RP 186-2008
Revision of
RP 186-1995

SMPTE RECOMMENDED PRACTICE

Video Index Information Coding for 525- and 625-Line Television Systems

Table of Contents

Approved
April 18, 2008

Foreword

SMPTE (the Society of Motion Picture and Television Engineers) is an internationally-recognized standards developing organization. Headquartered and incorporated in the United States of America, SMPTE has members in over 80 countries on six continents. SMPTE's Engineering Documents, including Standards, Recommended Practices and Engineering Guidelines, are prepared by SMPTE's Technology Committees. Participation in these Committees is open to all with a bona fide interest in their work. SMPTE cooperates closely with other standards-developing organizations, including ISO, IEC and ITU.

SMPTE Engineering Documents are drafted in accordance with the rules given in Part XIII of its Administrative Practices.

SMPTE Recommended Practice RP 186 was prepared by Technology Committee S22.

1 Scope

This Recommended Practice is intended to provide a method of coding the Video Index Information data structure in 525-line and 625-line component digital video signals so that various picture and program related source data can be carried in conjunction with a video signal. Specific details of transporting the data structure through various video interconnection systems are not included in this document. These may be found in SMPTE 125M.

The specifications of Active Format Description (AFD) and Pan and Scan data in this Recommended Practice have been superseded by SMPTE 2016-1 through SMPTE 2016-4. Designers and users are urged to consult these documents. The information conveyed in the AFD and Pan and Scan sections of this document can be accurately represented by the mechanisms defined in the SMPTE 2016 suite; however the converse is not necessarily the case. Use of this Recommended Practice to convey AFD and Pan and Scan data is deprecated.

2 Conformance Notation

Normative text is text that describes elements of the design that are indispensable or contains the conformance language keywords: "shall", "should", or "may". Informative text is text that is potentially helpful to the user, but not indispensable, and can be removed, changed, or added editorially without affecting interoperability. Informative text does not contain any conformance keywords.

All text in this document is, by default, normative, except: the Introduction, any section explicitly labeled as "Informative" or individual paragraphs that start with "Note:"

The keywords "shall" and "shall not" indicate requirements strictly to be followed in order to conform to the document and from which no deviation is permitted.

The keywords, "should" and "should not" indicate that, among several possibilities, one is recommended as particularly suitable, without mentioning or excluding others; or that a certain course of action is preferred but not necessarily required; or that (in the negative form) a certain possibility or course of action is deprecated but not prohibited.

The keywords "may" and "need not" indicate courses of action permissible within the limits of the document.

The keyword “reserved” indicates a provision that is not defined at this time, shall not be used, and may be defined in the future. The keyword “forbidden” indicates “reserved” and in addition indicates that the provision will never be defined in the future.

A conformant implementation according to this document is one that includes all mandatory provisions ("shall") and, if implemented, all recommended provisions ("should") as described. A conformant implementation need not implement optional provisions ("may") and need not implement them as described.

Unless otherwise specified the order of precedence of the types of normative information in this document shall be as follows. Normative prose shall be the authoritative definition. Tables shall be next, followed by formal languages, then figures, and then any other language forms.

3 Normative References

The following standard contains provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the edition indicated was 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 edition of the standard indicated below.

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 Classes of Video Index Data

The Video Index Information data structure organizes video source data into three groups based on their types and usage. The Class 1 data group provides information that is required for display or realtime processing of the video signal. The Class 2 data group provides heritage information; that is, information about how the video originated or was previously processed, which if known would facilitate optimization of subsequent processing or display. The Class 3 data group provides for the association with the video signal of other information not required for the display or realtime processing of that signal. The three classes of data are further divided into sub classes as follows:

Class 1.1 – Information required to display the signal, not including pan and scan.

Class 1.2 – Pan and scan data, first 3 octets.

Class 1.3 – Pan and scan data, last 3 octets.

Class 2.1 – Field rate technical heritage information useful for further signal processing.

Class 2.2 – Slow rate technical heritage information useful for further signal processing.

Class 2.3 – Reserved for other technical heritage information.

Class 3.x – User information, undefined at this time, which could include such things as:

Program ID.

Station or production company.

Tape; length, type, purchase date, serial number.

