SMPTE STANDARD

for Television — Mapping of Vertical Ancillary Data Packets and Extended Video Line Data into Video DIF Blocks of DV-Based 50 Mb/s DIF Stream Format

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1 Scope

The purpose of this standard is to specify mapping of the extended video line data and the vertical ancillary data packets (VANC) present in the vertical blanking interval (VBI) space of the serial digital interface (SDI) into a 50 Mb/s digital interface format (DIF) structure defined in SMPTE 314M. Format of a VANC packet is defined in SMPTE 291M.

Mapping of the extended video line data permits an increase of video aperture of 7.5 lines in the 525 system and an aperture increase of 9 lines in the 625 system. Mapping of VANC packets provides for carriage of metadata and data essence through the 50 Mb/s DV-based DIF stream structure.

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 editions of the standards indicated below:

ANSI/SMPTE 259M-1997, Television — 10-Bit 4:2:2 Component and $4f_{sc}$ Composite Digital Signals — Serial Digital Interface

SMPTE 291M-1998, Television — Ancillary Data Packet and Space Formatting

Approved
March 17, 2003

SMPTE 314M-1999, Television — Data Structure for DV-Based Audio, Data and Compressed Video — 25 and 50 Mb/s

SMPTE RP 168-2002, Definition of Vertical Interval Switching Point for Synchronous Video Switching

3 General description

Metadata and data essence can be carried in the ancillary space of the SDI stream structures. These data are formatted according SMPTE 291M as ancillary packets and located in VBI space as VANC packets. VANC packets are transformed into digital ancillary packets (DANC) and then mapped into available data space of the 50 Mb/s DV-based DIF stream. The space that is used for mapping data contained in VANC packets and extended video line data is located in reserved space within a compressed macro block (CMB). Compressed macro blocks are located in multiple video DIF blocks of a DIF frame. Multiple DIF blocks of 80 bytes each form a DIF frame and are defined in the SMPTE 314M.

Due to limited CMB data space, and to achieve maximum benefit of the available space by the user, management of the data space should be established (see note 1). A specific data management method is beyond the scope of this standard.

NOTE 1 – Designers should be aware that the size of VANC data can exceed the capacity of the VAUX packs. It is the responsibility of the application to manage the mapping of VANC data into VAUX packs such that only complete VANC packets are mapped into VAUX DIF blocks. Where the VAUX capacity is exceeded, it is the responsibility of the application to manage this mapping in such a way as to minimize the effect on system performance of not mapping all of the VANC data.

Mapping schemes —

This standard specifies three similar mapping schemes. The first scheme (see 7.1) maps only a single extended video line from the end of a frame. This is either line 525 in the 525-line system or line 623 in the 625-line system. The second mapping scheme (see 7.2) maps additional information as well as the vertical ancillary data packets contained in the last video line. The third mapping scheme (see 7.3) maps an additional 7.5 lines of the 525-line system or an additional 9 lines of the 625-line system. These include the last line located at the end of a frame.

i) Extended video line aperture —

The purpose of mapping the extended video line data is to expand the video aperture of the existing 50 Mb/s DV-based compressed signal. Video aperture of this compressed signal is nominally determined by SMPTE 314M and equals 480 lines in the 525-line system and 576 lines in the 625-line system. The extended video line data mapping technique for expansion of the video aperture uses mild compression that is suitable for video signals and similar types of digital data signals, as is, for example, teletext. The method of compressing this data is defined in this standard.

ii) VANC packet mapping —

A VANC packet is located within VBI space of a SDI stream. The SDI interface operates as a 10-bit interface. However, the VANC data packets carry only 8-bit information and it is located in bits b0 to b7 of the VANC packet. The upper two bits of the VANC packet (b8 and b9) can be derived during the reverse conversion process, when the DANC packet is converted back into a VANC packet, and placed back onto the SDI interface.

Before the VANC packets are mapped into the video DIF blocks, they are converted (transformed) into a string of DANC packets. The DANC packets contain all necessary information present in the original VANC packet, including VANC header packet information. The only information not directly mapped is the ADF (ancillary data flag) bytes and bit 9 of the CS byte (check sum).

The ancillary packet conversion/transform to a DANC packet is a direct conversion technique, fully transparent for data content, and defined in this document.

3.1 Data capacity and structure of the available data area

Figure 1 shows organization of a 50 Mb/s DIF frame as defined in SMPTE 314M. Every video DIF block that carries DV-based compressed video essence contains reserved data space used for mapped data. The data payload of a video DIF block is called the compressed macro block (CMB), as shown in figure 2.

A compressed macro block contains two data areas, each occupying the space of two bytes, marked X0, X1. The 12-bits of each CMB data area (X0, X1) is a reserved data space, and used by the mapped data. The remaining lower 4 bits of the X0, X1 data area is set to code 0110.

