9	CRT	274M[12]
21,22	576	Int	625	24.5	50.000	15.625	27.000	1728 [4]	1440 [4]	276	4x3,16x9	CRT	BT656-4[33]
23,24	288	Prog	312	24.0	50.080	15.625	27.000	1728 [4]	1440 [4]	276	4x3,16x9	CRT	BT656-4[33]
23,24	288	Prog	313	25.0	49.920	15.625	27.000	1728 [4]	1440 [4]	276	4x3,16x9	CRT	BT656-4[33]
23,24	288	Prog	314	26.0	49.761	15.625	27.000	1728 [4]	1440 [4]	276	4x3,16x9	CRT	BT656-4[33]
25,26	576	Int	625	24.5	50.000	15.625	54.000	3456 [4]	2880 [4]	552	4x3,16x9	CRT	BT656-4[33]
27,28	288	Prog	312	24.0	50.080	15.625	54.000	3456 [4]	2880 [4]	552	4x3,16x9	CRT	BT656-4[33]
27,28	288	Prog	313	25.0	49.920	15.625	54.000	3456 [4]	2880 [4]	552	4x3,16x9	CRT	BT656-4[33]
27,28	288	Prog	314	26.0	49.761	15.625	54.000	3456 [4]	2880 [4]	552	4x3,16x9	CRT	BT656-4[33]
29,30	576	Prog	625	49	50.000	31.250	54.000	1728	1440	288	4x3,16x9	CRT/Dig	BT1358[31]
31	1080	Prog	1125	45	50.000	56.250	148.500	2640	1920	720	16x9	Dig	274M[12]
Output Formats (~23.97, 24, 25, 29.97, 30 Hz)													
Format	V active	Int/Prog	Total Lines	V blanking[1]	V Freq	H Freq	Pixel Freq	H total	H active	H blanking	Aspect[2]	Display[3]	Reference
32	1080	Prog	1125	45	23.976	26.973	74.175	2750	1920	830	16x9	CRT/Dig	274M[12]
32	1080	Prog	1125	45	24.000	27.000	74.250	2750	1920	830	16x9	CRT/Dig	274M[12]
33	1080	Prog	1125	45	25.000	28.125	74.250	2640	1920	720	16x9	CRT/Dig	274M[12]
34	1080	Prog	1125	45	29.970	33.716	74.175	2200	1920	280	16x9	CRT/Dig	274M[12]
34	1080	Prog	1125	45	30.000	33.750	74.250	2200	1920	280	16x9	CRT/Dig	274M[12]

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Table 4 Notes

[1]V blanking Note: fractional values indicate that the number of blanking lines varies (see timing diagram for more details).

[2]Picture Aspect Ratio Note: the display will state what picture aspect ratios it supports for a given format, and the source can choose how to support it. For example, with the 720X480 (16x9) data format and a 4x3 display, the source could (1) use pan and scan information to crop the data to 540 horizontal pixels and then resample up to the required 720 pixels for output to the display or (2) vertically resample to 360 lines and create bars of 60 lines above and below it to send this "letterbox" with the required 480 lines for output. Other picture scaling methods are possible in either source device or DTV Monitor. For example, picture aspect ratio scaling (picture expand, shrink, etc.) can be accomplished in the source device, including, possibly, added black/gray lines in the addressable pixel portion of the video. The exception to this is the 640x480 format, which is always sent as 4x3 data, and it is up to the display to determine how it wants to display it.

[3]Display Note: this category is not exclusive, but merely states the main target, Cathode Ray Tubes or Digital Displays.

[4]480i, 240p, 576i, and 288p Note: the pixels for the 720x*N* formats (where *N* is the number of lines) are double clocked for each line to meet minimum speed requirements of the interface, thus H active is shown as 1440, instead of 720. Each pixel of the 2880x*N* formats is repeated a variable number of times. The repeat value is communicated using the AVI InfoFrames (see Section 6.1.3).

[5]Format Note: For 60 Hz formats, the display will respond automatically to either 60 Hz or 59.94 Hz (same format with slightly different clocks). The 25.2 MHz pixel frequency value is within the +/-0.5% (allowed in the VESA MTS [10]) of 25.175 MHz. The 480p formats and the 480i formats are typically 59.94 Hz, and the HDTV formats are typically 60 Hz.

4.1 Aspect Ratio

The 480p, 480i, 240p, 576p, 576i, and 288p formats are available in two different aspect ratios (4:3 and 16:9). Video formats with different picture aspect ratios are considered different formats that can be independently supported and discovered.

As can be seen in the timing diagrams, there is no difference in the timing parameters for video formats that have different picture aspect ratios but are otherwise the same (e.g., 720X480p). For a display device to simultaneously support both formats, the source device needs a way to let the display device know the picture aspect ratio in which the video should be displayed. When EIA/CEA-861 was published, methods to indicate Picture Aspect Ratio were not defined and the recommendation was that the DTV Monitor should list only one picture aspect ratio of 720X480p and only one picture aspect ratio of 720X480i in the E-EDID structure at any given time and the signal shall be processed accordingly. For this standard, it is now mandatory that a DTV Monitor list only one picture aspect ratio of 720X480p (720X576p for 50 Hz countries) and only one picture aspect ratio of 720X480i (720X576i for 50 Hz countries) at a time unless it is capable of receiving and decoding the AVI defined in Section 6. Many of the new formats (e.g., 720X240p, (2880)X240p, (2880)X480i, 1440X480p, etc.) are also available in two different picture aspect ratios. However, if any of these formats are supported in the DTV Monitor, then it is required that CEA EDID Timing Extension Version 3 be used in the EDID data structure (see Section 7.1.3). This implies that these formats will not be supported in implementations that do not also support reception of the AVI InfoFrame Version 2.

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It was possible for a DTV Monitor compliant with EIA/CEA-861 to support both aspect ratios of the 720X480 formats as a user programmable option on the DTV Monitor. In that case, the EDID 18-byte detailed timing descriptor could be modified to reflect the proper picture aspect ratio. It is recommended that source devices (e.g., STB) periodically reread the EDID information.

The effects on the EDID data structure as well as backward compatibility to 861 devices are explained in Section 7.2.4.

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4.2 640x480p @59.94/60 Hz (Format 1)

This timing is based on the timing in *VESA Monitor Timings Specification,* version 1.0 revision 0.8 [10]. The only difference is where VESA defines blanking as not including the border while this document includes the border within the blanking interval. Unlike the other formats, PC quantization levels (i.e., 256 levels in the case of RGB) are used for this format.

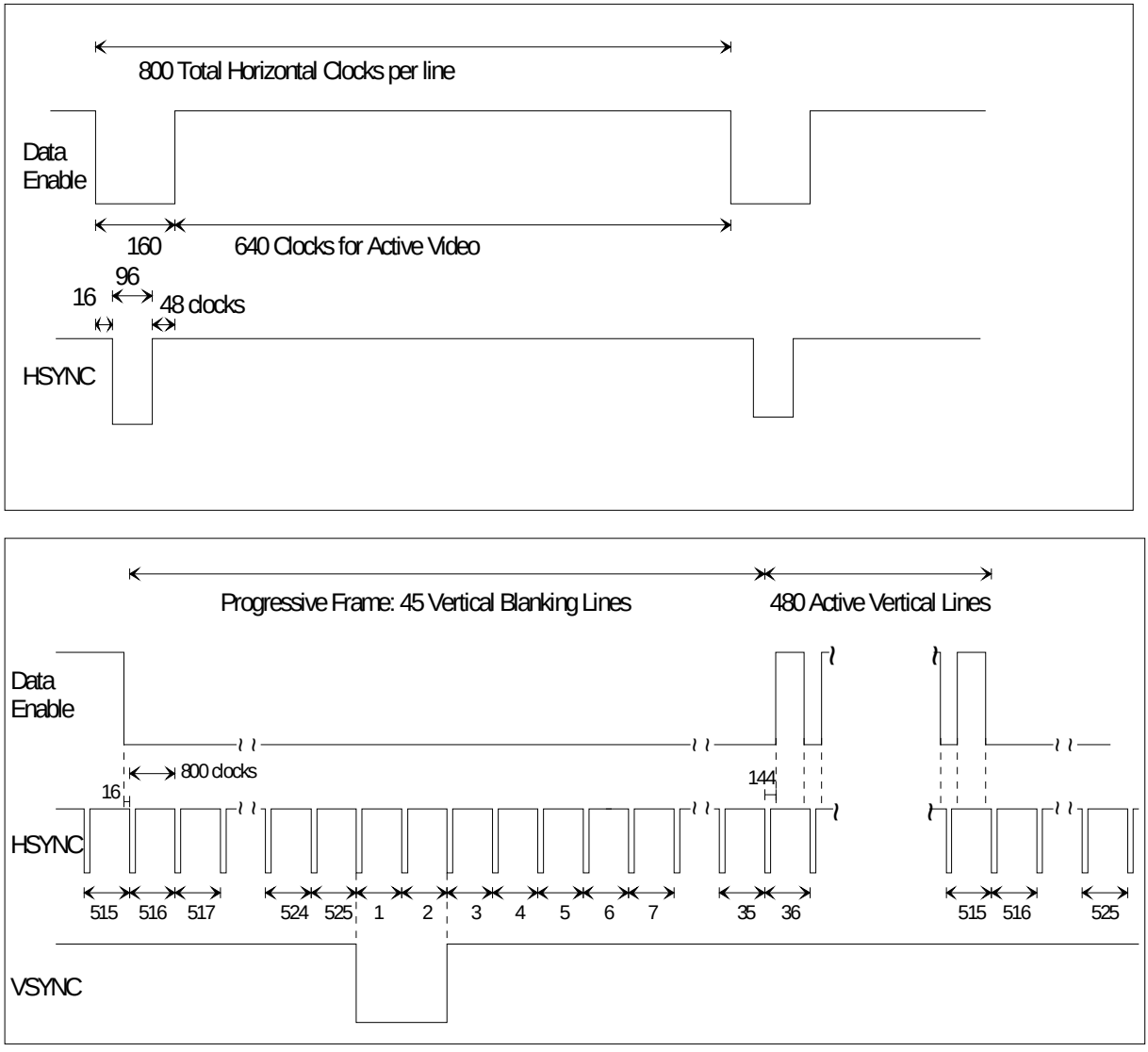

Figure 2. Timing parameters for 640x480p @ 59.94/60 Hz.

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4.3 1280x720p @59.94/60 Hz (Format 4)

This timing is based on EIA/CEA-770.3-C [20], but there are two differences. First, EIA/CEA-770.3-C uses tri-level sync, while this document uses bi-level. Bi-level sync timing is accomplished using the second half of the EIA/CEA-770.3-C tri-level sync, defining the actual sync time to be the rising edge of that pulse.

Second, EIA/CEA-770.3-C uses a composite sync while this document uses separate sync signals, thus eliminating the need for serrations during vertical sync.

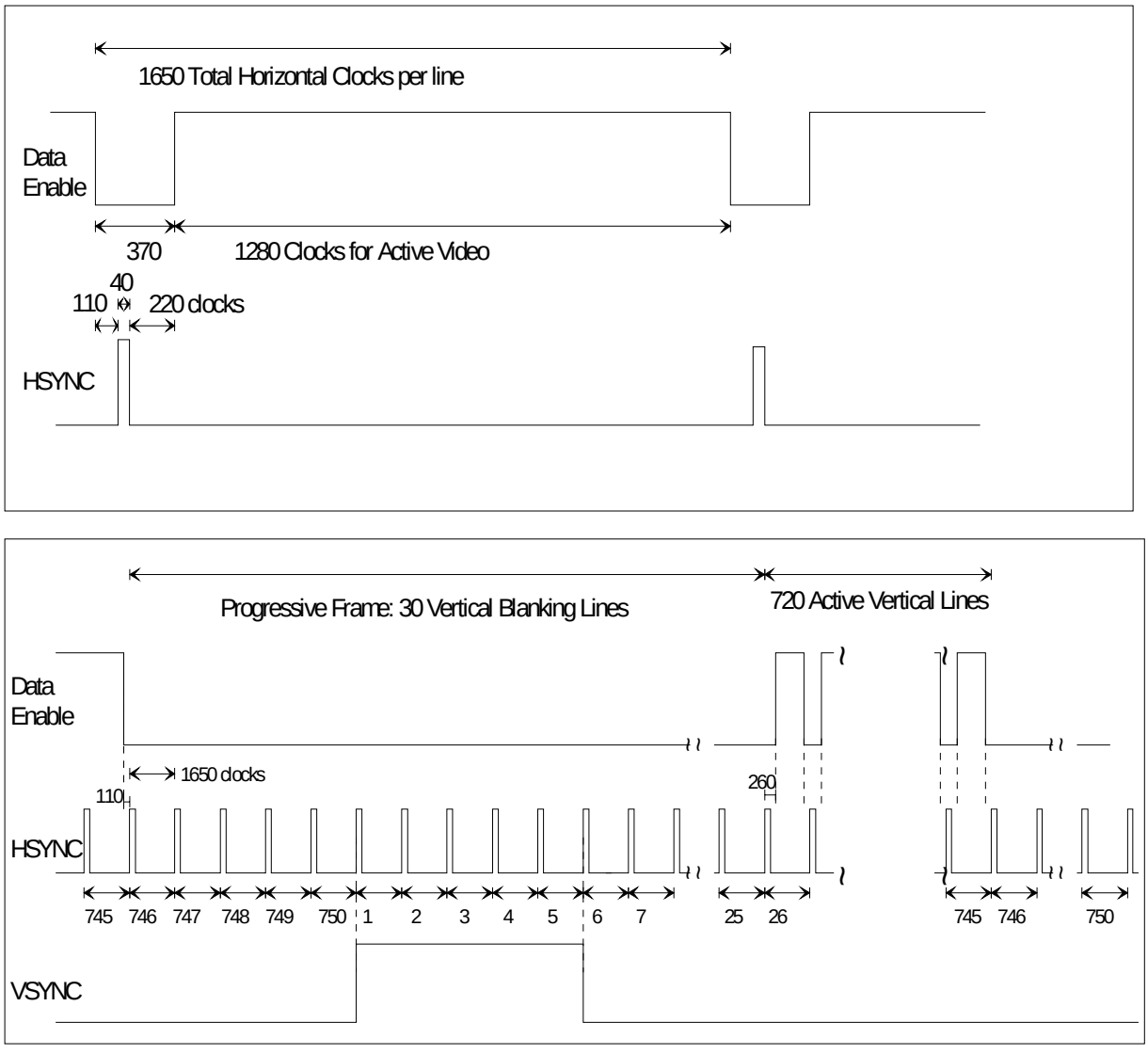

Figure 3. Timing parameters for 1280x720p @ 59.94/60 Hz.

Obtained from GLOBAL ENGINEERING DOCUMENTS
15 Inverness Way E. Englewood, CO 80112 (303)397-7956 (800)854-7179
<OPTION name="EXPANSION" />
<OPTION name="SESSION" />

4.4 1920x1080i @59.94/60 Hz (Format 5)

This timing is based on EIA/CEA-770.3-C [20], but there are two differences: First, EIA/CEA-770.3-C uses tri-level sync, while this document uses bi-level. Bi-level sync timing is accomplished using the second half of the EIA/CEA-770.3-C tri-level sync, defining the actual sync time to be the rising edge of that pulse.

Second, EIA/CEA-770.3-C uses a composite sync while this document uses separate sync signals, thus eliminating the need for serrations during vertical sync.