Date of production.

Studio light temperature.

Lens type.

Class 1.1 data is mandatory and shall always be provided. For other data classes, where specific information is unavailable, data fields should be set to the No Information state (all bits set to 0).

5 Formatting

Video Index data, as specified in this Recommended Practice, shall be formatted for insertion into video signals as specified in SMPTE 125M. The Video Index data shall be left-justified within the available data space; that is, it shall immediately follow the SAV on the line specified for it. The data may be identified by its position along the line; Class 1 is followed by Class 2, which is followed by Class 3. See Figure 1.

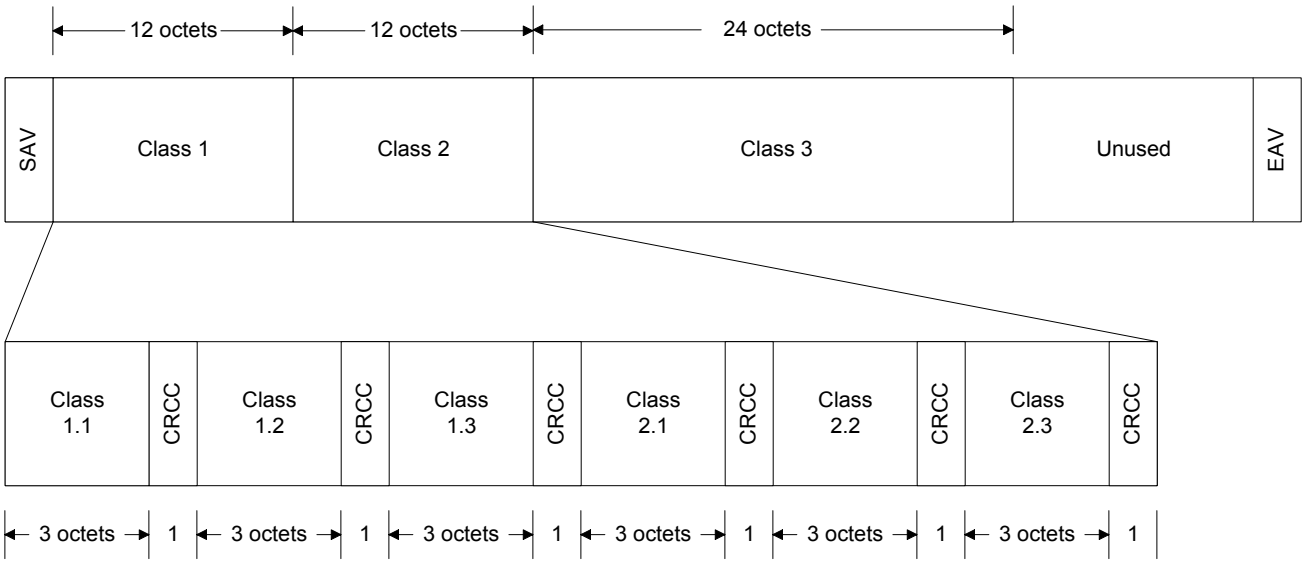

Figure 1 – Data Formatting

5.1 Classes 1 and 2

Each sub class in Class 1 and Class 2 shall contain a block of four 8 bit octets, three data octets followed by one CRCC octet. This totals 24 octets for the two classes. Octets may be further divided into upper and lower 4-bit quartets for coding purposes.

5.2 Class 3

Formatting of Class 3 will be determined at a later date. The total number of octets including data and CCRC check values shall not exceed 24 octets.

5.3 CRCC Polynomial

CRCC check values for each data block shall be calculated using the data octets for that block. All bits starting from B0 through B7 of the first data octet through the last data octet shall be passed through the CRCC check bit generator whose polynomial is

$$G(x) = X^8 + X^4 + X^3 + X^2 + 1$$

All registers constituting the generator polynomial shall be preset to logical 1 at the beginning of each data block.

6 Data Formats — Classes 1 and 2

Formats for each data octet are shown in the following charts.

6.1 Class 1.1, Information Required to Display the Signal

This data sub class codes data fields which define the video scanning system and the video signal form.

