

for Television — SDTI Content Package Format (SDTI-CP)



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1 Scope

This standard specifies the format for the transport of content packages (CP) on the serial digital transport interface (SDTI). This format is abbreviated to the term SDTI-CP. The format is a packaging structure for the assembly of system, picture, audio, and auxiliary data items as follows:

- A system item assembled as a group of timing and control elements, plus any metadata associated with the picture, audio, and auxiliary data items;
- A picture item assembled as a group of up to 255 picture stream elements;
- An audio item assembled as a group of up to 255 audio stream elements;
- An auxiliary item assembled as a group of up to 255 auxiliary data elements such as ancillary data lines, teletext, and other data.

This standard defines the structure of the content package mapped onto the SDTI transport. All element and metadata formats are defined by SMPTE 331M.

An SDTI-CP compliant receiver shall be capable of receiving and parsing the structure of the SDTI-CP format.

An SDTI-CP compliant decoder is defined by the ability to both receive and decode a defined set of elements and metadata according to an associated decoder template document.

The baseline operation of this standard is defined by the transport of content packages locked to the SDTI transport frame rate. This standard additionally defines format extension capabilities as follows:

- Allow content package transfers at higher and lower than the specified rate through isochronous and asynchronous transfer modes;
- Provision of a timing mode to reduce delay and provision for two content packages in each SDTI transport frame;
- Carriage of content packages in a low-latency mode; and
- Multiplexing of content packages from different sources onto one SDTI transport.

This standard is limited to SDTI operating at a bit rate of 270 Mb/s and 360 Mb/s as defined by SMPTE 305M.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute 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 edition of the standards indicated below.

ANSI/SMPTE 298M-1997, Television — Universal Labels for Unique Identification of Digital Data

SMPTE 12M-1999, Television, Audio and Film — Time and Control Code

SMPTE 305M-1998, Television — Serial Data Transport Interface

SMPTE 331M-2000, Television — Element and Metadata Definitions for the SDTI-CP

SMPTE RP 168-1993, Definition of Vertical Interval Switching Point for Synchronous Video Switching

SMPTE RP 204-2000, SDTI-CP MPEG Decoder Templates

3 General specification

Figure 1 shows the basic layered structure of a content package. It shall be constructed of up to four items where each item is constructed of one or more elements.

The system item carries content package metadata and may contain a control element. The system item also carries metadata which is related to elements in the other items.

The picture item can consist of up to 255 picture stream elements.

The audio item can consist of up to 255 audio stream elements.

The auxiliary item can consist of up to 255 auxiliary data elements.

A content package contains the associated contents of one content package frame period starting with a system item and optionally containing picture, audio, and auxiliary items.

Element and metadata formats are defined in SMPTE 331M. New element and metadata types may be added as new requirements are defined.

An SDTI-CP decoder shall be specified by its ability to receive and decode an element or set of elements together with associated metadata defined by an associated decoder template document. The MPEG decoder template is SMPTE RP 204. Other decoder template recommended practices may be defined as required for other applications of the SDTI-CP. An SDTI-CP encoder which creates a content package with greater capabilities than those defined by a decoder template may risk undocumented decoder effects.

The term baseline operation is used throughout this standard and has a specific meaning defined as the combination of synchronous transfer mode operating in normal timing mode. Transfer and timing modes are defined in clauses 8 and 9.

This standard first describes baseline operation. Later parts of this standard define the methods by which the SDTI-CP format may:

- allow content package transfers at higher and lower than the specified rate through isochronous and asynchronous transfer modes;
- provide a timing mode to reduce delay and provide for two content packages in each SDTI transport frame;
- carry content packages in a low-latency mode; and