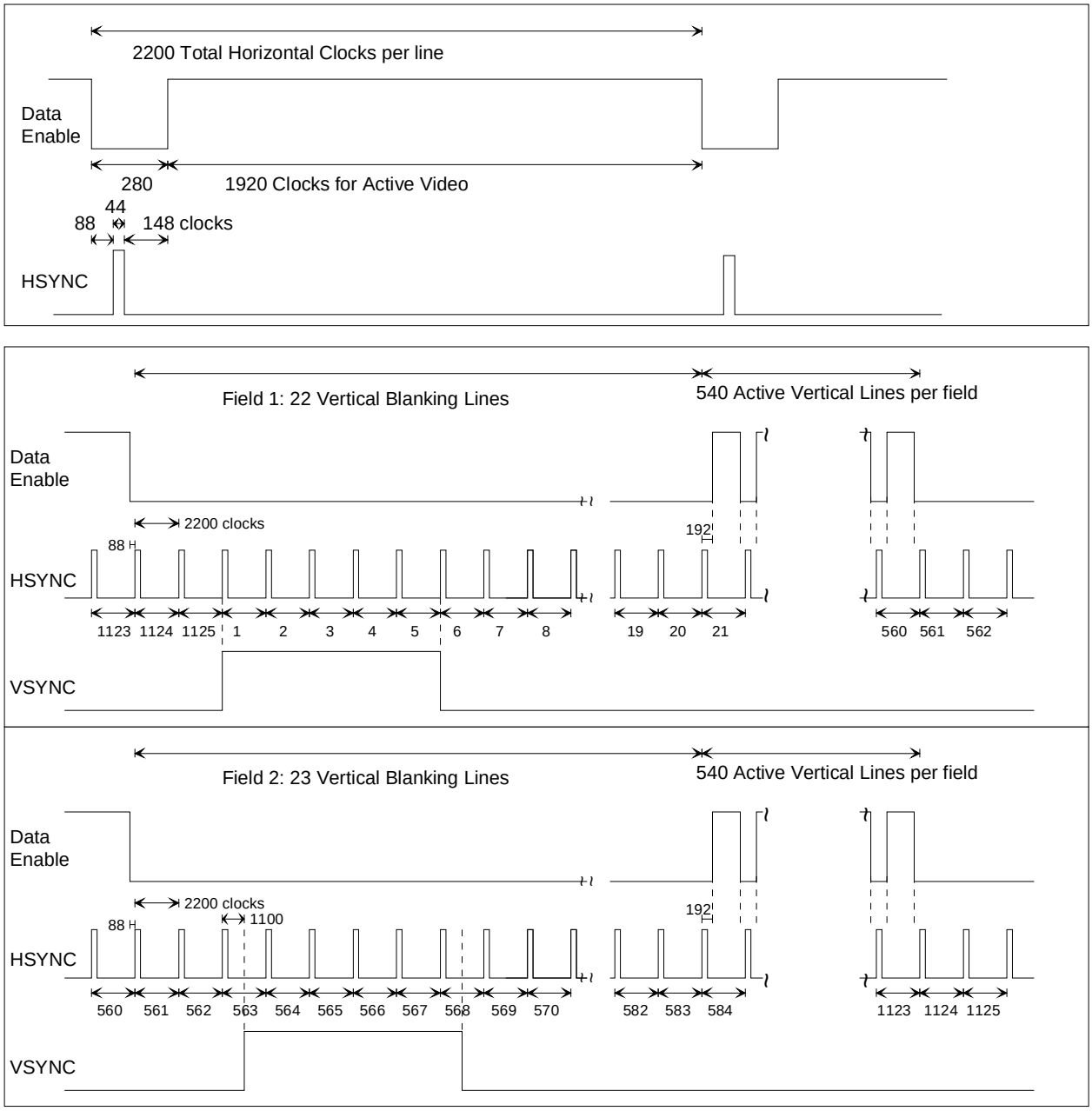

Figure 4. Timing parameters for 1920x1080i @ 59.94/60 Hz.

Obtained from GLOBAL ENGINEERING DOCUMENTS
15 Inverness Way E. Englewood, CO 80112 (303)397-7956 (800)854-7179
<OPTION name="EXPANSION" />
<OPTION name="SESSION" />

4.5 720x480p @59.94/60 Hz (Formats 2 & 3)

This timing is based on EIA/CEA-770.2-C [19], with one difference. EIA/CEA-770.2-C has a composite sync while this document uses separate sync signals, thus eliminating the need for serrations during vertical sync. This format timing can use either 4:3 or 16:9 aspect ratio. The DTV Monitor tells the source device, through the EDID structure, which formats it supports. The source device then formats the picture and scales the horizontal resolution for proper display.

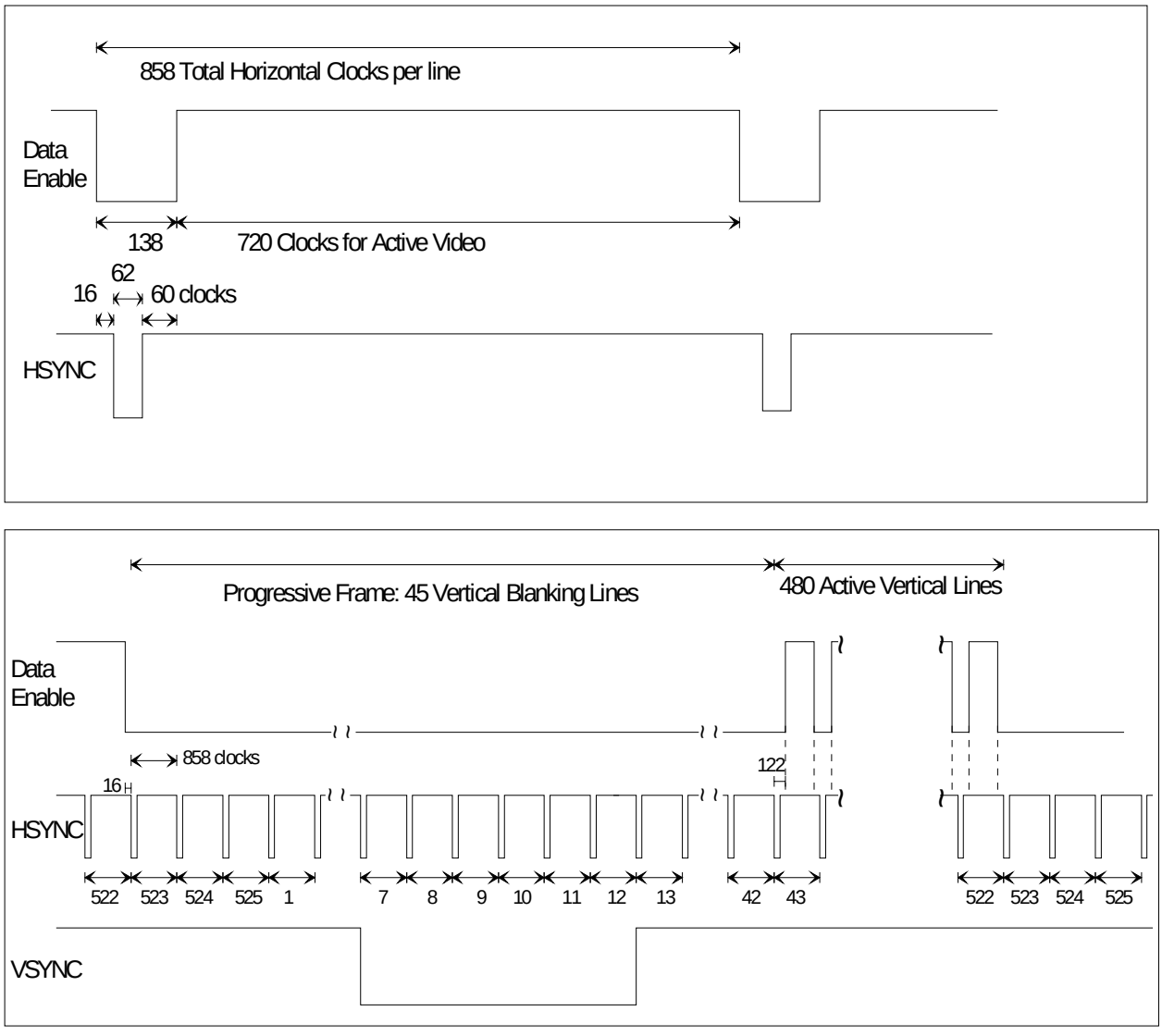

Figure 5. Timing parameters for 720x480p @ 59.94/60 Hz.

Obtained from GLOBAL ENGINEERING DOCUMENTS
15 Inverness Way E. Englewood, CO 80112 (303)397-7956 (800)854-7179
<OPTION name="EXPANSION" />
<OPTION name="SESSION" />

4.6 720(1440)x480i @59.94/60 Hz (Formats 6 & 7)

This timing is based on EIA/CEA-770.2-C [19], with a few differences. EIA/CEA-770.2-C has a composite sync while this document uses separate sync signals, thus eliminating the need for serrations during vertical sync. This format also assumes the pixels are double clocked to meet minimum clock speed requirements for the interface. This format timing can use either 4:3 or 16:9 aspect ratio. The DTV Monitor tells the source device, through the EDID structure, which formats it supports. The source device then formats the picture and scales the horizontal resolution for proper display.

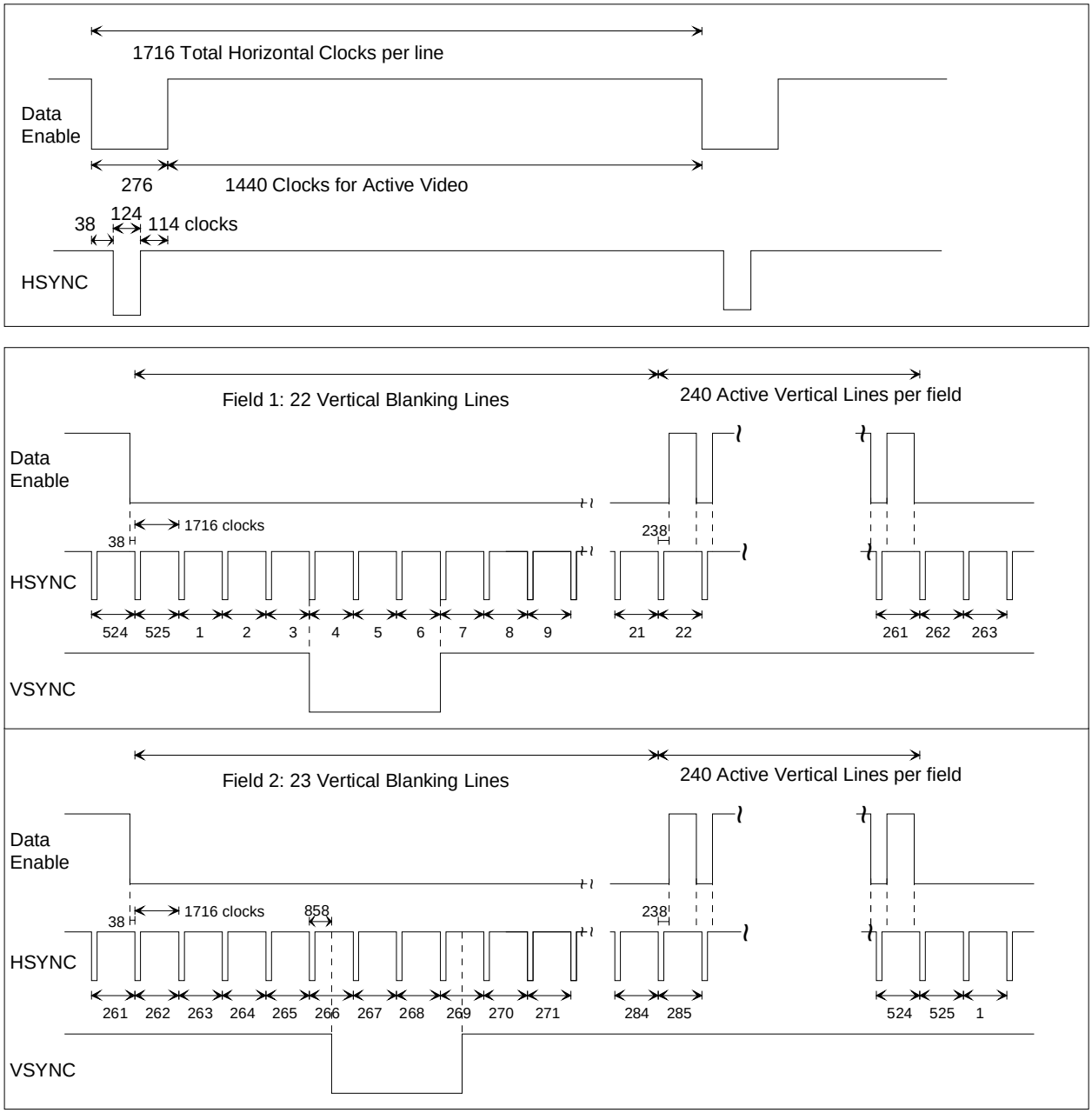

Figure 6. Timing Parameters for 720(1440)X480i @ 59.94/60 Hz.

Obtained from GLOBAL ENGINEERING DOCUMENTS
15 Inverness Way E. Englewood, CO 80112 (303)397-7956 (800)854-7179
<OPTION name="EXPANSION" />
<OPTION name="SESSION" />

4.7 1280X720p @ 50 Hz (Format 19)

This timing is based on SMPTE 296M [14], but there are two differences. First, SMPTE 296M uses tri-level sync, while this document uses bi-level. Bi-level sync timing is accomplished using the second half of the SMPTE 296M tri-level sync, defining the actual sync time to be the rising edge of that pulse.

Second, SMPTE 296M uses a composite sync while this document uses separate sync signals, thus eliminating the need for serrations during vertical sync.

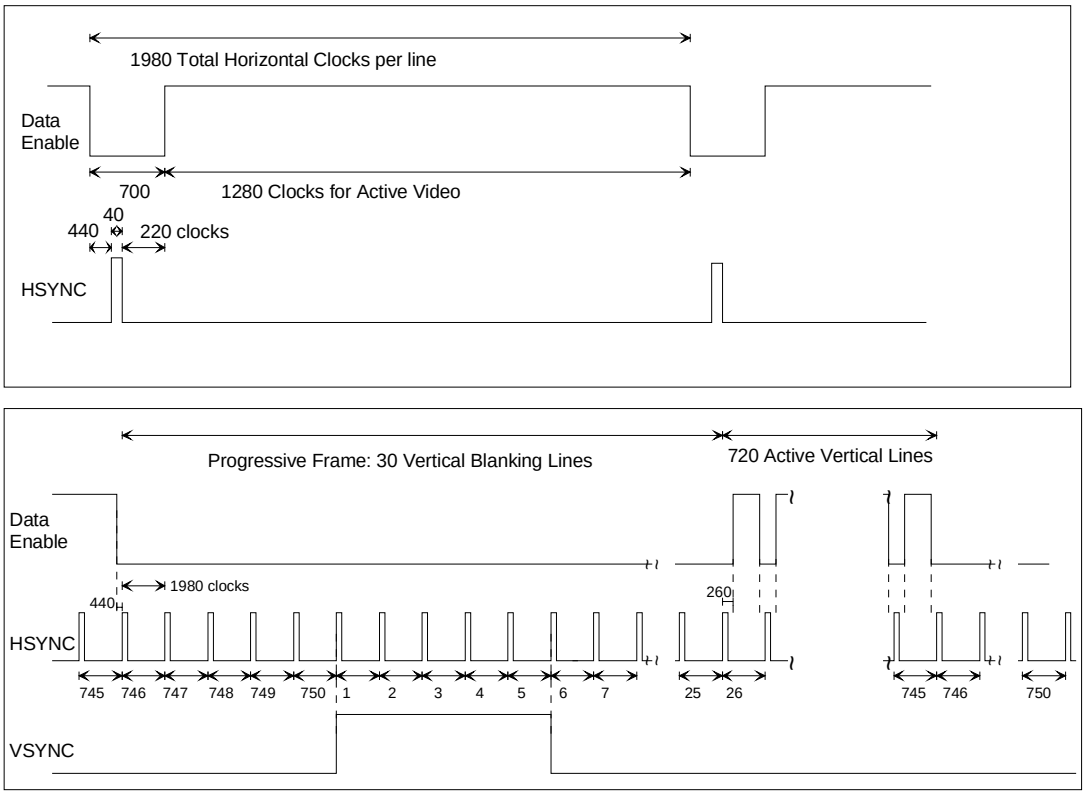

Figure 7. Timing parameters for 1280x720p @ 50 Hz.