6.1.1 Class 1.1, Data Octet 1 — Scanning System Data Field

The scanning system data field provides information about the scanning system used, including total number of lines, field rate and aspect ratio and active format description.

6.1.1.1 Scanning System

Bits B0–B2 identify the scanning system and shall be set as shown below:

SCANNING SYSTEM	B2	B1	B0
No information	0	0	0
525/59.94/4x3	0	0	1
625/50/4x3	0	1	0
Reserved	0	1	1
Reserved	1	0	0
525/59.94/16x9	1	0	1
625/50/16x9	1	1	0
Reserved, from	1	1	1
through	1	1	1

6.1.1.2 Active Format Description

Note: The representation of AFD defined here has been superseded by SMPTE 2016-1. Transport of SMPTE 2016-1 data in the vertical ancillary space is defined in SMPTE 2016-3. Users are urged to consult these documents.

Bits B3-B6 comprise the Active Format Description, or AFD, and shall be set as defined in ETSI TR 101 154 V1.4.1. The settings are reproduced for convenience in the table below. The Active Format is the area of interest in terms of its aspect ratio within the active area of the scanning system, as illustrated in ETSI TR 101 154 V1.4.1. For further information, including additional illustrations for some of the AFD states, see the Recommended Receiver Reaction to Aspect Ratio Signaling in Digital Video Broadcasting from the Digital Television Group (listed in annex A).

AFD	B6	B5	B4	B3
Reserved, see below	0	0	0	0
Reserved (see below for exception)	0	0	0	1
Box 16:9 (top)	0	0	1	0
Box 14:9 (top)	0	0	1	1
Box > 16:9 (center)	0	1	0	0
Reserved	0	1	0	1
Reserved	0	1	1	0
Reserved	0	1	1	1
Active format is the same as coded frame	1	0	0	0
4:3 (center)	1	0	0	1
16:9 (center)	1	0	1	0
14:9 (center)	1	0	1	1
Reserved	1	1	0	0
4:3 (with shoot and protect 14:9 center)	1	1	0	1
16:9 (with shoot and protect 14:9 center)	1	1	1	0
16:9 (with shoot and protect 4:3 center)	1	1	1	1

Designers should note that AFD is largely redundant with the pan and scan data defined in section 5.2. If it is desired to use the pan and scan data, AFD shall be set to 0000. If valid AFD data is present, it shall override the pan and scan data.

Note: Both ETSI TS 101 154 V1.8.1 and ATSC A/53 Part 4:2007 use the SMPTE 2016-1 semantics for AFD rather than those set forth above. The differences are minor, however, and a receiving device designed in accordance with SMPTE 2016-1 should provide acceptable results with the AFD coding given here and vice versa.

6.1.1.3 Bit B7 is reserved and unused; it shall be set to 0.

6.1.2 Class 1.1, Data Octet 2, Lower Quartet — Signal Form Data Field

The signal form data field identifies which component set is used. The bits in this field shall be set as defined in the table below, except that where the signal is in Y, Cb, Cr form, the color encoding heritage of the signal, if any, may be indicated here. This ensures compatibility with equipment in the field which was designed in accordance with earlier documents. See section 6.3.5.

SIGNAL FORM	B3	B2	B1	B0
No information	0	0	0	0
R, G, B	0	0	0	1
Y, Cb, Cr	0	0	1	0
Y, U, V	0	0	1	1
Monochrome	0	1	0	0
NTSC	0	1	0	1
PAL	0	1	1	0
PAL-M	0	1	1	1
SECAM	1	0	0	0
Reserved, from	1	0	0	1
through	1	1	1	1

6.1.3 Class 1.1, Data Octet 2, Upper Quartet — Reserved Data Field

This data field is reserved. Until defined, this field shall be set to 0000 .

RESERVED	B7	B6	B5	B4
No information	0	0	0	0
Reserved, from	0	0	0	1
through	1	1	1	1

6.1.4 Class 1.1, Data Octet 3, Lower Quartet — Sampling Structure Data Field

This data field describes the sample structure of the component signal, and also identifies the main and sub channels, where applicable. The bits in this field shall be set as shown in the table below. The fourth component, where shown, is an auxiliary or key channel. Samples in 4:4:4 and 4:4:4:4 systems are distributed between main and sub channels as described in SMPTE RP 175.