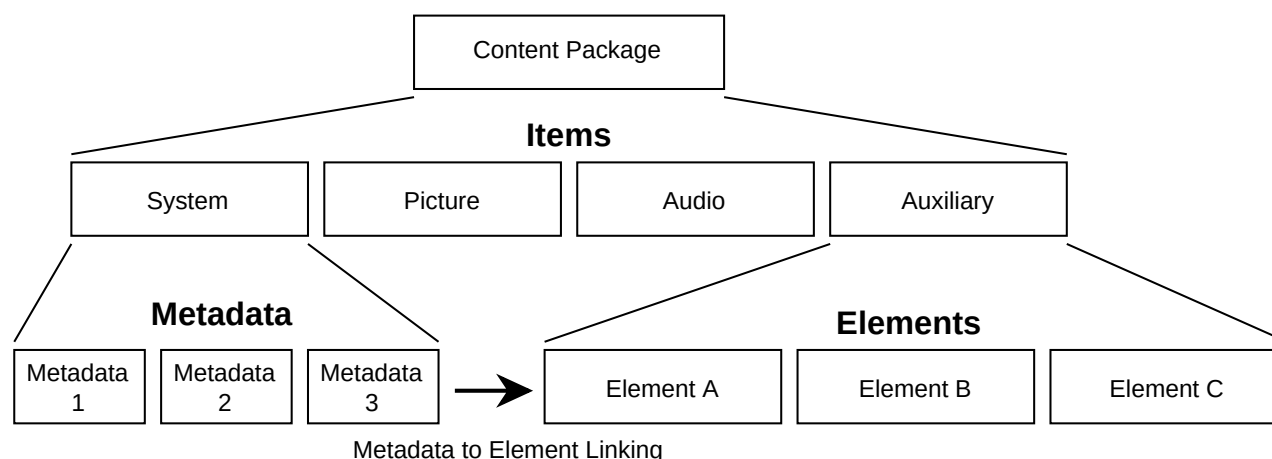


Figure 1 – Basic content package structure

- multiplex content packages from different sources onto one SDTI transport.

In general, special decoders are required to support these modes and the level of support provided shall be indicated in an associated decoder template document.

4 SDTI block structure

The system, picture, audio, and auxiliary items are each formatted as SDTI variable blocks beginning with the separator word and terminating with the end code word. Each variable block shall start immediately following the SAV sequence. Thus, the starting point of a content package can be found through the detection of a system item type code.

The format of each variable length block is shown in figure 2. The input format is 8-bit data entered into bits b0 to b7 of the 10-bit word.

Bits b8 and b9 are both set to 1 for the separator and end code words. For the item type, word count, and data block words, bit 8 is set to be the even parity of bits b0 to b7 and bit 9 is set to be the odd parity of bits b0 to b7. These specifications follow those of SMPTE 305M.

The SDTI data type word values are as follows:

- System item: 04_h
- Picture item: 05_h
- Audio item: 06_h
- Auxiliary item: 07_h

These data type values shall be registered in SMPTE 305M.

4.1 SDTI line and address numbers

Since the data in each SDTI variable block continue through as many lines as necessary until the block

end, it is necessary that the SDTI header line numbers are contiguous. It is also necessary that the SDTI header source and destination address values are constant throughout the transmission of all lines associated with any one content package.

4.2 SDTI switching

The arbitrary switching of SDTI data streams, although at the picture frame boundary, may affect the ability to successfully decode picture, audio, and auxiliary data without the use of special processing equipment to mitigate the switching effects. The lines affected by a picture switch are defined in SMPTE RP 168. A continuity count is provided in the system item which can be used to indicate content packages affected by a switch.

5 Content package structure

Each content package shall consist of a minimum of the system item together with any, all, or none of the picture, audio, and auxiliary items.

The system item shall appear first in any sequence of items within a content package. The order of the picture, audio, and auxiliary items may be restricted in an associated decoder template document. There shall be only one item of any type in any one content package.

A system item shall be present in the content package. The presence of the other items in the content package is optional depending upon the transmission requirements.

In baseline operation, the content package start reference is defined by the switching point of SMPTE RP 168. The system data marks the first item of the content package and, for baseline operation, starts on the following reserved line for current television systems:

525/60: Line 13 625/50: Line 9



Figure 2 – Format of the SDTI variable block

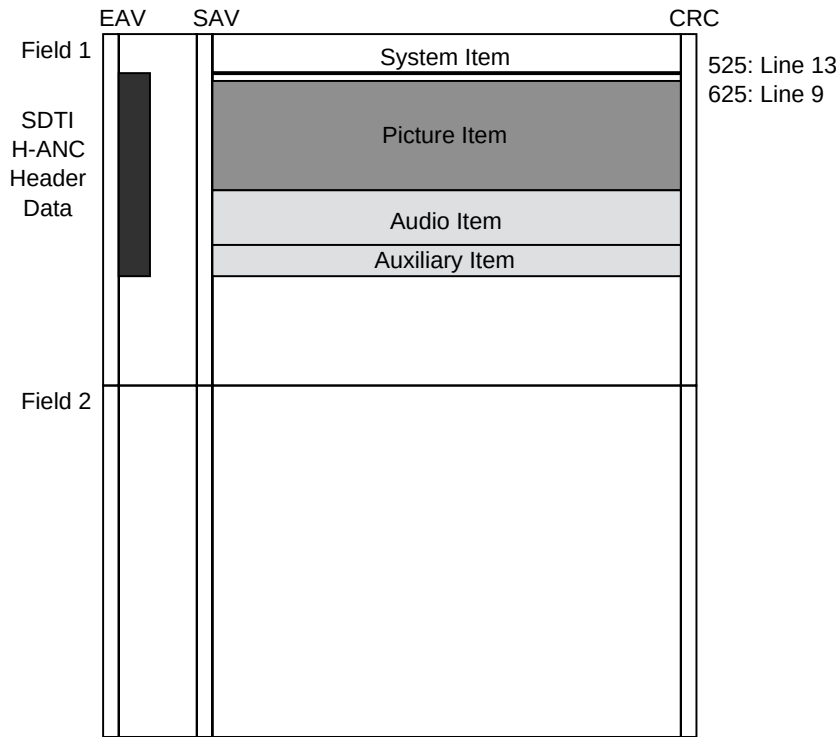


Figure 3 – Arrangement of system, picture, audio and auxiliary items in the content package

The general arrangement of system, picture, audio, and auxiliary data is given in figure 3.

The system item is provided to give content package metadata and control information together with metadata of the associated picture, audio, and auxiliary items.

A picture item is an assembly of up to 255 picture stream elements.

An audio stream item is an assembly of up to 255 audio stream elements.

An auxiliary data item is an assembly of up to 255 auxiliary data elements.

Assignment of an element to an item type is defined in SMPTE 331M. An element shall be placed in its defined item type.

The content package formed by the system, picture, audio, and auxiliary items shall represent the associated contents of one content package frame period defined by the content package rate variable in the system item.

The content package shall not exceed the frame period of the SDTI except where specifically provided by the special transfer modes described later in this standard.

The content package distribution for an example 12-frame MPEG-2 GOP is shown in figure 4.

In the case of special transfer modes, a content package may overlap the interface frame period. In some optional modes, there may be more than one content package per interface frame period. Details of these modes are available in later clauses of this standard.

5.1 Timing considerations

Each content package shall be regarded as a potentially editable unit, so time alignment of the items and elements within a content package is recommended. There may be occasions where time alignment is impractical, but it should be noted that the specification of timing misalignment between items, or elements within an item, is not automatically supported.

The transmission order for all elements in a content package is the order of transmission at the output of each respective element encoder. This may be different for each element (notably in the case of MPEG-2

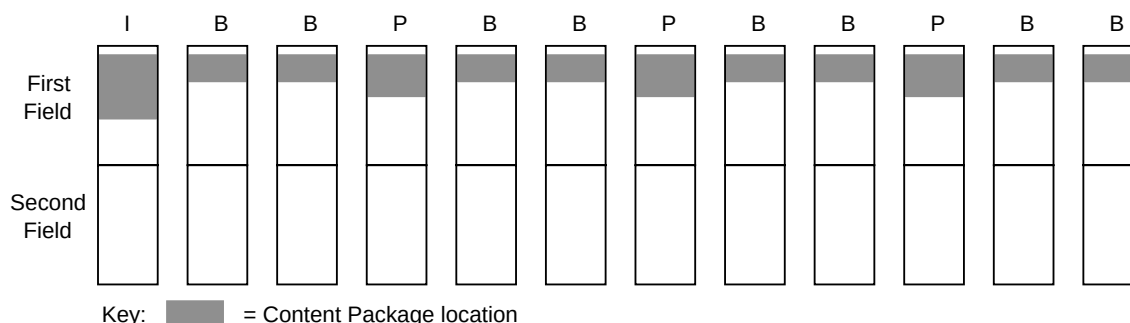


Figure 4 – Content package distribution over an example MPEG-2 GOP

encoding using B frames). Users of this standard should be aware that the elements of a content package may not be time aligned on a frame-by-frame basis and should take appropriate action to avoid timing errors.

Metadata for any element within a content package shall maintain accurate frame association with the element data.

6 Picture, audio, and auxiliary item structure

The picture, audio, or auxiliary item type value is followed by a 4-byte word count and a 1-byte item header word which defines the number of elements in the item.

The item word count value for each item may be set to the length of the data block as defined by SMPTE 305M. However, when not known in advance, the word count value may be set to zero to indicate an undefined block length as defined by SMPTE 305M.

The value of the item header word is the element count and has the range 1 to 255 as shown in figure 5. An element count value of 0 is not a valid value and shall not be used. The maximum number of elements will be typically restricted by an associated decoder template document.

The element data block structure is shown in figure 6.

Each element data block starts with a 1-byte element type value, followed by a 4-byte word count of the element data block size, a 1-byte element number, and the element data.

The element word count has the same format as specified in SMPTE 305M and its value shall be the

length of the element number and element data words. However, where the element word count value is not known at the point of transmission, it may be set to zero to indicate an undefined data block length.

The value of the element number shall lie in the range 0 to 255 and shall be unique among the elements within any item. It is recommended that the element number increment by one for each element in sequence in the item.