Obtained from GLOBAL ENGINEERING DOCUMENTS
15 Inverness Way E. Englewood, CO 80112 (303)397-7956 (800)854-7179
<OPTION name="EXPANSION" />
<OPTION name="SESSION" />

4.8 1920X1080i @ 50 Hz (Format 20)

This timing is based on SMPTE 274M [12], but there are two differences: First, SMPTE 274M uses tri-level sync, while this document uses bi-level. Bi-level sync timing is accomplished using the second half of the SMPTE 274M tri-level sync, defining the actual sync time to be the rising edge of that pulse.

Second, SMPTE 274M uses a composite sync while this document uses separate sync signals, thus eliminating the need for serrations during vertical sync.

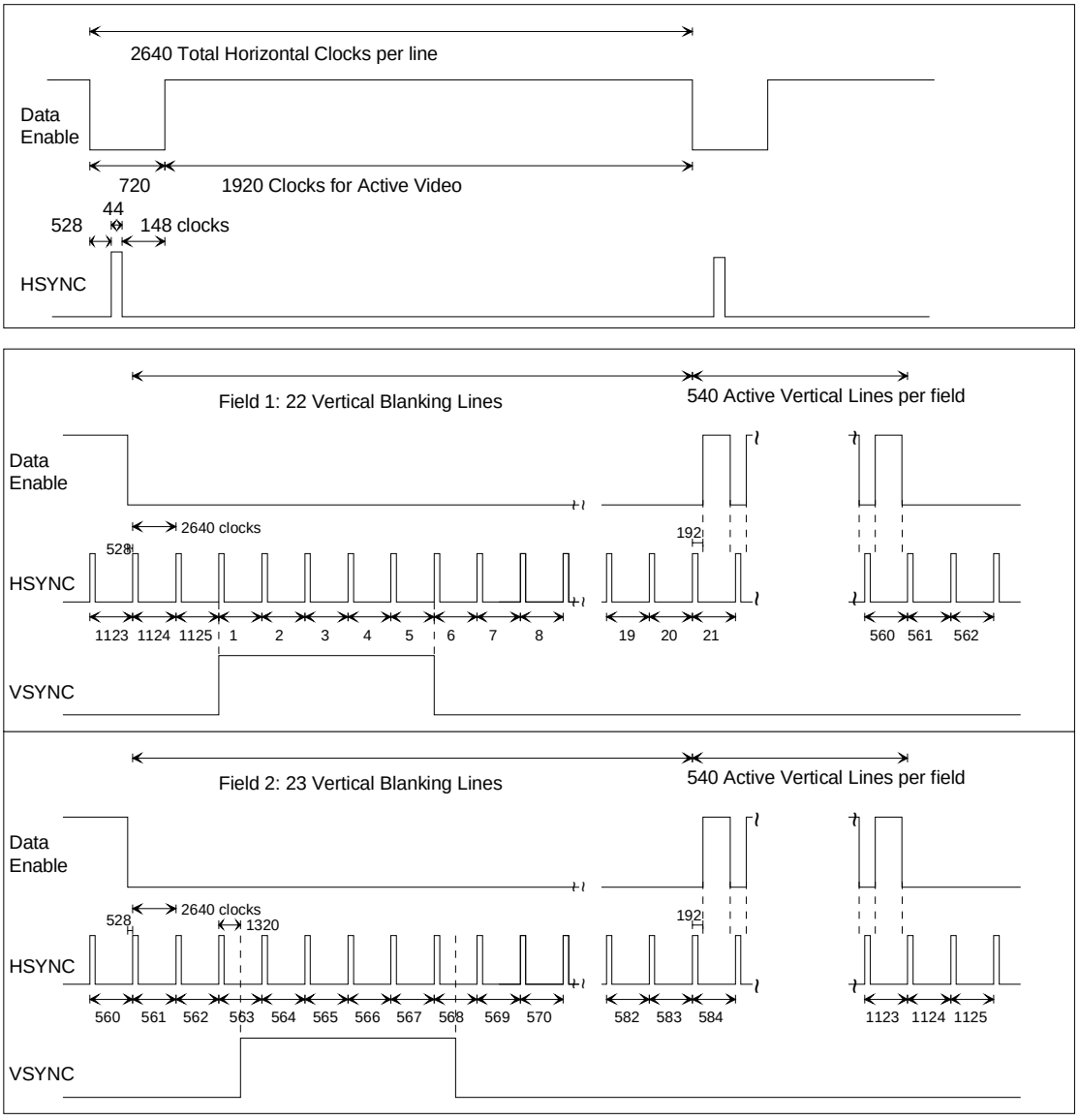

Figure 8. Timing parameters for 1920x1080i @ 50 Hz.

Obtained from GLOBAL ENGINEERING DOCUMENTS
15 Inverness Way E. Englewood, CO 80112 (303)397-7956 (800)854-7179
<OPTION name="EXPANSION" />
<OPTION name="SESSION" />

4.9 720X576p @ 50 Hz (Formats 17 & 18)

This timing is based on ITU-R BT.1358 [31]. This format timing can use either 4:3 or 16:9 aspect ratio. The DTV tells the Video Source, through the EDID structure, which formats it supports. The Video Source then formats the picture and scales the horizontal resolution for proper display.

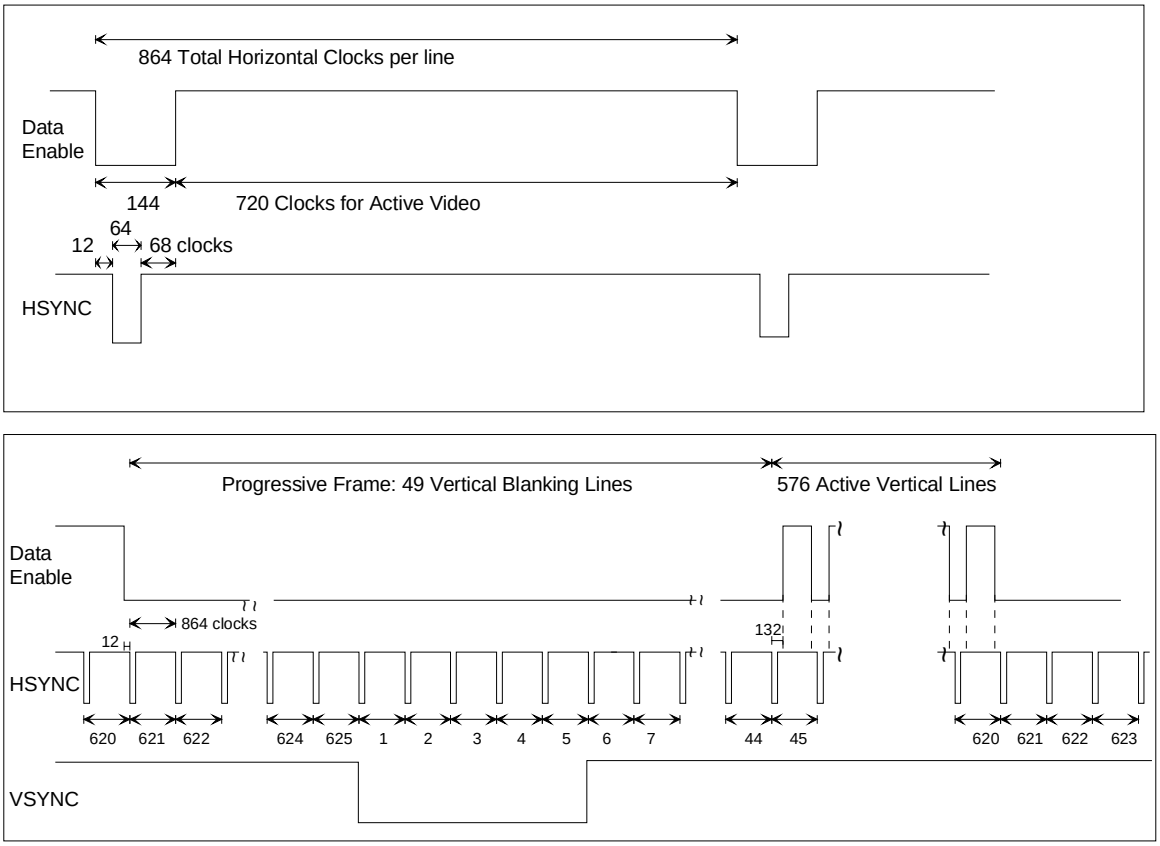

Figure 9. Timing parameters for 720x576p @ 50 Hz.

Obtained from GLOBAL ENGINEERING DOCUMENTS
15 Inverness Way E. Englewood, CO 80112 (303)397-7956 (800)854-7179
<OPTION name="EXPANSION" />
<OPTION name="SESSION" />

4.10 720(1440)X576i @ 50 Hz (Formats 21 & 22)

This timing is based on ITU-R BT.656–4 [33] except for horizontal and vertical synchronization pulse durations, which are specified in ITU-R BT.711–1 [34] and ITU-R BT.470–6 [32]. This format assumes the pixels are double clocked to meet minimum clock speed requirements for the interface. Thus, the clock is 27 MHz. This format timing can use either 4:3 or 16:9 aspect ratio. The DTV Monitor tells the Video Source, through the EDID structure, which formats it supports. The Video Source then formats the picture and scales the horizontal resolution for proper display.

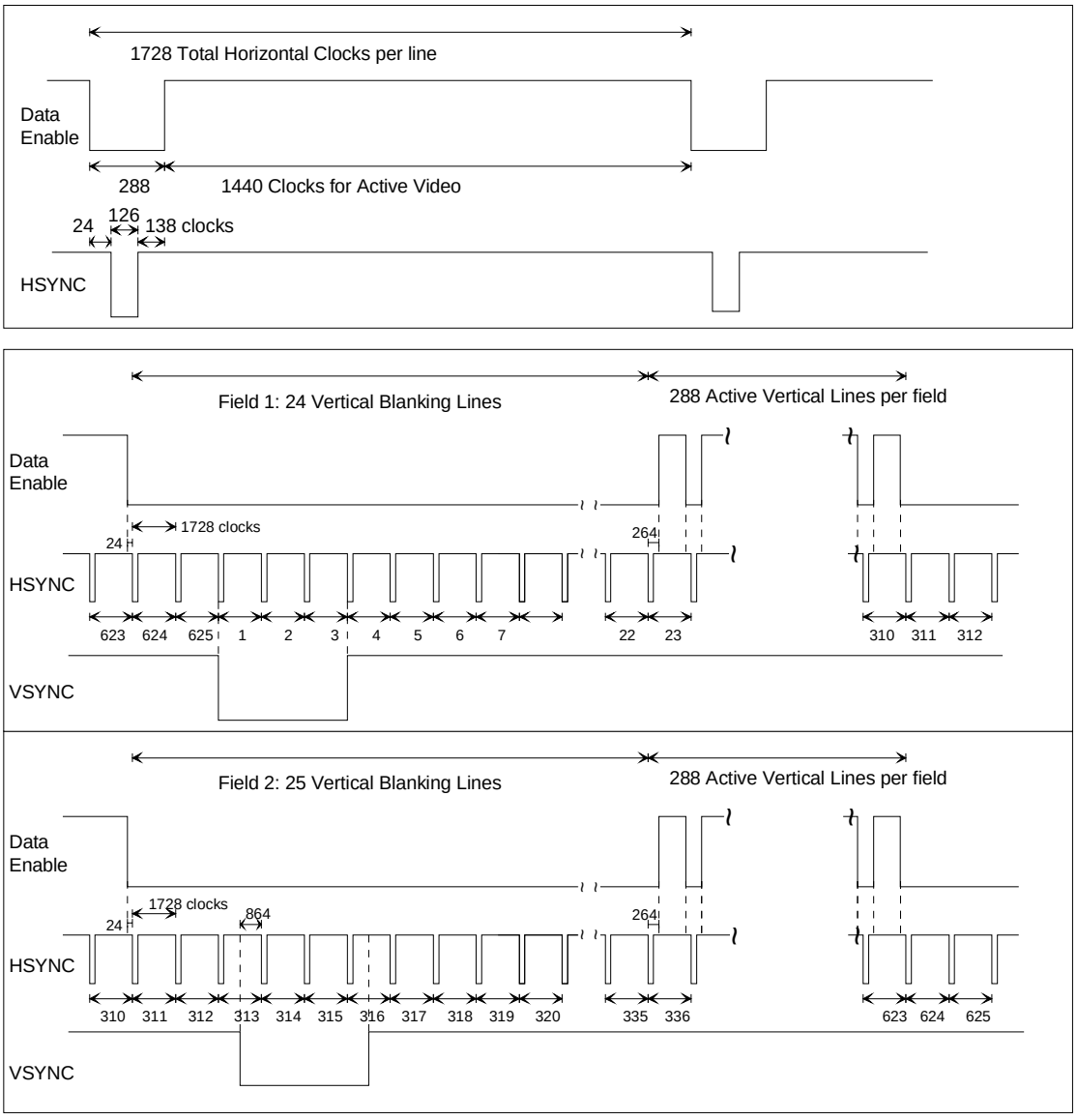

Figure 10. Timing Parameters for 720(1440)x576i @ 50 Hz

Obtained from GLOBAL ENGINEERING DOCUMENTS
15 Inverness Way E. Englewood, CO 80112 (303)397-7956 (800)854-7179
<OPTION name="EXPANSION" />
<OPTION name="SESSION" />

4.11 720(1440)X240p @ 59.94/60 Hz (Formats (8 & 9)

This format assumes the pixels are double clocked to meet minimum clock speed requirements for the interface. There are two possible frame formats that differ only in the number of lines in the vertical blanking interval of the frame. Both are considered variations of the same format. This format timing can use either 4:3 or 16:9 aspect ratio. The DTV Monitor tells the source device through the EDID structure, which formats it supports. The source device then formats the picture and scales the horizontal resolution for the proper display. Designers should be aware that this format was not defined at the time when EIA/CEA-861 was published. Therefore, an 861 type source box will probably not recognize this format in an 18-byte detailed timing descriptor.