SAMPLING STRUCTURE	B3	B2	B1	B0
No information	0	0	0	0
4:0:0	0	0	0	1
4:2:2	0	0	1	0
4:2:2:4, main	0	0	1	1
4:2:2:4, sub	0	1	0	0
4:4:4, main	0	1	0	1
4:4:4, sub	0	1	1	0
4:4:4:4, main	0	1	1	1
4:4:4:4, sub	1	0	0	0
4:2:2 progressive, main	1	0	0	1
4:2:2 progressive, sub	1	0	1	0
4:2:0 progressive	1	0	1	1
8:4:4, main	1	1	0	0
8:4:4, sub	1	1	0	1
4:2:2:4, single link	1	1	1	0
Reserved	1	1	1	1

6.1.5 Class 1.1, Data Octet 3, Upper Quartet — Reserved Data Field

This data field is reserved. Until defined, the bits in this field shall be set to 0000.

RESERVED	B7	B6	B5	B4
No information	0	0	0	0
Reserved, from	0	0	0	1
through	1	1	1	1

6.2 Classes 1.2 and 1.3, Pan and Scan Data

Note: The representation of Pan and Scan data defined here has been superseded by SMPTE 2016-2. Transport of SMPTE 2016-2 data in the vertical ancillary space is defined in SMPTE 2016-4. Users are urged to consult these documents.

There are 6 octets of pan and scan data, which shall be formatted into 2 3-octet classes as defined below. The 6 octets are used to represent 3 15-bit numbers and 3 flags, which define a viewport (target) aperture relative to the source image. Bit 0 shall be the LSB.

Pan			X	Tilt					Y	Zoom			Z
0		14	15	0		7	8	14	15	0		14	15
Class 1.2							Class 1.3						

Pan Location of left edge of viewport with respect to center of source image, in source pixels
Tilt Location of top edge of viewport with respect to center of source image, in source lines
Zoom Height of viewport, in lines.
X, Y, Z Flags

See Figure 2. Pan, Tilt and Zoom are 2's complement numbers, representing source image pixels or lines, with 4 bits subpixel resolution.