The element type and element data formats shall be as defined in SMPTE 331M.

7 System item structure

The system item contains content package metadata and control data together with metadata for each element of the picture, audio, and auxiliary items.

The system item structure is defined in figure 7. It shall start with a 7-byte system item header and may be followed by an SMPTE universal label, timing, package, picture, audio, and auxiliary metadata sets, and control as indicated by the system item bitmap word.

The seven bytes of the system item header define:

- a system item bitmap word;
- a content package rate word;
- a content package type word, including stream status flags;
- a channel handle word;
- a continuity count word.

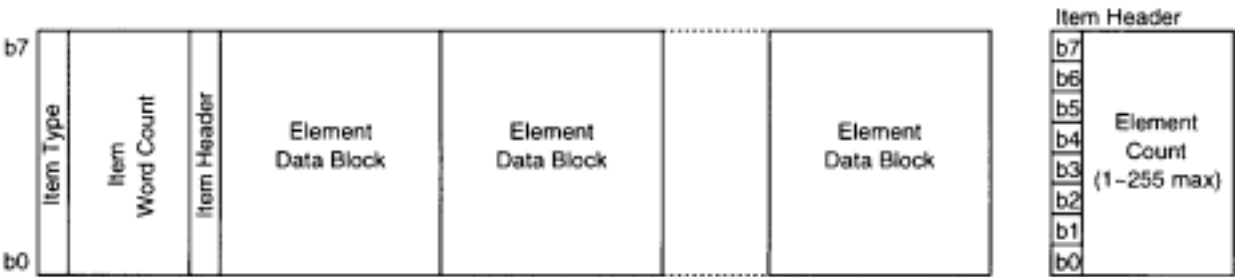


Figure 5 – Structure of picture, audio and auxiliary items

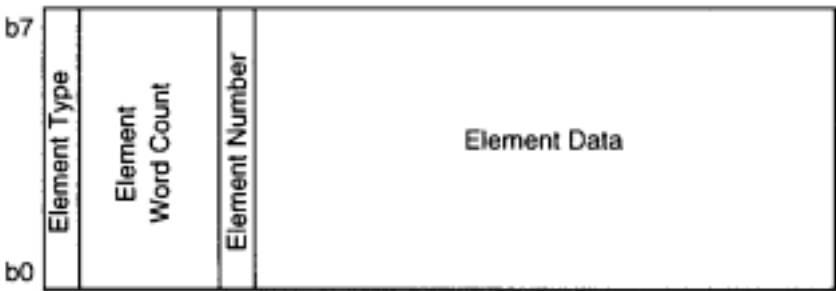


Figure 6 – Structure of element data blocks

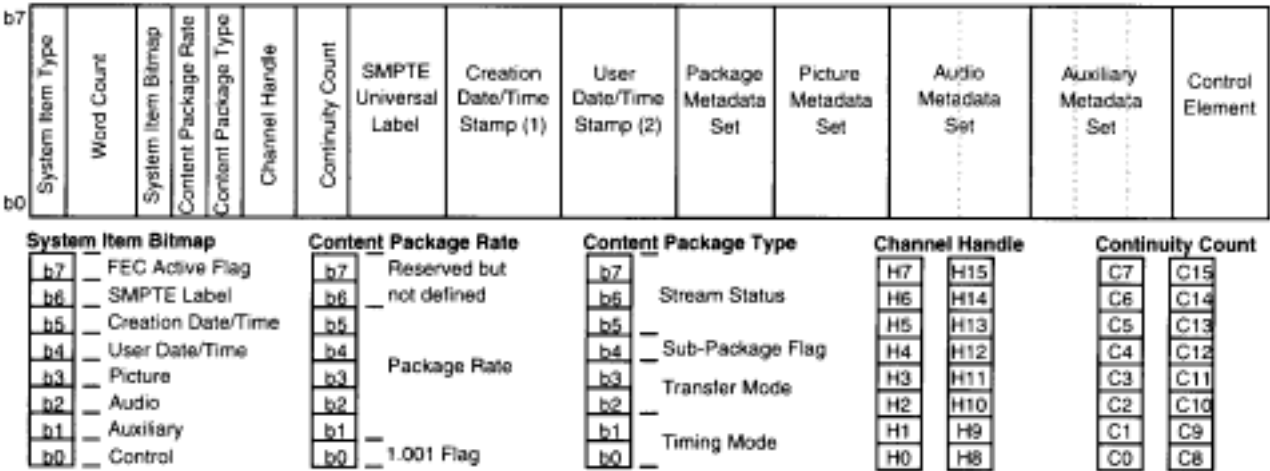


Figure 7 – System item structure