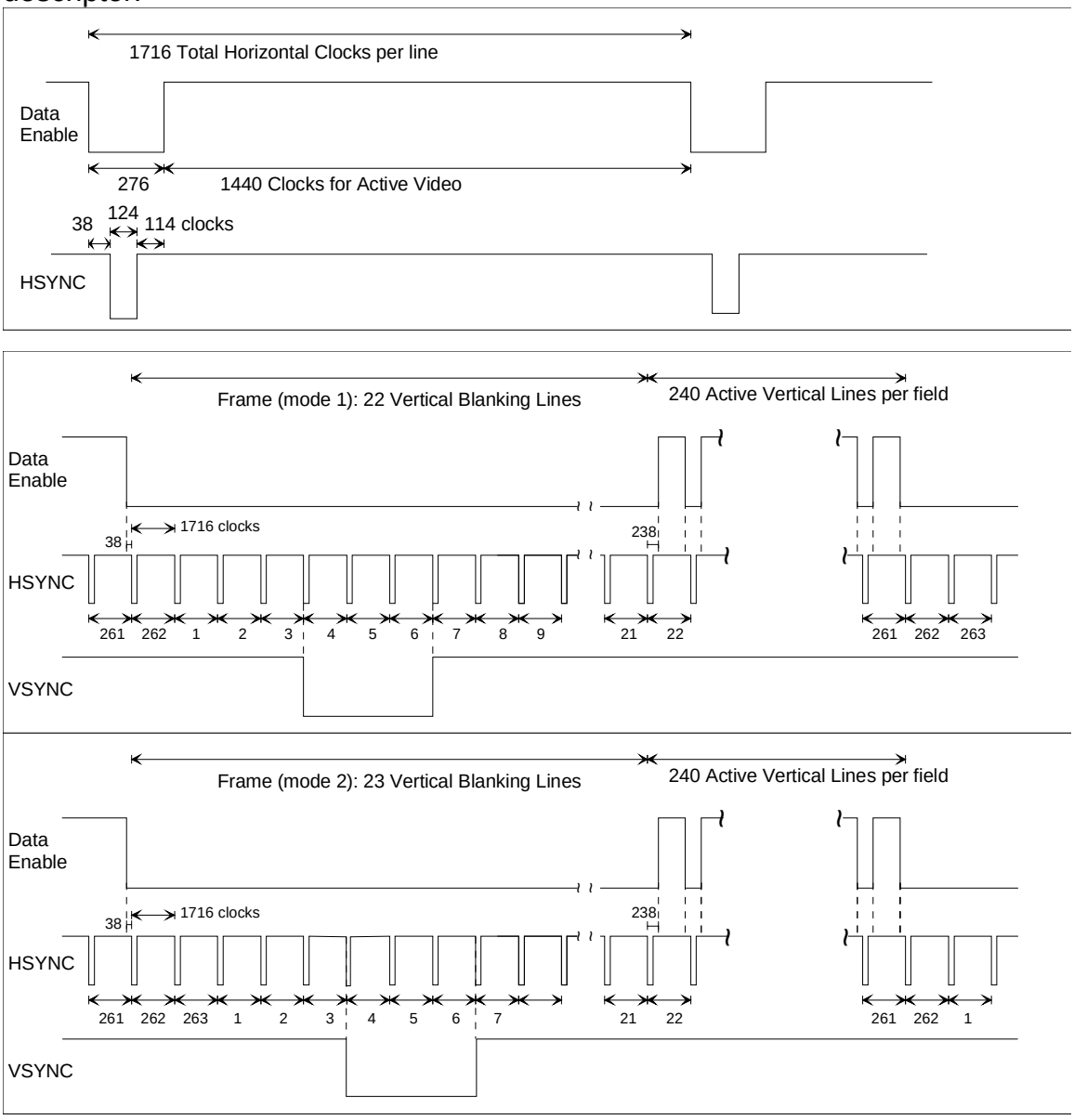

Figure 11. Timing Parameters for 720(1440)X240p @ 59.94/60 Hz.

Obtained from GLOBAL ENGINEERING DOCUMENTS
15 Inverness Way E. Englewood, CO 80112 (303)397-7956 (800)854-7179
<OPTION name="EXPANSION" />
<OPTION name="SESSION" />

4.12 (2880)X480i @ 59.94/60 Hz (Formats 10 & 11)

This format is a superset of a variety of video formats used in various game consoles. This format is unique in that, depending upon the pixel repetition factor specified in the AVI InfoFrame, this format can represent any of the following typical formats:

- 2880/10=288 pixels/line
- 2880/8=360 pixels/line
- 2880/7=411 pixels/line
- 2880/5=576 pixels/line
- 2880/4=720 pixels/line

The pixel repetition factor is specified in the AVI. The DTV Monitor indicates it can accept any of the formats implied by this format superset through EDID.

This format will also typically have bars on the left and right sides. These bars will be 160/*n* pixels wide where *n* is the repetition factor.

This format timing can use either 4:3 or 16:9 aspect ratio. The DTV Monitor tells the source device through the EDID structure, which formats it supports. The source device then formats the picture and scales the horizontal resolution for the proper display.

Designers should be aware that this format was not defined at the time when EIA/CEA-861 was published. Because of the repetition factor, this format cannot be used in legacy 861/861A implementations.

Obtained from GLOBAL ENGINEERING DOCUMENTS
15 Inverness Way E. Englewood, CO 80112 (303)397-7956 (800)854-7179
<OPTION name="EXPANSION" />
<OPTION name="SESSION" />

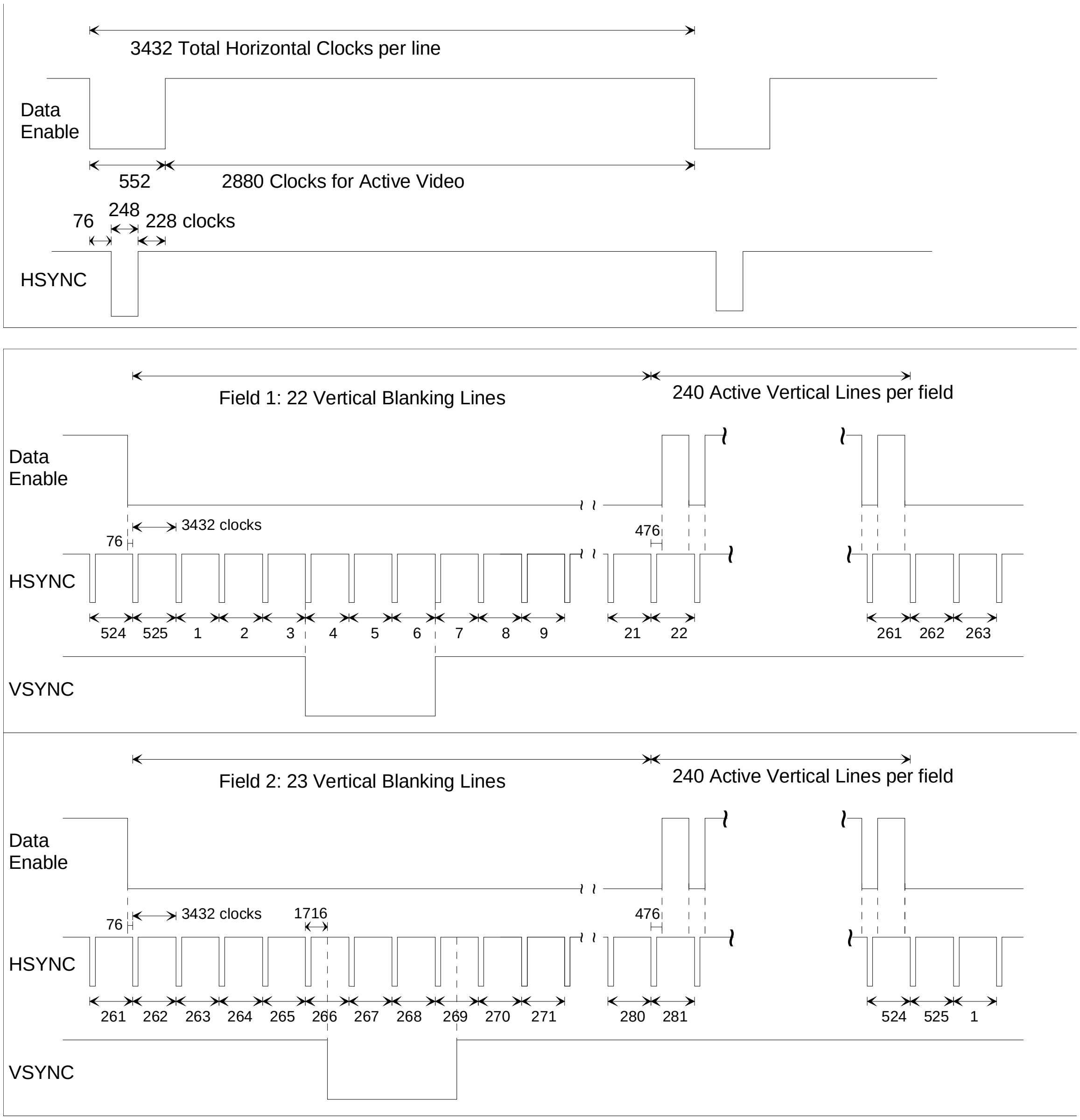

Figure 12. Timing Parameters for (2880)X480i @ 59.94/60 Hz.

Obtained from GLOBAL ENGINEERING DOCUMENTS
15 Inverness Way E. Englewood, CO 80112 (303)397-7956 (800)854-7179
<OPTION name="EXPANSION" />
<OPTION name="SESSION" />

4.13 (2880)X240p @ 59.94/60 Hz (Formats 12 & 13)

This format is a superset of a variety of video formats used in various game consoles. This format is unique in that, depending upon the pixel repetition factor specified in the AVI InfoFrame, this format can represent any of the following typical formats:

- 2880/10=288 pixels/line
- 2880/8=360 pixels/line
- 2880/7=411 pixels/line
- 2880/5=576 pixels/line
- 2880/4=720 pixels/line

The pixel repetition factor is specified in the AVI. The DTV Monitor indicates it can accept any of the formats implied by this format superset through EDID.

This format will also typically have bars on the left and right sides. These bars will be 160/*n* pixels wide where *n* is the repetition factor.

There are two possible frame formats that differ only in the number of lines in the vertical blanking interval of the frame. Both are considered variations of the same format.

This format timing can use either 4:3 or 16:9 aspect ratio. The DTV Monitor tells the source device through the EDID structure, which formats it supports. The source device then formats the picture and scales the horizontal resolution for the proper display.

Designers should be aware that this format was not defined at the time when EIA/CEA-861 was published. Because of the repetition factor, this format cannot be used in legacy 861 implementations.

Obtained from GLOBAL ENGINEERING DOCUMENTS
15 Inverness Way E. Englewood, CO 80112 (303)397-7956 (800)854-7179
<OPTION name="EXPANSION" />
<OPTION name="SESSION" />

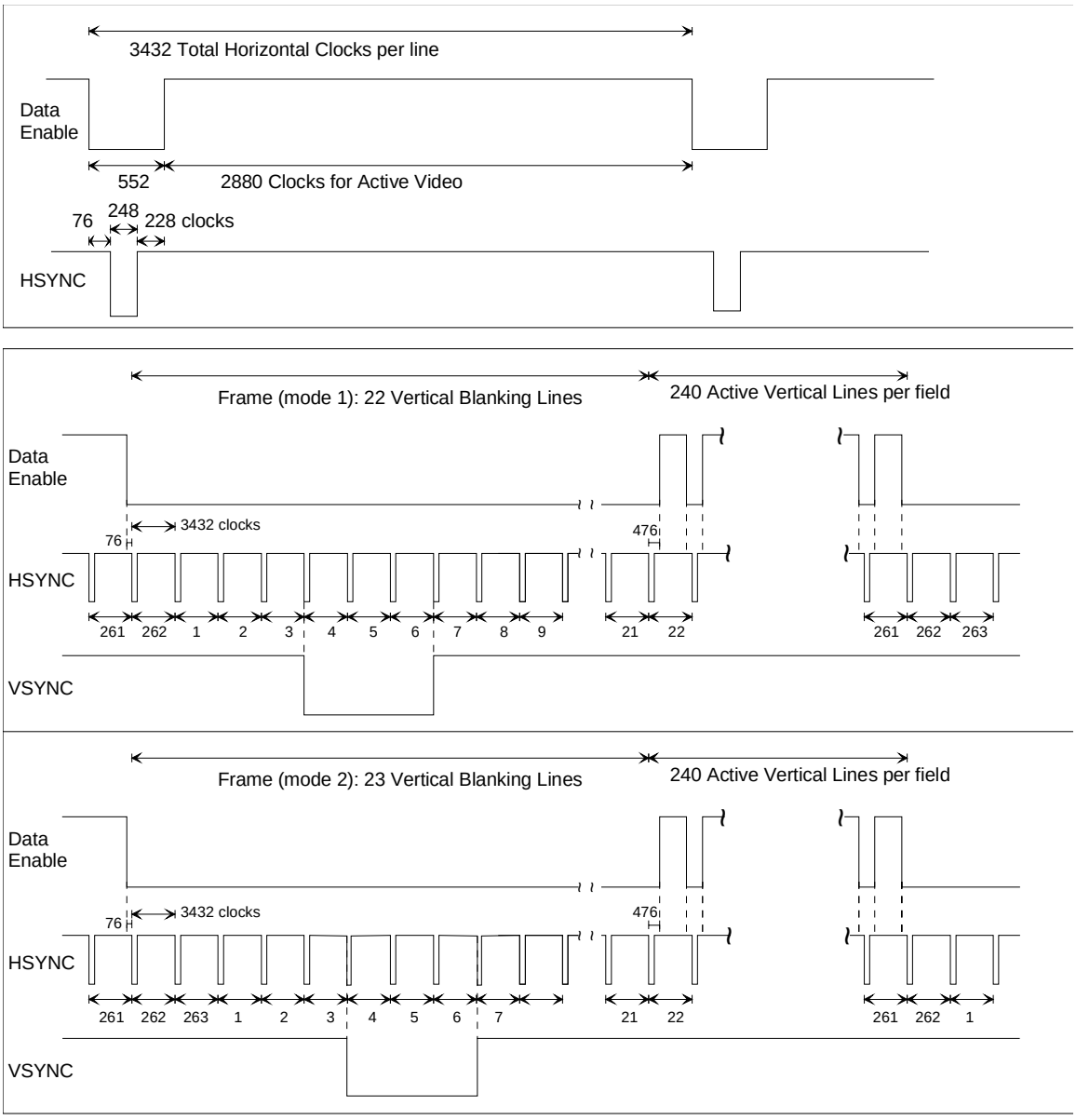

Figure 13. Timing Parameters for (2880)X240p @ 59.94/60 Hz.

Obtained from GLOBAL ENGINEERING DOCUMENTS
15 Inverness Way E. Englewood, CO 80112 (303)397-7956 (800)854-7179
<OPTION name="EXPANSION" />
<OPTION name="SESSION" />

4.14 1440X480p @ 59.94/60 Hz (Formats 14 & 15)

This format is for high-end DVD Players. It can use either 4:3 or 16:9 aspect ratio. The DTV Monitor tells the source device through the EDID structure, which formats it supports. The source device then formats the picture and scales the horizontal resolution for the proper display. Designers should be aware that this format was not defined at the time when EIA/CEA-861 was published. Therefore, an 861 type source box will probably not recognize this format in an 18-byte detailed timing descriptor.