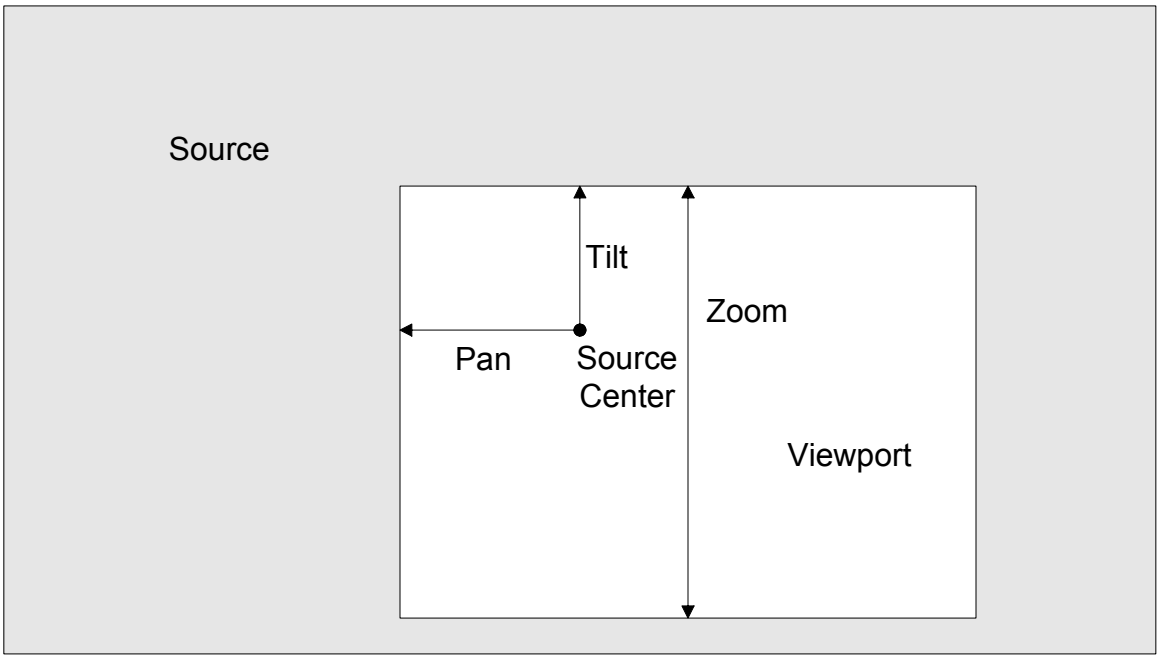

Figure 2 – Pan and Scan Parameters

As only two aspect ratios, 16:9 and 4:3, are in the scope of this document, the aspect ratio of the target image shall be assumed to be whichever the source is not; e.g., if the source is 16:9, the target viewport shall be assumed to be 4:3. The width of the viewport shall be calculated by the receiving device from the height, as given by the Zoom value, taking into account the aspect ratio of the pixels. The X and Y flags provide a mechanism for altering this, as follows:

X AND Y FLAGS	**Y**	**X**
Normal operation	0	0
Height = Zoom, width held from previous field	0	1
Width = Zoom, height held from previous field [1]	1	0
Reserved	1	1

[1] When the Y flag is set, the width shall be given directly in source pixels.

The Z flag is reserved.

Resetting all bits in the Pan, Tilt and Zoom fields and the X, Y and Z flags to 0 shall turn pan and scan off.

If AFD is present (see section 5.1.1.2) it shall override pan and scan.

See Annex B for examples.

6.3 Class 2.1, Field Rate Technical Heritage Information

This data sub class codes data fields that define technical heritage information that changes at field rate.

6.3.1 Class 2.1, Data Octet 1, Lower Quartet — Color Field Data Field

The Color Field data field may be used to provide optional color field information for video from composite sources which have been decoded into component. If used, it shall be coded as shown in the table below.

COLOR FIELD	B3	B2	B1	B0
No information	0	0	0	0
Color field 1	0	0	0	1
Color field 2	0	0	1	0
Color field 3	0	0	1	1
Color field 4	0	1	0	0
Color field 5, PAL only	0	1	0	1
Color field 6, PAL only	0	1	1	0
Color field 7, PAL only	0	1	1	1
Color field 8, PAL only	1	0	0	0
Reserved, from	1	0	0	1
through	1	1	1	1

6.3.2 Class 2.1, Data Octet 1, Upper Quartet — Video Fields, Film Frames Data Field

The Video Fields, Film Frames data field may be used to provide pulldown information for video that has been transferred from film. If used, it shall be coded as shown in the table below.

VIDEO FIELDS, FILM FRAMES	B7	B6	B5	B4
No information	0	0	0	0
Video field 1, scan 1, 2 scan frame	0	0	0	1
Video field 2, scan 2, 2 scan frame	0	0	1	0
Video field 1, scan 1, 3 scan frame	0	0	1	1
Video field 2, scan 2, 3 scan frame	0	1	0	0
Video field 1, scan 3, 3 scan frame	0	1	0	1
Video field 2, scan 1, 2 scan frame	0	1	1	0
Video field 1, scan 2, 2 scan frame	0	1	1	1
Video field 2, scan 1, 3 scan frame	1	0	0	0
Video field 1, scan 2, 3 scan frame	1	0	0	1
Video field 2, scan 3, 3 scan frame	1	0	1	0
reserved, from	1	0	1	1
through	1	1	1	1

6.3.3 Class 2.1, Data Octet 2 — Film Frame Rate Data Field

The Film Frame Rate data field may be used to identify the source film frame rate. If used, it shall be set as defined in the table below.

FILM FRAME RATE	B7	B6	B5	B4	B3	B2	B1	B0
No information	0	0	0	0	0	0	0	0
Film frame rate, as a percentage of nominal rate (1%-254%)	n	n	n	n	n	n	n	n
Still Frame	1	1	1	1	1	1	1	1

Nominal rate is defined in section 6.3.4.

6.3.4 Class 2.1, Data Octet 3, Lower Quartet — Source Flags Data Field

The Source Flags data field provides three binary data flags that may be used to identify the status of the video source.