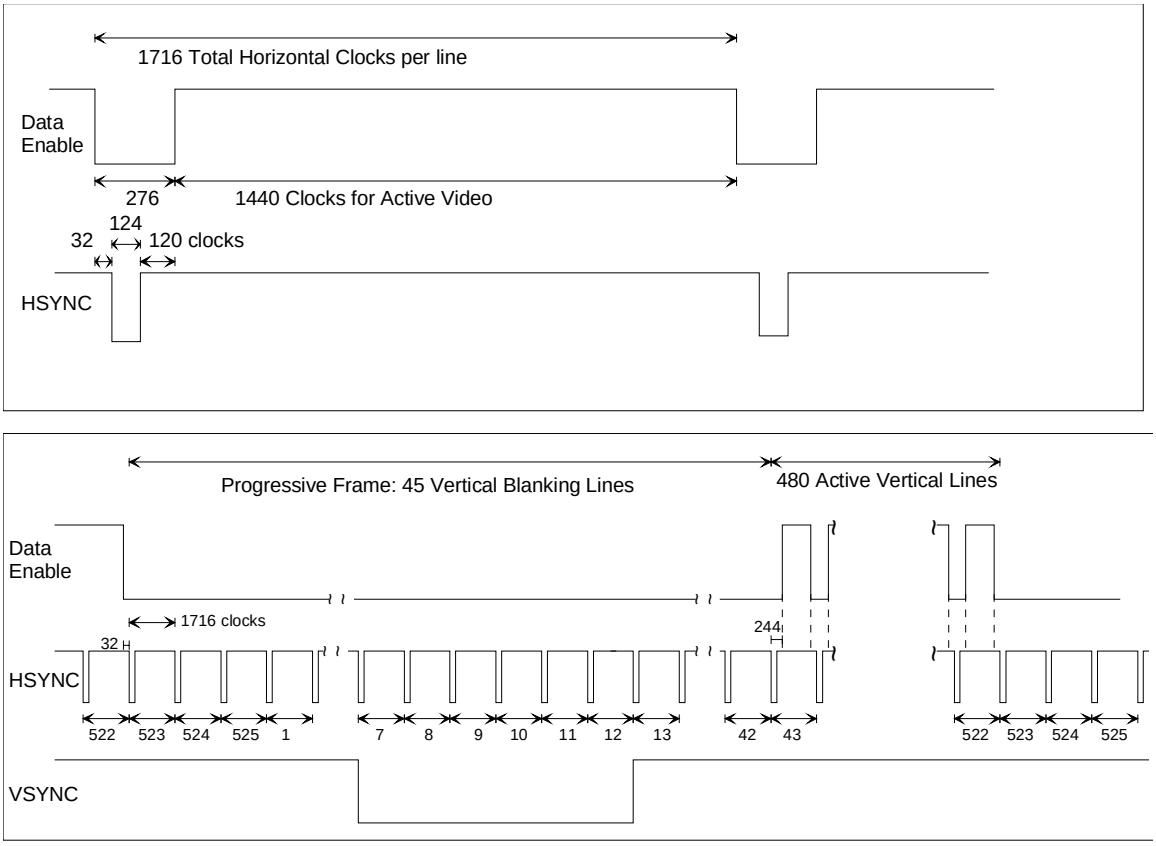

Figure 14. Timing Parameters for 1440X480p @ 59.94/60 Hz.

Obtained from GLOBAL ENGINEERING DOCUMENTS
15 Inverness Way E. Englewood, CO 80112 (303)397-7956 (800)854-7179
<OPTION name="EXPANSION" />
<OPTION name="SESSION" />

4.15 1920X1080p @ 59.94/60Hz (Format 16)

This format is available only in a 16:9 aspect ratio. Designers should be aware that this format was not defined at the time when EIA/CEA-861 was published. Therefore, an 861 type source box will probably not recognize this format in an 18-byte detailed timing descriptor.

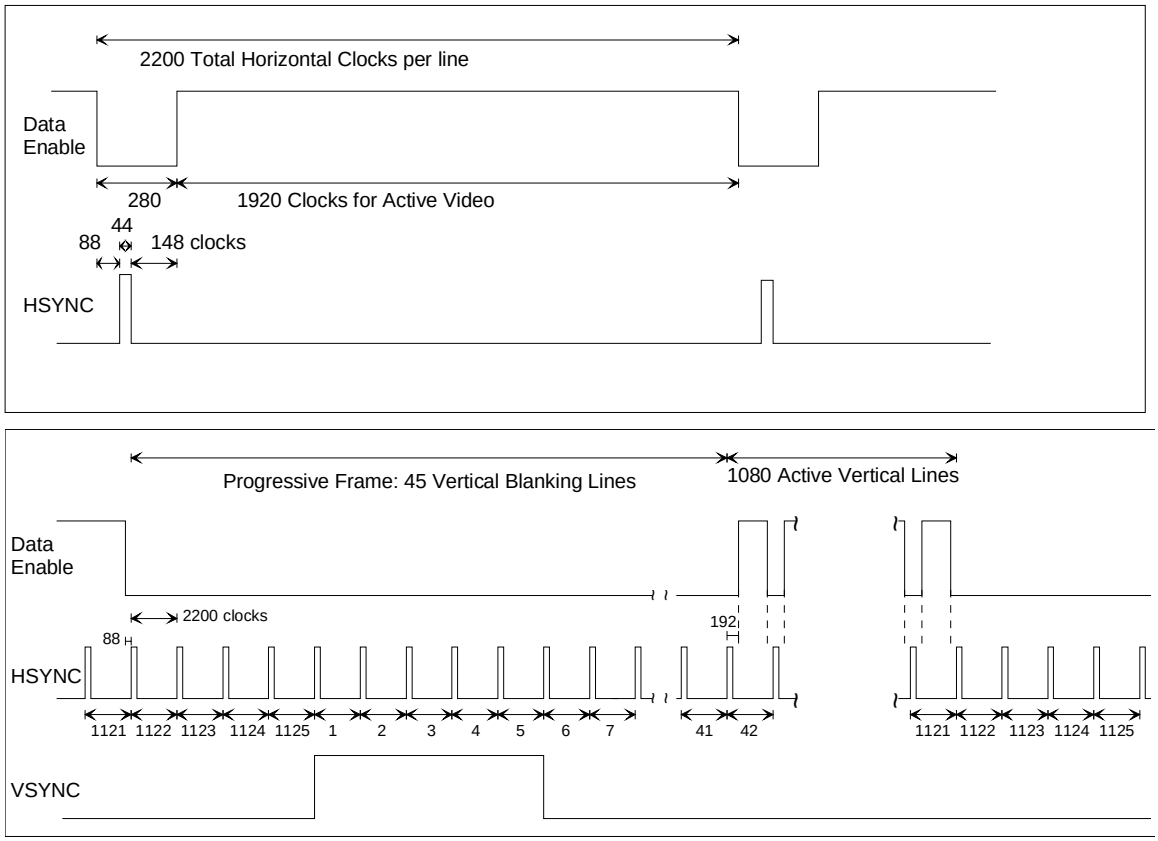

Figure 15. Timing Parameters for 1920X1080p @ 59.94/60 Hz.

Obtained from GLOBAL ENGINEERING DOCUMENTS
15 Inverness Way E. Englewood, CO 80112 (303)397-7956 (800)854-7179
<OPTION name="EXPANSION" />
<OPTION name="SESSION" />

4.16 720(1440)X288p @ 50 Hz (Formats 23 & 24)

This format assumes the pixels are double clocked to meet minimum clock speed requirements for the interface. There are three possible frame formats that differ only in the number of lines in the vertical blanking interval of the frame. All three are considered variations of the same format.

This format timing can use either 4:3 or 16:9 aspect ratio. The DTV Monitor tells the source device through the EDID structure, which formats it supports. The source device then formats the picture and scales the horizontal resolution for the proper display. Designers should be aware that this format was not defined at the time when EIA/CEA-861 was published. Therefore, an 861 type source box will probably not recognize this format in an 18-byte detailed timing descriptor.

Obtained from GLOBAL ENGINEERING DOCUMENTS
15 Inverness Way E. Englewood, CO 80112 (303)397-7956 (800)854-7179
<OPTION name="EXPANSION" />
<OPTION name="SESSION" />

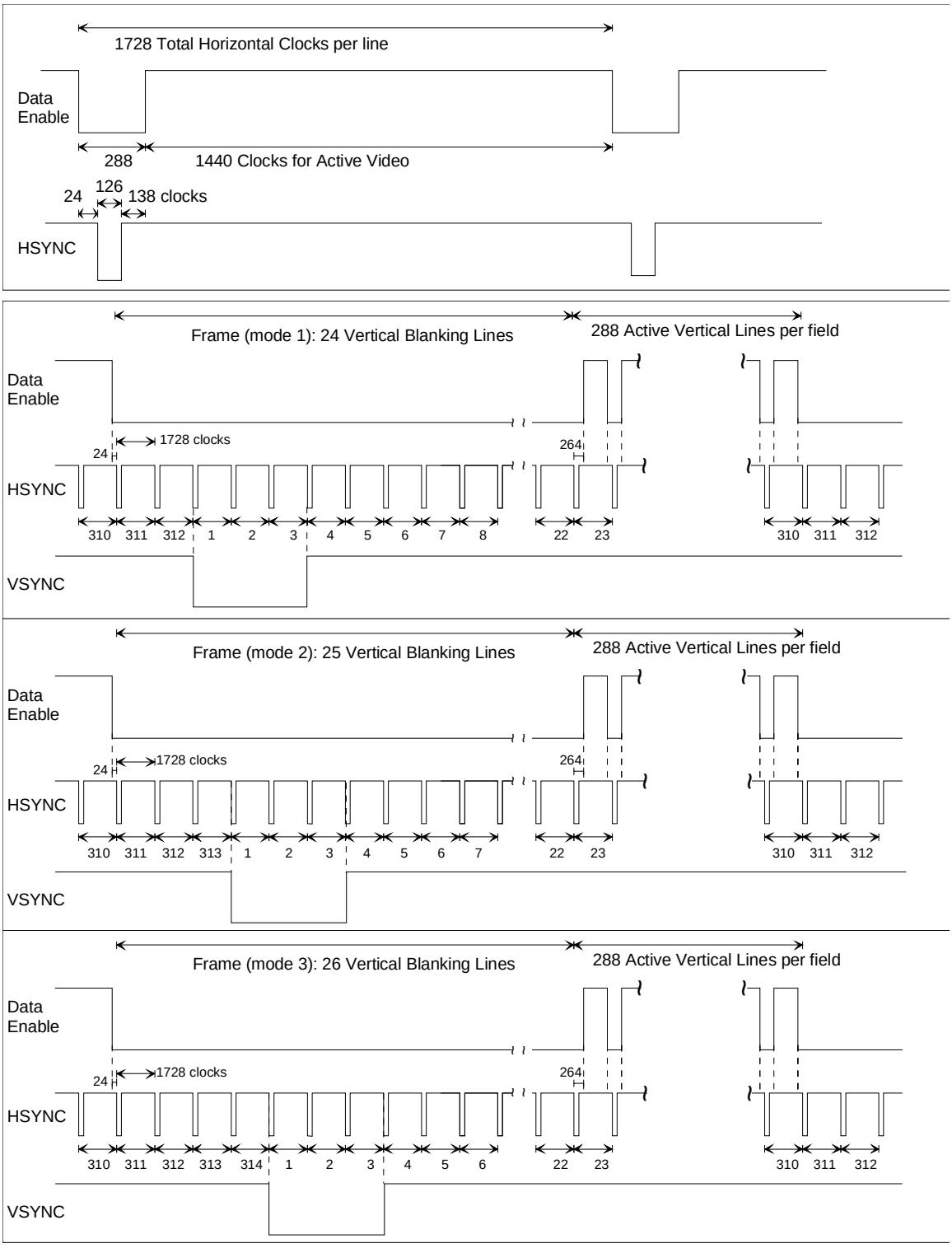

Figure 16. Timing Parameters for 720(1440)X288p @ 50 Hz.

Obtained from GLOBAL ENGINEERING DOCUMENTS
15 Inverness Way E. Englewood, CO 80112 (303)397-7956 (800)854-7179
<OPTION name="EXPANSION" />
<OPTION name="SESSION" />

4.17 (2880)X576i @ 50Hz (Formats 25 & 26)

This format is a superset of a variety of video formats used in various game consoles. This format is unique in that, depending upon the pixel repetition factor specified in the AVI InfoFrame, this format can represent any of the following typical formats:

- 2880/10=288 pixels/line
- 2880/8=360 pixels/line
- 2880/7=411 pixels/line
- 2880/5=576 pixels/line
- 2880/4=720 pixels/line

The pixel repetition factor is specified in the AVI. The DTV Monitor indicates it can accept any of the formats implied by this format superset through EDID.

This format will also typically have bars on the left and right sides. These bars will be 160/*n* pixels wide where *n* is the repetition factor.

This format timing can use either 4:3 or 16:9 aspect ratio. The DTV Monitor tells the source device through the EDID structure, which formats it supports. The source device then formats the picture and scales the horizontal resolution for the proper display.

Designers should be aware that this format was not defined at the time when EIA/CEA-861 was published. Because of the repetition factor, this format cannot be used in legacy 861 implementations.

Obtained from GLOBAL ENGINEERING DOCUMENTS
15 Inverness Way E. Englewood, CO 80112 (303)397-7956 (800)854-7179
<OPTION name="EXPANSION" />
<OPTION name="SESSION" />

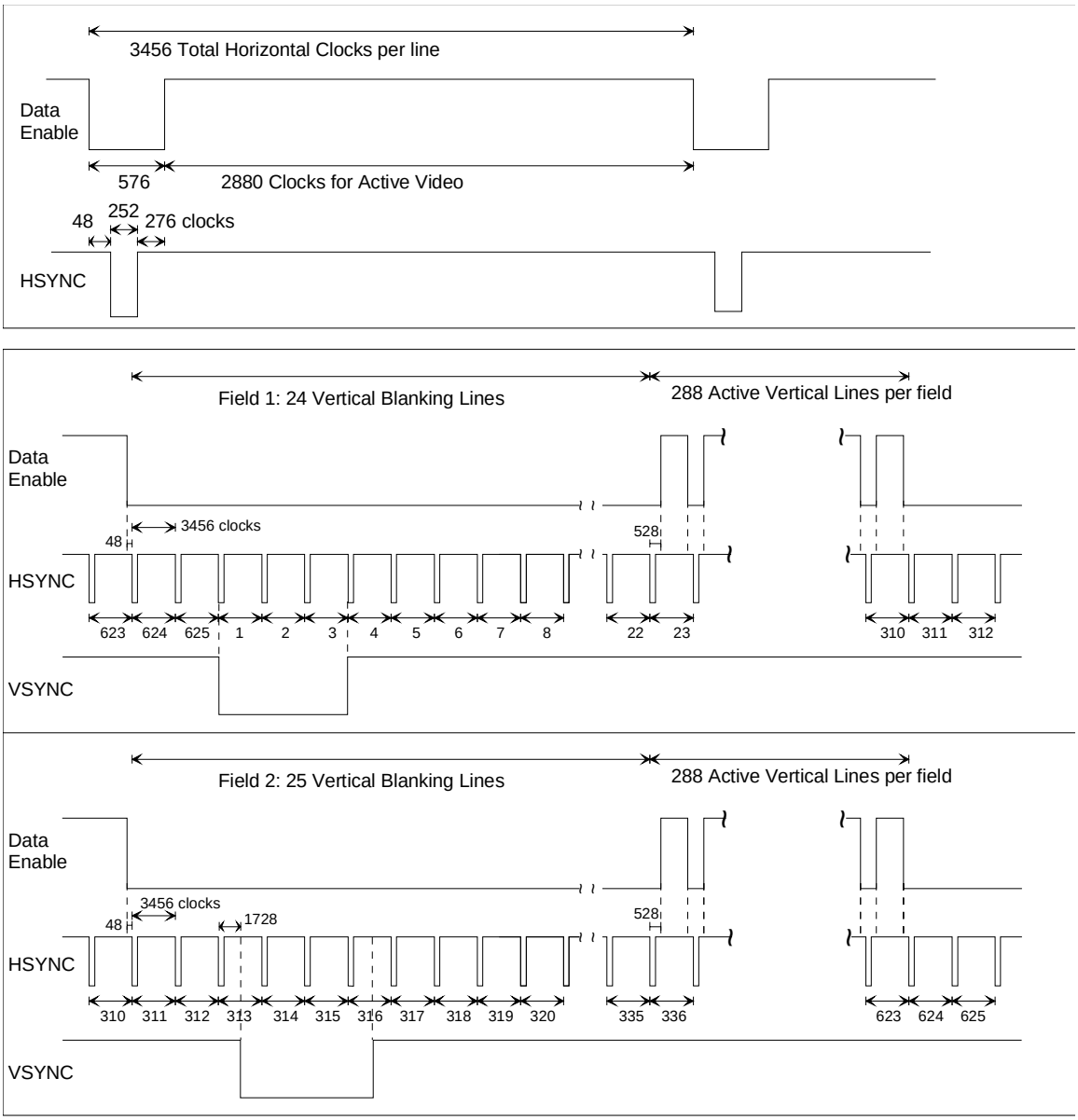

Figure 17. Timing Parameters for (2880)X576i @ 50 Hz

Obtained from GLOBAL ENGINEERING DOCUMENTS
15 Inverness Way E. Englewood, CO 80112 (303)397-7956 (800)854-7179
<OPTION name="EXPANSION" />
<OPTION name="SESSION" />

4.18 (2880)X288p @ 50 Hz (Formats 27 & 28)

This format is a superset of a variety of video formats used in various game consoles. This format is unique in that, depending upon the pixel repetition factor specified in the AVI InfoFrame, this format can represent any of the following typical formats:

- 2880/10=288 pixels/line
- 2880/8=360 pixels/line
- 2880/7=411 pixels/line
- 2880/5=576 pixels/line
- 2880/4=720 pixels/line

The pixel repetition factor is specified in the AVI. The DTV Monitor indicates it can accept any of the formats implied by this format superset through EDID.

This format will also typically have bars on the left and right sides. These bars will be 160/*n* pixels wide where *n* is the repetition factor.

There are three possible frame formats that differ only in the number of lines in the vertical blanking interval of the frame. All three are considered variations of the same format.

This format timing can use either 4:3 or 16:9 aspect ratio. The DTV Monitor tells the source device through the EDID structure, which formats it supports. The source device then formats the picture and scales the horizontal resolution for the proper display.

Designers should be aware that this format was not defined at the time when EIA/CEA-861 was published. Because of the repetition factor, this format cannot be used in legacy 861 implementations.

Obtained from GLOBAL ENGINEERING DOCUMENTS
15 Inverness Way E. Englewood, CO 80112 (303)397-7956 (800)854-7179
<OPTION name="EXPANSION" />
<OPTION name="SESSION" />

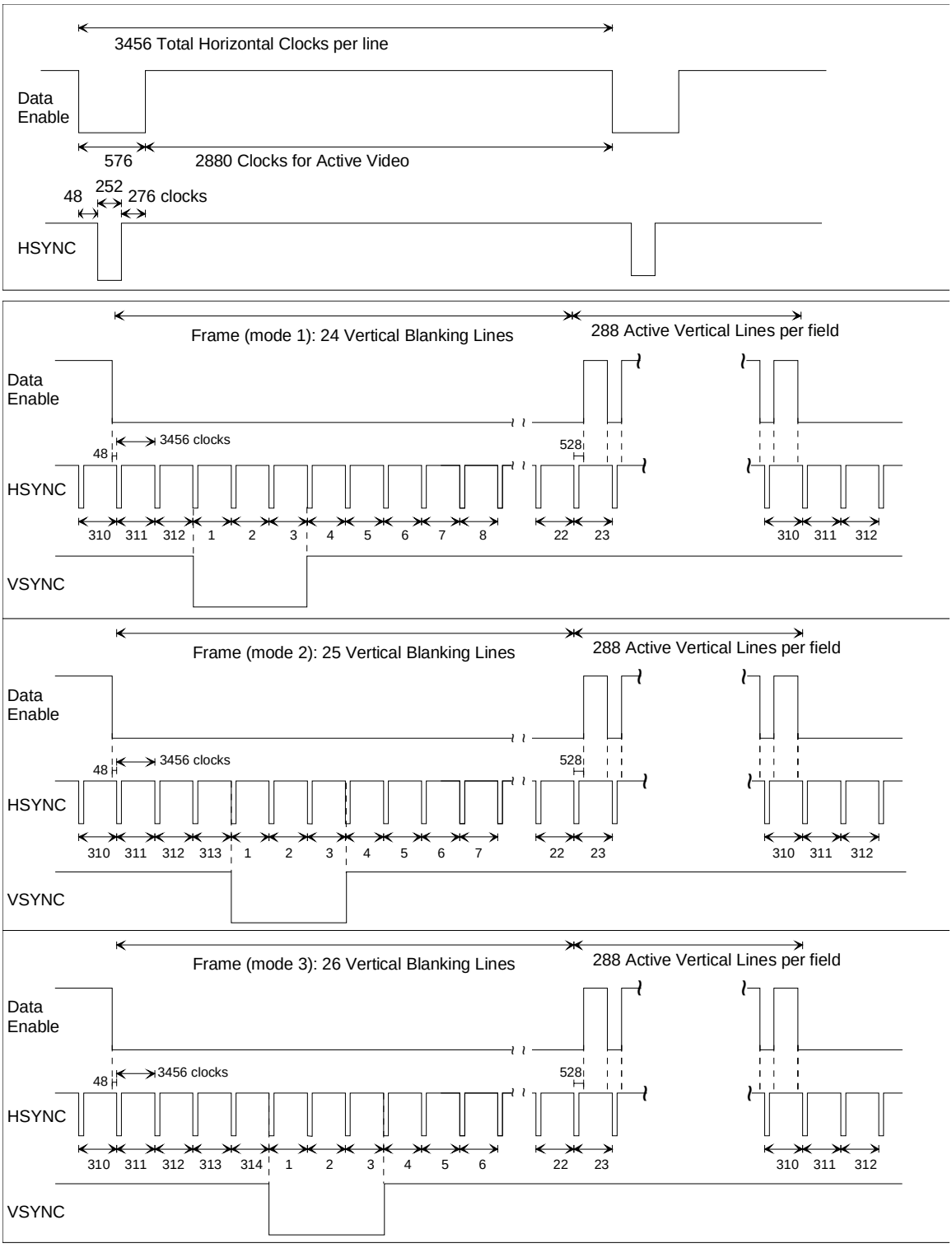

Figure 18. Timing Parameters for (2880)X288p @ 50 Hz.

Obtained from GLOBAL ENGINEERING DOCUMENTS
15 Inverness Way E. Englewood, CO 80112 (303)397-7956 (800)854-7179
<OPTION name="EXPANSION" />
<OPTION name="SESSION" />

4.19 1440X576p @ 50Hz (Formats 29 & 30)

This format is for high-end DVD Players. It can use either 4:3 or 16:9 aspect ratio. The DTV Monitor tells the source device through the EDID structure, which formats it supports. The source device then formats the picture and scales the horizontal resolution for the proper display. Designers should be aware that this format was not defined at the time when EIA/CEA-861 was published. Therefore, an 861 type source box will probably not recognize this format in an 18-byte detailed timing descriptor.

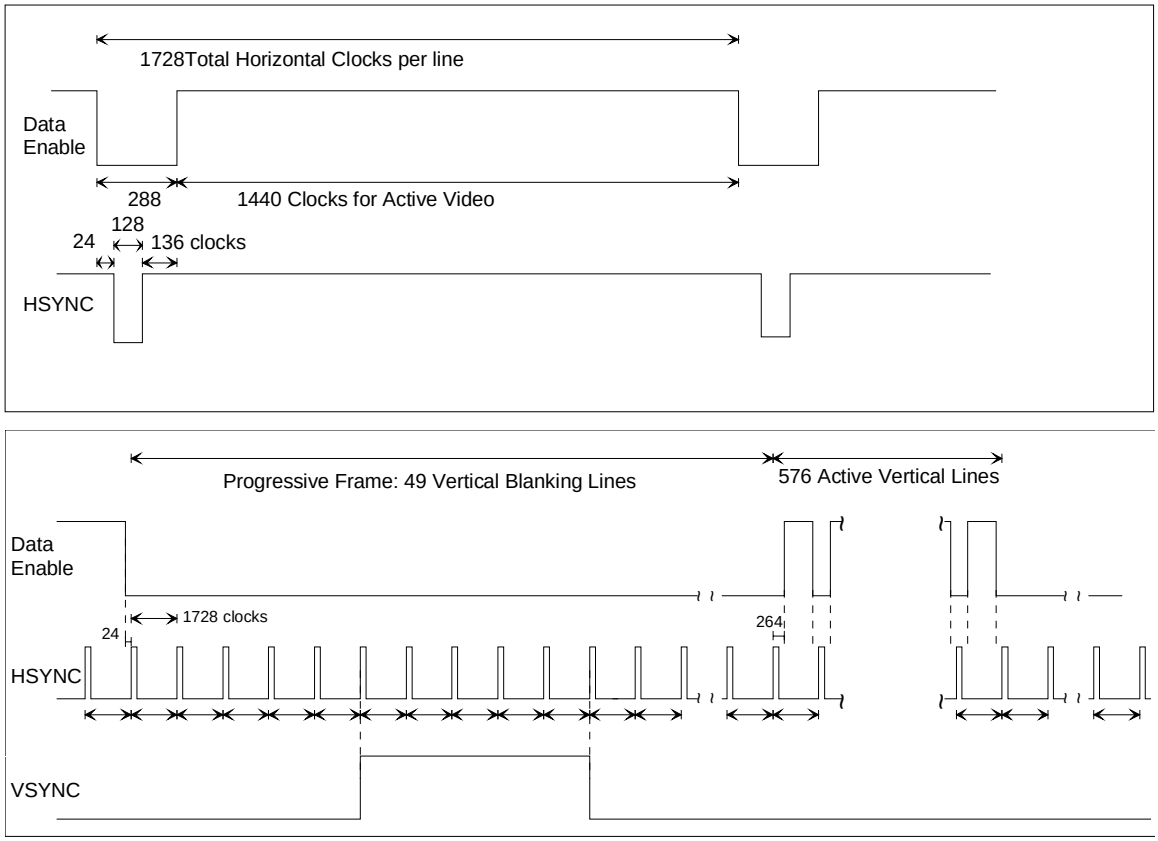

Figure 19. Timing Parameters for 1440X576p @ 50 Hz.

Obtained from GLOBAL ENGINEERING DOCUMENTS
15 Inverness Way E. Englewood, CO 80112 (303)397-7956 (800)854-7179
<OPTION name="EXPANSION" />
<OPTION name="SESSION" />

4.20 1920X1080p @ 50 Hz (Format 31)

This format is available only in a 16:9 aspect ratio. Designers should be aware that this format was not defined at the time when EIA/CEA-861 was published. Therefore, an 861 type source box will probably not recognize this format in an 18-byte detailed timing descriptor.

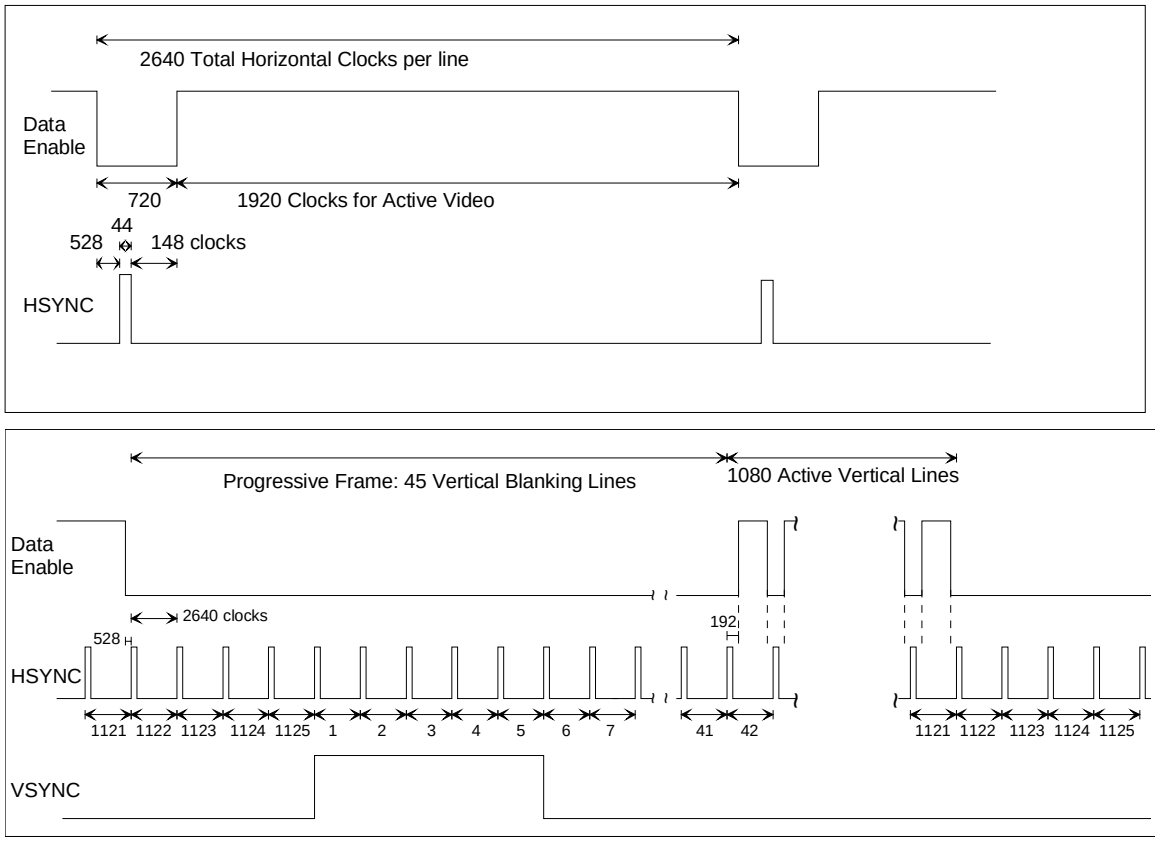

Figure 20. Timing Parameters for 1920X1080p @ 50 Hz.

Obtained from GLOBAL ENGINEERING DOCUMENTS
15 Inverness Way E. Englewood, CO 80112 (303)397-7956 (800)854-7179
<OPTION name="EXPANSION" />
<OPTION name="SESSION" />

4.21 1920X1080p @ 23.97/24 Hz (Format 32)

This format is available only in a 16:9 aspect ratio. Designers should be aware that this format was not defined at the time when EIA/CEA-861 was published. Therefore, an 861 type source box will probably not recognize this format in an 18-byte detailed timing descriptor.