The scene change flag (S), when set to 1, indicates the first field of video cut. The telecine source flag (T), when set to 1, indicates the video was transferred from film. The film nominal rate flag (F), in combination with the Scanning System data field (Class 1.1, data octet 1), indicates the nominal rate of the film during transfer to video, in frames per second. If any of these flags are used, B2 shall be be set to 1, otherwise it shall be set to 0. The F flag is only meaningful if the T flag is set to 1.

SOURCE FLAGS	B3	B2	B1	B0
No information	0	0	0	0
Undefined (xxx > 0)	x	0	x	x
Flags valid	F	1	T	S

Note: S = 1 at first field of video cut, 0 elsewhere
T = 1 when video was transferred from film, 0 otherwise
F = Film nominal rate, as defined below:

FILM NOMINAL RATE	F = 0	F = 1
525/59.94	24/1.001	24
625/50	25	24

6.3.5 Class 2.1, Data Octet 3, Upper Quartet — Color Encoding Heritage

The Color Encoding Heritage data field may be used to describe the type of color encoding from which the signal was last decoded, if applicable. If used, the bits shall be set as defined in the table below. Designers of receiving equipment are cautioned that some equipment in the field may code this data in class 1.1, data octet 2, lower quartet, as described in section 6.1.2.

RESERVED	B7	B6	B5	B4
No information	0	0	0	0
NTSC	0	0	0	1
PAL	0	0	1	0
PAL-M	0	0	1	1
SECAM	0	1	0	0
Reserved, from	0	1	0	1
through	1	1	1	1

6.4 Class 2.2, Slow Rate Technical Heritage Information

This data class may be used to indicate the processing used for the nominal signal. This includes such items as colorimetry, gamma, and highlight compression. The specifications for the nominal values are contained in other standards that define these parameters. It is expected that the actual signal processing may have been adjusted for artistic reasons, however, this data octet indicates how the signal is to be treated so those artistic changes will be preserved.

If used, the data in these fields shall be set as defined in the tables below. All bits in any unused fields shall be set to 0.

6.4.1 Class 2.2, Data Octet 1, Lower Quartet — Reference Primaries and Luminance Equation Data Field

This data field, if used, conveys a code which specifies the reference primaries and luminance equation used.

REFERENCE PRIMARIES & LUMINANCE EQ	B3	B2	B1	B0
No information	0	0	0	0
SMPTE 170M	0	0	0	1
PAL	0	0	1	0
ITU-R BT 709, step1	0	0	1	1
ITU-R BT 709, step2	0	1	0	0
SMPTE 240M	0	1	0	1
Reserved, from	0	1	1	0
through	1	1	1	1

6.4.2 Class 2.2, Data Octet 1, Upper Quartet — Gamma Equation data field

The Gamma Equation data field, if used, provides a code which specifies the non linear relationship between scene light levels and the amplitude compressed video signal.

GAMMA EQUATION	B7	B6	B5	B4
No information	0	0	0	0
ITU-R BT 709	0	0	0	1
SMPTE 240M	0	0	1	0
Reserved, from	0	0	1	1
through	1	1	1	1

6.4.3 Class 2.2, Data Octet 2, Lower Quartet – Sample Quantization Data Field

The Sample Quantization data field, if used, provides a code which specifies the number of bits per digital sample for the video signal.

BITS PER SAMPLE	B3	B2	B1	B0
No information	0	0	0	0
8	0	0	0	1
10	0	0	1	0
12	0	0	1	1
14	0	1	0	0
16	0	1	0	1
Reserved, from	0	1	1	0
through	1	1	1	1

6.4.4 Class 2.2, Data Octet 2, Upper Quartet — Reserved Data Field

This data field is reserved. Until defined, this field should be set to 0000.

RESERVED	B7	B6	B5	B4
No information	0	0	0	0
Reserved, from	0	0	0	1
through	1	1	1	1

6.4.5 Class 2.2, Data Octet 3, Lower Quartet — Filtering Data Field

The Filtering data field, if used, provides a code which specifies the filtering which has been applied prior to sampling the video signal.