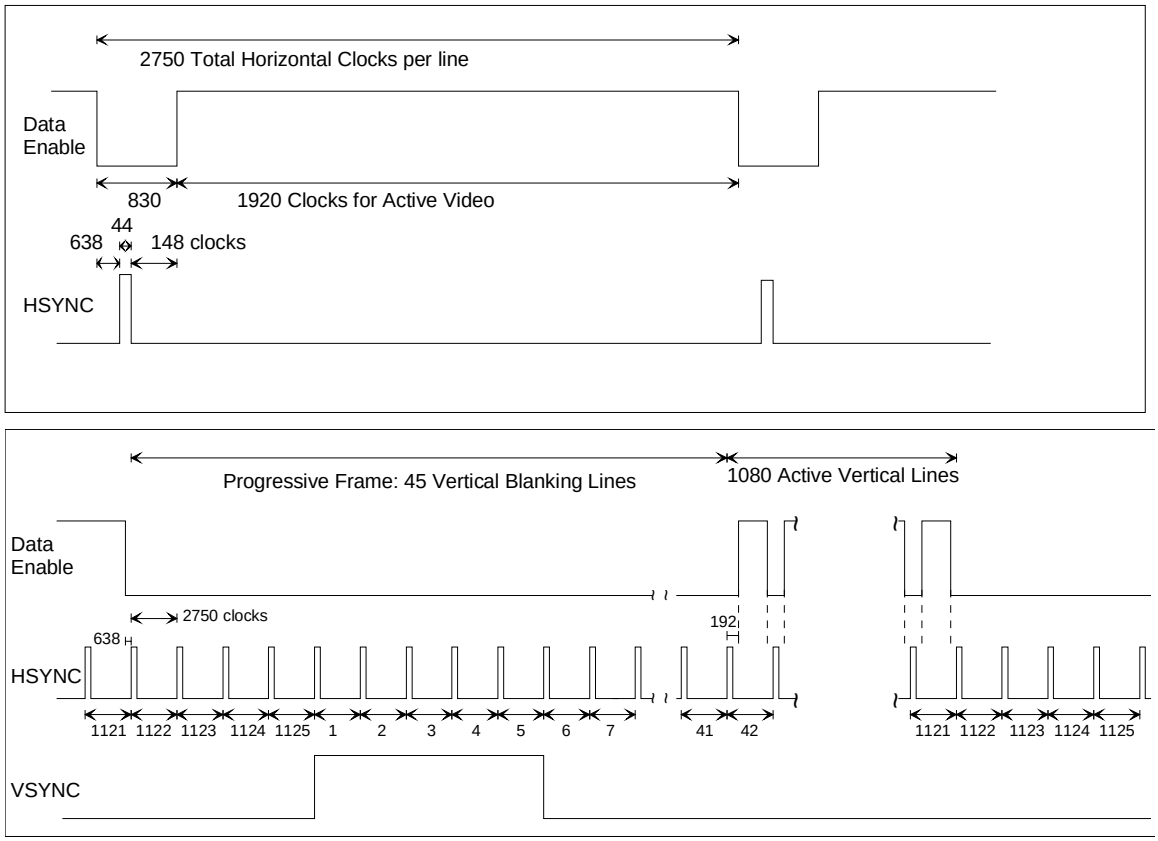

Figure 21. Timing Parameters for 1920X1080p @ 23.97/24 Hz.

Obtained from GLOBAL ENGINEERING DOCUMENTS
15 Inverness Way E. Englewood, CO 80112 (303)397-7956 (800)854-7179
<OPTION name="EXPANSION" />
<OPTION name="SESSION" />

4.22 1920X1080p @ 25 Hz (Format 33)

This format is available only in a 16:9 aspect ratio. Designers should be aware that this format was not defined at the time when EIA/CEA-861 was published. Therefore, an 861 type source box will probably not recognize this format in an 18-byte detailed timing descriptor.

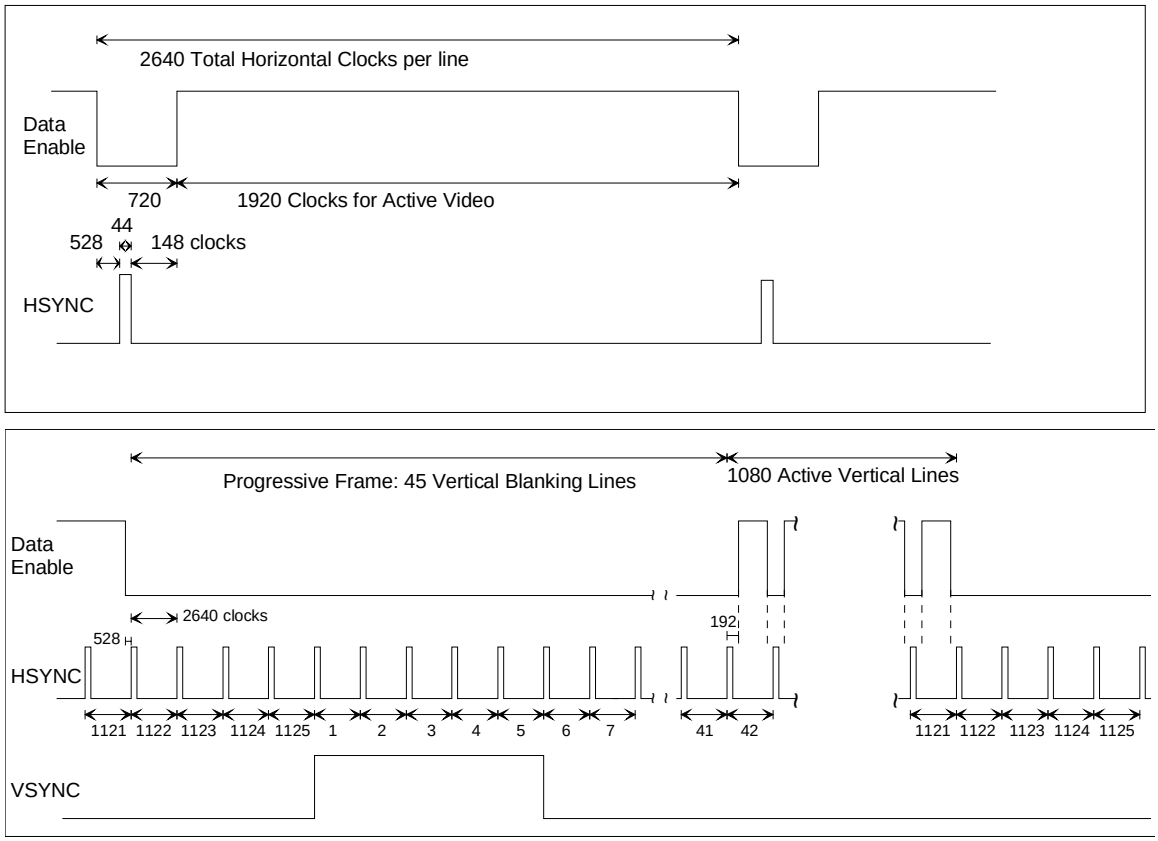

Figure 22. Timing Parameters for 1920X1080p @ 25 Hz.

Obtained from GLOBAL ENGINEERING DOCUMENTS
15 Inverness Way E. Englewood, CO 80112 (303)397-7956 (800)854-7179
<OPTION name="EXPANSION" />
<OPTION name="SESSION" />

4.23 1920X1080p @ 29.97/30 Hz (Format 34)

This format is available only in a 16:9 aspect ratio. Designers should be aware that this format was not defined at the time when EIA/CEA-861 was published. Therefore, an 861 type source box will probably not recognize this format in an 18-byte detailed timing descriptor.

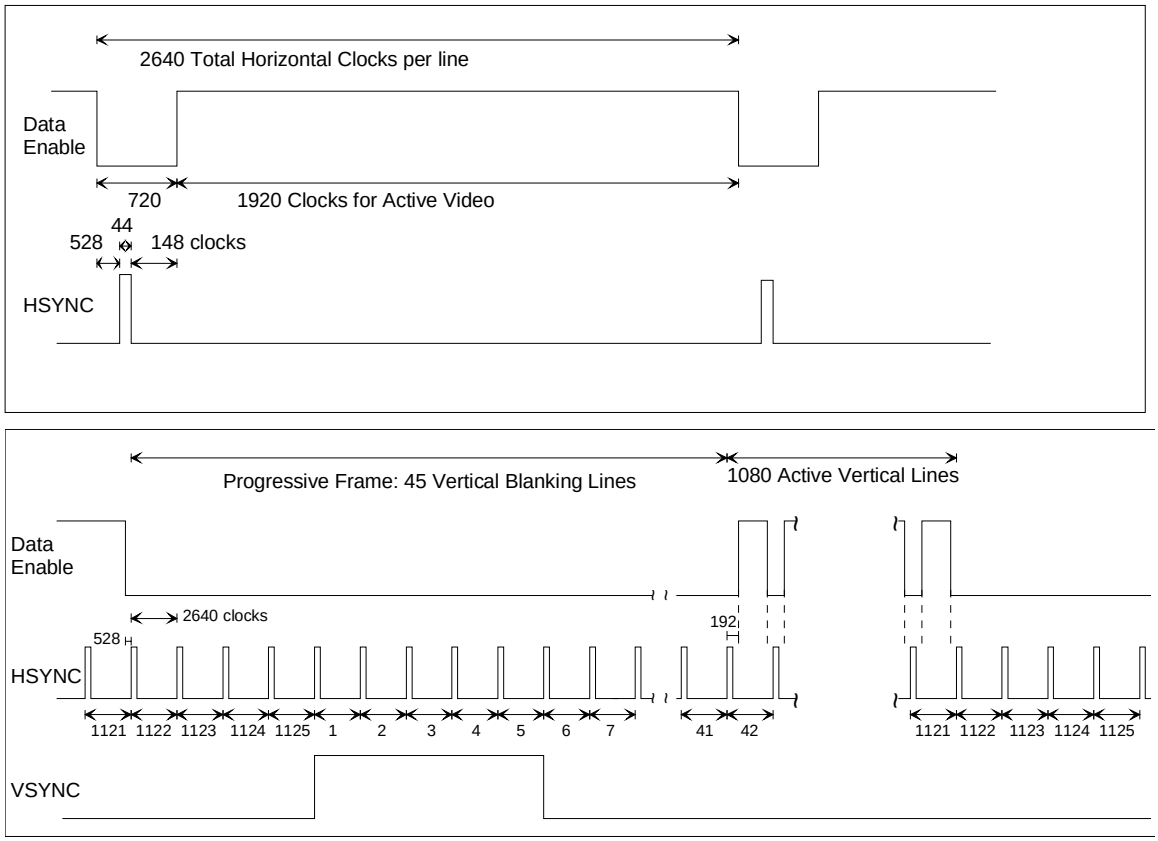

Figure 23. Timing Parameters for 1920X1080p @ 29.97/30 Hz.

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4.24 Format Requirements Summary

The required support for the formats defined in this standard is summarized in Table 5.

Table 5. Summary of Video Format Requirements

60 Hz Systems

Format num.	Format	Field Rate	Picture Aspect Ratio (H:V)	Pixel[5] Aspect Ratio (H:V)	Requirement on Display
1	640X480p	59.94 Hz, 60 Hz	4:3	1:1	Required (VGA)
2	720X480p	59.94 Hz, 60 Hz	4:3	8:9	At least one of these two is required
3	720X480p	59.94 Hz, 60 Hz	16:9	32:27	
4	1280X720p	59.94 Hz, 60 Hz	16:9	1:1	Optional, but at least one format must be supported for an HDTV Monitor.
5	1920X1080i	59.94 Hz, 60 Hz	16:9	1:1	
6	720(1440)X480i	59.94 Hz, 60 Hz	4:3	8:9	Optional 861A Format
7	720(1440)X480i	59.94 Hz, 60 Hz	16:9	32:27	Optional 861A Format

50 Hz Systems

Format num.	Format	Field Rate	Picture Aspect Ratio (H:V)	Pixel Aspect Ratio (H:V)	Requirement on Display
1	640x480p	59.94 Hz, 60 Hz	4:3	1:1	Required (VGA)
17	720x576p	50 Hz	4:3	16:15	At least one of these two is required
18	720x576p	50 Hz	16:9	64:45	
19	1280x720p	50 Hz	16:9	1:1	Optional, but at least one format must be supported by an HDTV Monitor.
20	1920x1080i	50 Hz	16:9	1:1	
21	720(1440)x576i	50 Hz	4:3	16:15	Optional 861A Format
22	720(1440)x576i	50 Hz	16:9	64:45	Optional 861A Format

[5] Pixel Aspect Ratio may vary slightly depending on display technology.

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The following formats are new to this version of 861 (i.e., 861B) and are optional for both the DTV Monitor and source box.

Table 6. Formats new to this Standard (861B)

Format num.	Formats	Field Rate	Picture Aspect Ratio (H:V)	Pixel Aspect Ratio (H:V)	Requirement on Display
8	720(1440)X240p	59.94Hz/60Hz	4:3	4:9	Optional
9	720(1440)X240p	59.94Hz/60Hz	16:9	16:27	Optional
10	2880X480i	59.94Hz/60Hz	4:3	2:9 - 20:9[6]	Optional
11	2880X480i	59.94Hz/60Hz	16:9	8:27 -80:27	Optional
12	2880X240p	59.94Hz/60Hz	4:3	1:9 - 10:9	Optional
13	2880X240p	59.94Hz/60Hz	16:9	4:27 - 40:27	Optional
14	1440X480p	59.94Hz/60Hz	4:3	4:9	Optional
15	1440X480p	59.94Hz/60Hz	16:9	16:27	Optional
16	1920X1080p	59.94Hz/60Hz	16:9	1:1	Optional
23	720(1440)X288p	50Hz	4:3	8:15	Optional
24	720(1440)X288p	50Hz	16:9	32:45	Optional
25	2880X576i	50Hz	4:3	2:15 - 20:15	Optional
26	2880X576i	50Hz	16:9	16:45-160:45	Optional
27	2880X288p	50Hz	4:3	1:15 - 10:15	Optional
28	2880X288p	50Hz	16:9	8:45 - 80:45	Optional
29	1440X576p	50Hz	4:3	8:15	Optional
30	1440X576p	50Hz	16:9	32:45	Optional
31	1920X1080p	50Hz	16:9	1:1	Optional
32	1920X1080p	23.97Hz/24Hz	16:9	1:1	Optional
33	1920X1080p	25Hz	16:9	1:1	Optional
34	1920X1080p	29.97Hz/30Hz	16:9	1:1	Optional

[6] Although the pixel repeat field is 4 bits (see Section 6.1.3), the largest value used for typical formats is 10. Therefore, in this standard the pixel repeat value can vary from 1 to 10. This results in a factor of 10 variation in the Pixel Aspect Ratio.

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5 COLORIMETRY AND QUANTIZATION

This interface shall be capable of supporting RGB (red, green, and blue), with encoding parameters based on the format. The interface may optionally support YC_BC_R.

5.1 480p, 480i, 576p, 576i, 240p, and 288p

The color space used by the 480-line, 576-line, 240-line, and 288-line formats will likely be based on SMPTE 170M [1].[7]

ITU-R BT.601-5 Section 3.5 [5] (or EIA/CEA-770.2-C Section 3.3 [19]) shall be used for any color space conversion needed in the course of processing unless a different colorimetry is specified in the Auxiliary Video Information InfoFrame.

The encoding parameter values shall be as defined in Table 3 of ITU-R BT.601-5 [5] and are summarized below:

The coding shall be 8-bit coding (scale of 0 to 255). R, G, B, and Y signals shall have 220 quantization levels with the black level corresponding to level 16 and the peak white level corresponding to level 235. The signal level may occasionally move beyond level 235. C_BC_R signals shall have 225 quantization levels with a zero level corresponding to digital level 128 and the full range corresponding with 16 to 240. For R, G, B, Y, C_B, C_R signals, 0 and 255 are reserved and should not be considered video.

The VGA format (i.e., 640X480p) should use all 256 quantization levels.

5.2 1080i, 1080p, and 720p

The color space used by the high definition formats will likely be based on ITU-R BT.709-4 [6].[7]

ITU-R BT.709-4 Part 1, Section 4 [6] (or EIA/CEA-770.3-C Sections 5.4-5.7 [20]) shall be used for any color space conversion needed in the course of processing unless a different colorimetry is specified in the AVI.

The digital representation shall be as defined in Part 1, Section 6.10 of ITU-R BT.709-4 and is summarized below:

The coding shall be 8-bit coding (scale of 0 to 255). R, G, B, and Y signals shall have 220 quantization levels with the black level corresponding to level 16 and the peak white level corresponding to level 235. The signal level may occasionally move beyond level 235. C_BC_R signals shall have 225 quantization levels with a zero level corresponding to digital level 128 and full range corresponding with 16 to 240. For R, G, B, Y, C_B, C_R signals, 0 and 255 are reserved and should not be considered video.

[7] The service provider (e.g., cable, DBS, terrestrial, etc.) is expected to signal to the source device (receiver, video card, etc.) via its digital Transport Stream, which color space is being transmitted and associated with the video content.

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5.3 Recommendations on Conversions to/from Analog Signals

If the digital video signal is converted to an analog signal in the DTV Monitor, it is recommended that for RGB or Y, the black level (i.e., sync level and blanking level) should be aligned with the video portion of the signal at digital levels 16 and the white level at digital level 235, such that the full range of the D/A converted signal is the same as the actual video.[8] This means that zero analog level (0.0 IRE) should be associated with digital level 16, which implies in some cases removal of a "black level setup" in the display DAC. Digital levels 1 - 15 (undershoot region) and level 235 - 254 (overshoot region) are recommended to be passed through the D/A, however, full range of the analog signal should be aligned with 16-235 since it is expected that essential video is in the 16-235 range. For the 640x480 format, there may be video at these levels; it is recommended that the full 0-255 range be displayed for this format.

If the digital video signal is converted to an analog signal, it is recommended that for the C_BC_R portion of the YC_BC_R digital signal (P_B, P_R for analog signal), the clamping level (sync level and blanking level) should be aligned with digital level 128 and the full range of the analog signal should be aligned with digital level 16 to 240. However, the D/A may pass the full 1-254 range or may pass levels 16-254.

[8] RGB signals have the same notation in the digital and analog domains. Typically, Y, C_B, C_R notation is used for digital domains; and Y, P_B, P_R is used for analog domains.

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6 AUXILIARY INFORMATION CARRIED FROM SOURCE TO DTV MONITOR

Various types of auxiliary data can be carried from the Source to the DTV Monitor using the InfoFrame/InfoPacket Structure defined in Annex G. This section describes the types of InfoFrames that have been defined so far. The Version 1 AVI was specified in EIA/CEA-861A. This standard (EIA/CEA-861B) adds three more InfoFrames (Source Product Description InfoFrame, Audio InfoFrame, and MPEG Source InfoFrame).

The DTV Monitor's ability to receive and decode various InfoFrames is indicated by its inclusion of specific information in EDID (See the following paragraph and Section 7.1). In most cases, the version number of the CEA Timing Extension indicates support of certain InfoFrames. In a few cases, support of a specific format or specific type of audio indicates support. These requirements will be spelled out in the various sections on each infoFrame, but the specific format of EDID will be covered in Section 7.

Inclusion of the Version 3 (or higher) CEA EDID Timing Extension in the DTV Monitor's EDID data structure indicates to the source device that the DTV monitor is capable of receiving the three newly defined InfoFrames (Source Product Description, Audio, and MPEG Source) and Version 2 AVI InfoFrame in addition to the Version 1 AVI InfoFrame, which appeared in EIA/CEA-861A. The use of the Version 2 CEA Timing Extension in the DTV Monitor's EDID data structure indicates to the source device that the DTV monitor is capable of receiving the Version 1 AVI InfoFrame.

6.1 Auxiliary Video Information (AVI) InfoFrame

The Auxiliary Video Information (AVI) was the main addition from EIA/CEA-861 to EIA/CEA-861A. Its principle use was to indicate to the DTV Monitor the intended picture aspect ratio of a video format timing that is available in more than one picture aspect ratio. The ability to designate in what colorimetry the picture should be displayed and information on the active format were also included. In this standard (861B), pixel repeat information associated with the new 2880 formats has been added. A field that can be used to identify the video format has also been added (i.e., Video Identification Code).

The AVI is carried in the AV-stream from the source device to the DTV Monitor as an InfoFrame within an InfoPacket (see Annex G). Note that the actual mechanism for carrying this information is different depending on the actual digital interface being used[9].

If the source device supports the transmission of the Auxiliary Video Information (AVI) and if it determines that the DTV Monitor is capable of receiving that information, it shall

[9] Neither DVI 1.0 [2] nor OpenLDI 0.95 [7] (both of which were suitable for EIA/CEA-861) contain a mechanism for transporting this data. These physical interfaces can be used to implement this standard with reduced functionality (i.e., 861). New physical interfaces that are backward compatible with DVI 1.0 and contain mechanisms for transferring InfoPackets, digital audio, and YC_BC_R pixel data are expected to become available soon. These physical interfaces can be used to implement the full capabilities of this standard.

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send the AVI to the DTV Monitor once per frame. The data applies to the next full frame of video data.

In order to convey the information across the interface, a packet structure is used. The general packet structure which consists of “InfoFrames” contained within an “InfoPacket” is defined in Section G.1. The AVI is carried as an InfoFrame within the InfoPacket. An InfoPacket can carry more than one InfoFrame. One InfoPacket can be sent every video frame, and must be sent once every video frame if the source device supports AVI and determines that the DTV Monitor does, too.

Source boxes should be aware that if the DTV Monitor does not use version 2 (or higher) of the CEA EDID Timing Extension and is not a dual aspect ratio DTV monitor[10], then the uncompressed digital video receiver in the DTV monitor may not work properly if AVI information is sent. If the DTV does not use version 2 (or higher) of the CEA EDID Timing Extension with the basic audio bit and one of the YC_BC_R bits set, then the DTV monitor may not work properly if digital audio or YC_BC_R pixel data is sent.

For DTV Monitors that simultaneously support formats available in different aspect ratios (e.g., 720X480p), the DTV Monitor shall be able to receive and decode the Version 1 Auxiliary Video Information (AVI) described in this Section. Simultaneous support of formats available in two different aspect ratios shall be indicated by listing both formats in the EDID data structure at the same time. The DTV shall indicate its support of the Version 1 AVI InfoFrame by using Version 2 (or higher) CEA EDID Timing Extension in the EDID data structure.

If a Dual Aspect Ratio DTV Monitor is receiving a video format timing for which it has declared support for both picture aspect ratios in EDID and the source device has indicated the picture aspect ratio by including the AVI in the video stream, then the DTV Monitor shall display the picture in the aspect ratio that has been indicated by the source device in the AVI. If the source device does not support transmission of the AVI (perhaps it is only EIA/CEA-861 compliant), then the source device shall provide the video to the DTV monitor in the preferred aspect ratio as explained in Section 7.

If, for some reason, an indication is received that conflicts with the video format being received (e.g., the source device indicates 4:3 but sends the 1920X1080i format), then the DTV Monitor shall use the picture aspect ratio that is associated with the format being sent.

[10] In the previous version of this standard (i.e., 861A), it was possible for a DTV Monitor to support the use of the AVI InfoFrame without using the Version 2 CEA Timing Extension as an indication. In that case, the indication was provided through being a Dual Aspect Ratio DTV. It is now required that a Dual Aspect Ratio DTV use either Version 2 or Version 3 of the CEA EDID Timing Extension. However, source boxes should be aware that some older DTV implementations may have been created that only indicate support of the AVI InfoFrame in this manner.

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If a DTV Monitor supports the basic audio (see Section 7.4) available on the digital interface being used, then it shall include the version 2 (or higher) CEA Timing Extension with the basic audio bit set, and shall be capable of receiving the AVI.

If a DTV Monitor supports YC_BC_R (in addition to RGB), then it shall include the version 2 (or higher) CEA Timing Extension with at least one of the YC_BC_R bits set and shall be capable of receiving the AVI. If no AVI is being sent from the source device, then the DTV Monitor shall assume the video data is RGB.

The information on "Active Format Aspect Ratio," bar widths, overscan/underscan, non-uniform picture scaling, and colorimetry is information that can be used by the DTV Monitor to improve the picture. Use of this information by the DTV Monitor is optional. If this information is present at the source device and valid,[11] and if the DTV Monitor is capable of receiving the AVI, it is required that this information be sent.

For DTV Monitors that would like to receive AVI even though they may not support different aspect ratios, the DTV Monitor shall include version 2 (or higher) of the CEA Timing Extension in the EDID data structure and shall be capable of receiving the AVI.

For DTV Monitors not capable of receiving AVI, the DTV Monitor shall not declare in its EDID data structure more than one format that is the same except for picture aspect ratio at the same time. It shall use version 1 of the CEA Timing Extension if needed to declare additional formats.

6.1.1 Additional Requirements related to Version 2 AVI InfoFrame

Version 2 of the AVI InfoFrame contains additional information such as a Video Identification Code and a Pixel Repeat field (see Section 6.1.3). There are some additional requirements related to this new information. Note that the Version 2 AVI InfoFrame is backward compatible with the Version 1 AVI InfoFrame. Therefore, any DTV Monitor that supports reception of the Version 2 AVI InfoFrame shall also support reception of the Version 1 AVI InfoFrame.

If the DTV Monitor supports any of the new 861B video formats, then it shall be able to receive and interpret Version 2 of the AVI InfoFrame. Support of AVI InfoFrame Version 2 is indicated by the inclusion of the CEA EDID Timing Extension Version 3 in EDID (see Section 7).

If AVI InfoFrame Version 2 is sent from a source box to a DTV Monitor and if one of the video formats defined in this document is being sent, then the Video Identification Code shall be set correctly. If a video format other than one of the formats defined in this document is sent, then the Video Identification Code shall be set to 0. In many cases, the DTV Monitor will be able to determine the video format from the video itself. If the

[11] The data may not be valid if, for example, the source box has already post-processed the signal.

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Video Identification Code being received in the AVI does not match the video being received, then the DTV Monitor shall ignore the Video Identification Code.

6.1.2 Format of Version 1 AVI InfoFrame

The AVI InfoFrame is constructed with a 2-byte header (Type Code and Version Number) followed by a 1-byte length field followed by 13 bytes of data.The general format of the Version 1 AVI InfoFrame is shown below:

Table 7. Auxiliary Video Information InfoFrame format (Version 1)

InfoFrame Type Code	InfoFrame Type = 02_{16}							
InfoFrame Version Number	Version = 01_{16}							
Length of AVI InfoFrame	Length of AVI InfoFrame (13)							
Data Byte 1	Rsvd=0	Y1	Y0	A0	B1	B0	S1	S0
Data Byte 2	C1	C0	M1	M0	R3	R2	R1	R0
Data Byte 3	Reserved for Future (shall be 0)						SC1	SC0
Data Byte 4	Reserved for Future (shall be 0)							
Data Byte 5	Reserved for Future (shall be 0)							
Data Byte 6	Line Number of End of Top Bar (lower 8 bits)							
Data Byte 7	Line Number of End of Top Bar (upper 8 bits)							
Data Byte 8	Line Number of Start of Bottom Bar (lower 8 bits)							
Data Byte 9	Line Number of Start of Bottom Bar (upper 8 bits)							
Data Byte 10	Pixel Number of End of Left Bar (lower 8 bits)							
Data Byte 11	Pixel Number of End of Left Bar (upper 8 bits)							
Data Byte 12	Pixel Number of Start of Right Bar (lower 8 bits)							
Data Byte 13	Pixel Number of Start of Right Bar (upper 8 bits)							

Data Byte 1 (Table 8) contains bits that describe overscan/underscan (e.g., computer graphics or video), two bits to indicate whether optional YC_BC_R is being used, and bits that indicate the presence of valid active format and/or bar information. If the bar information and the active format information do not agree, then the bar information shall take precedence.

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Table 8. AVI InfoFrame Data Byte 1

F7	Future Use, all Zeros
0	

Y1	Y0	RGB or YCbCr
0	0	RGB (default)
0	1	YCbCr 4:2:2
1	0	YCbCr 4:4:4
1	1	Future

A0	Active Format Information Present
0	No Data
1	Active Format Information valid

B1	B0	Bar Info
0	0	Bar Data not valid
0	1	Vert. Bar Info valid
1	0	Horiz. Bar Info Valid
1	1	Vert. and Horiz. Bar Info valid

S1	S0	Scan Information
0	0	No Data
0	1	Overscanned (television)
1	0	Underscanned (Computer)
1	1	Future

Data Byte 2 (Table 9) contains bits that describe colorimetry, picture aspect ratio, and the active format information.

Table 9. AVI InfoFrame Data Byte 2

C1	C0	Colorimetry
0	0	No Data
0	1	SMPTE 170M [1] ITU601 [5]
1	0	ITU709 [6]
1	1	Future

M1	M0	Picture Aspect Ratio
0	0	No Data
0	1	4:3
1	0	16:9
1	1	Future

R3	R2	R1	R0	Active Format Aspect Ratio
1	0	0	0	Same as picture aspect ratio
1	0	0	1	4:3 (Center)
1	0	1	0	16:9 (Center)
1	0	1	1	14:9 (Center)
other values				Per DVB AFD active_format field in [3].

Table 10 illustrates the terminology and examples of common aspect ratio information that can be communicated from a source device to a display device using this standard. It illustrates some of the possibilities for the two standard picture aspect ratios (4:3 and 16:9) with the active format over the picture. The “active format” codes shall be coded in accordance with the Active Format Description[12] (AFD) in the DVB specification[3].[13]

[12] Note that the use of the term “active” in the “Active Format Description” differs from how it is used in other places of this standard and documents referenced by this standard. Active usually refers to any and all addressable pixels. In this case, Active Format refers to the useful information within this active area.
[13] DVB [3] supports 10 active formats. Other active formats can be supported by the bar information contained in bytes 6-13 of the AVI InfoFrame.

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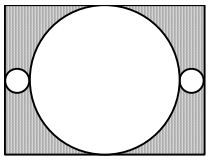
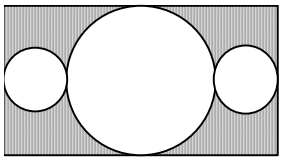
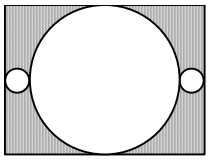
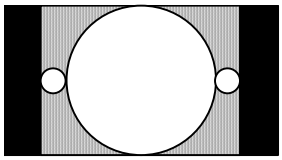
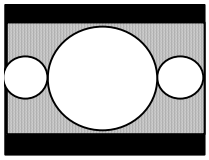
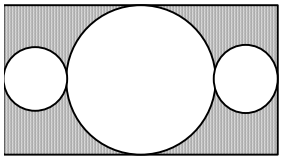
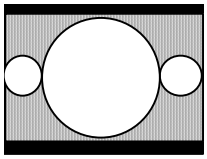
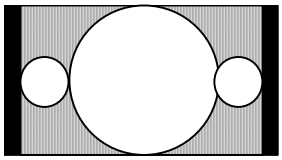
All of the active format codes defined in [3] are reproduced in informative Annex H of this standard.

Table 10. Common Active Formats

active format		illustration of described format	
Value	**Description**	**4:3 Picture AR**	**16:9 Picture AR**
1000	Same as Picture		
1001	4:3 (center)		
1010	16:9 (center)		
1011	14:9 (center)		

Data Byte 3 (Table 11) contains information on whether the picture has been scaled in a non-uniform way (i.e., unequal along horizontal and vertical dimensions) prior to transmission to the DTV Monitor. The Non-uniform Picture Scaling bits shall be set if the source device scales the picture or has determined that scaling has been performed in a specific direction. If the picture has been stretched or shrunk in a uniform way (i.e., equally along both dimensions), then the bits should not be set. These bits are present to help avoid situations such as the one illustrated in Annex I. All bits labeled as F# are reserved for the future and shall be set to 0.

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