FILTERING	B3	B2	B1	B0
No information	0	0	0	0
ITU-R BT 601	0	0	0	1
SMPTE 240M	0	0	1	0
Filter undefined	0	0	1	1
No filter	0	1	0	0
Reserved, from	0	1	0	1
through	1	1	1	1

6.4.6 Class 2.2, Data Octet 3, Upper Quartet — Reserved Data Field

This data field is reserved. Until defined, this field should be set to 0000.

RESERVED	B7	B6	B5	B4
No information	0	0	0	0
Reserved, from	0	0	0	1
through	1	1	1	1

6.5 Class 2.3, Other Technical Heritage Information (Reserved)

The format of this data block is undefined at this time. A total of 3 data octets are reserved. Until defined, each octet should be set to 0000 0000.

RESERVED	B7	B6	B5	B4	B3	B2	B1	B0
No information	0	0	0	0	0	0	0	0
Reserved, from	0	0	0	0	0	0	0	1
through	1	1	1	1	1	1	1	1

Annex A (Informative)
Bibliography

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SMPTE 170M-2004, Television — Composite Analog Video Signal — NTSC for Studio Applications

SMPTE 240M-1999 (Archived 2004), Television — 1125-Line High-Definition Production Systems — Signal Parameters

SMPTE 2016-1-2007, Format for Active Format Description and Bar Data

SMPTE 2016-2-2007, Format for Pan-Scan Information

SMPTE 2016-3-2007, Vertical Ancillary Data Mapping of Active Format Description and Bar Data

SMPTE 2016-4-2007, Vertical Ancillary Data Mapping of Pan-Scan Information

SMPTE RP 175-1997, Digital Interface for 4:4:4:4 Component Video Signals (Dual Link)

ATSC A/53-4:2007, ATSC Digital Television Standard, Part 4 — MPEG-2 Video System Characteristics

ETSI TS 101 154 V1.8.1, 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, June 2007.

ITU-R BT 601-5:1995, Studio Encoding Parameters of Digital Television for Standard 4:3 and Wide-Screen 16:9 Aspect Ratios

ITU-R BT 656-4:1998, Interfaces for Digital Component Video Signals in 525-Line and 625-Line Television Systems Operating at the 4:2:2 Level of Recommendation ITU-R BT.601 (Part A)

ITU-R BT 709-5:2002, Parameter Values for the HDTV Standards for Production and International Programme Exchange

Recommended Receiver Reaction to Aspect Ratio Signaling in Digital Video Broadcasting, Issue 1.2.1, February 2001, Digital TV Group (www.dtg.org.uk)

Annex B (Informative)
Pan and Scan Examples

The following examples illustrate some situations which are likely to be encountered in practice. Figure B.1 shows a 4 x 3 viewport centered on a 16x9 source image. The source image is sampled in accordance with SMPTE 267M at a 13.5-MHz sample rate.

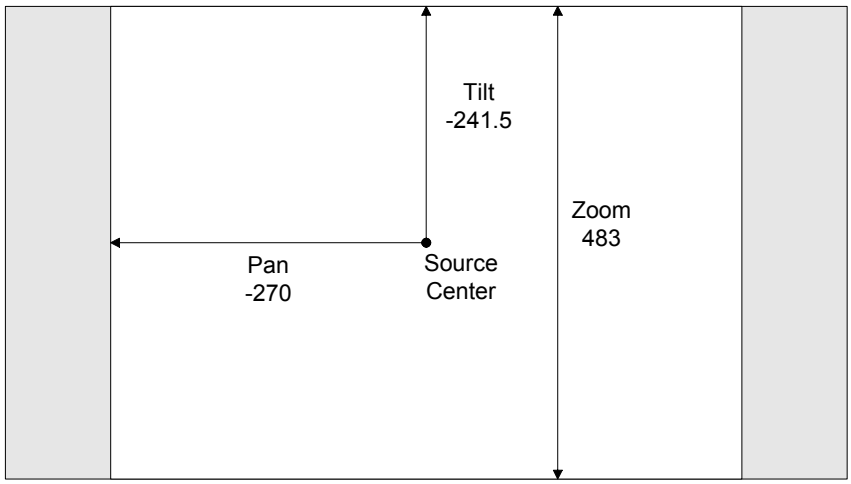

Figure B.1 – 16 x 9 Source, 4 x 3 Sub-Image, 4 x 3 Viewpoint

Figure B.2 also shows a 4 x 3 viewport centered on a 16 x 9 source, but in letterbox format. The source image format is the same as for the first example.

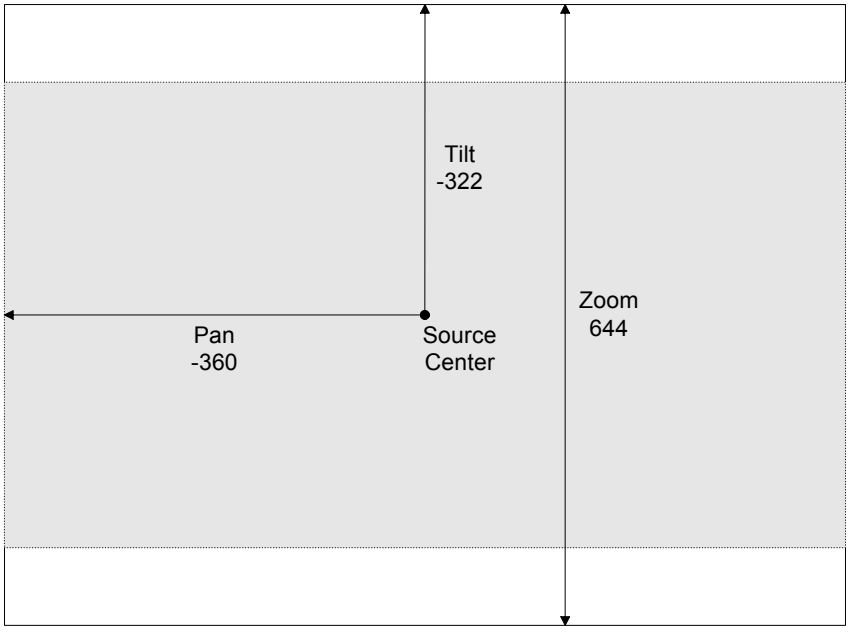

Figure B.2 – 16 x 9 Source, 16 x 9 Image, 4 x 3 Viewport, Letterbox

The final example (Figure B.3) also shows a 4 x 3 viewport centered on a 16 x 9 source, but sized so that the intersection of the two is a rectangle with an aspect ratio of 14 x 9. The source image is the same format as Example 1.

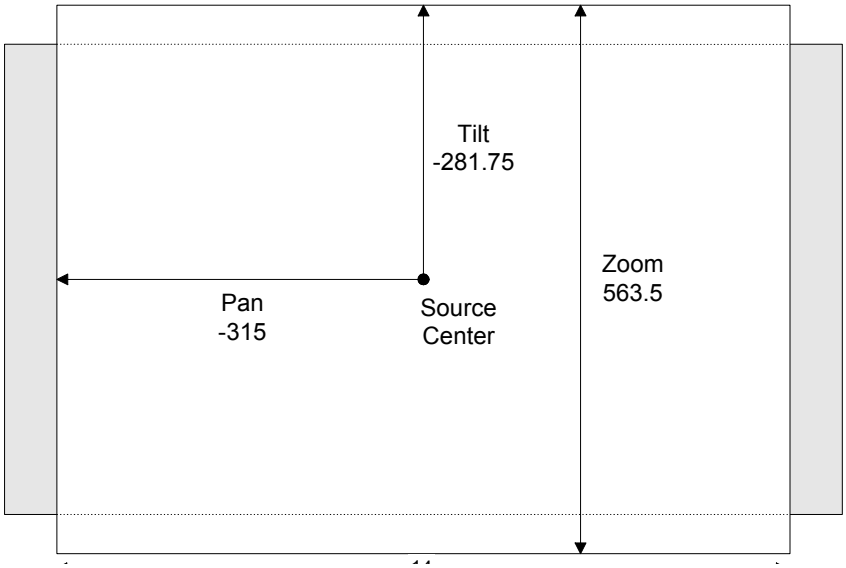

Figure B.3 – 16 x 9 Source, 14 x 9 Sub-Image, 4 x 3 Viewport