Capacity (see note 2) of the CMB data area for different television systems is calculated below, and represents the total available mapping space in a DIF frame:

525 /60 system
(12 bits x 2 areas x 135 compressed macro blocks x 20 DIF sequences) / 8 bits = 8100 bytes

625 /50 system
(12 bits x 2 areas x 135 compressed macro blocks x 24 DIF sequences) / 8 bits = 9720 bytes

NOTE 2 – The total data space available for mapping is allocated into two sections, where one section is dedicated to mapping of VANC packets and the other section is dedicated to mapping of extended video line data to achieve a larger video aperture.

4 Division and control of the mapped space (CMB data area)

Figure 1 also shows VAUX DIF blocks located in each of the DIF sequences. DIF frame/stream control information is located in the payload space of these VAUX DIF blocks (3 VAUX DIF blocks are contained in each DIF sequence). This control information is called VAUX source pack (VS) and is defined in SMPTE 314M.

The structure of a VAUX source pack is shown in table 1. While SMPTE 314M does not define the extension flag (EXT) control bits (EXT bits shown in SMPTE 314M are marked as “Reserved” bits for future use), these EXT bits are defined in this standard. The EXT control flag identifies which type of mapped information (VANC or extended video line video content) is located in the CMB data area as indicated in tables 2 and 3.

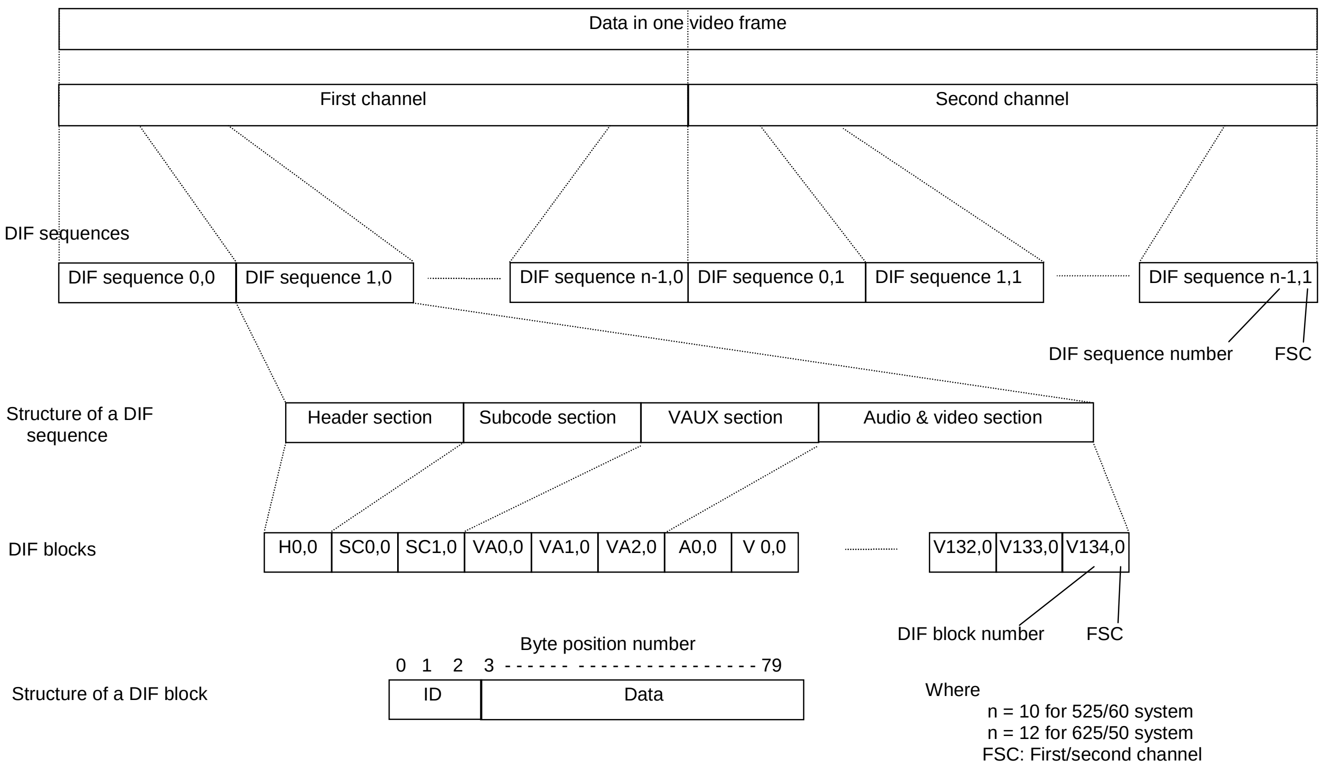

Figure 1 – Organization of a DIF frame for 50-Mb/s DV-based compression

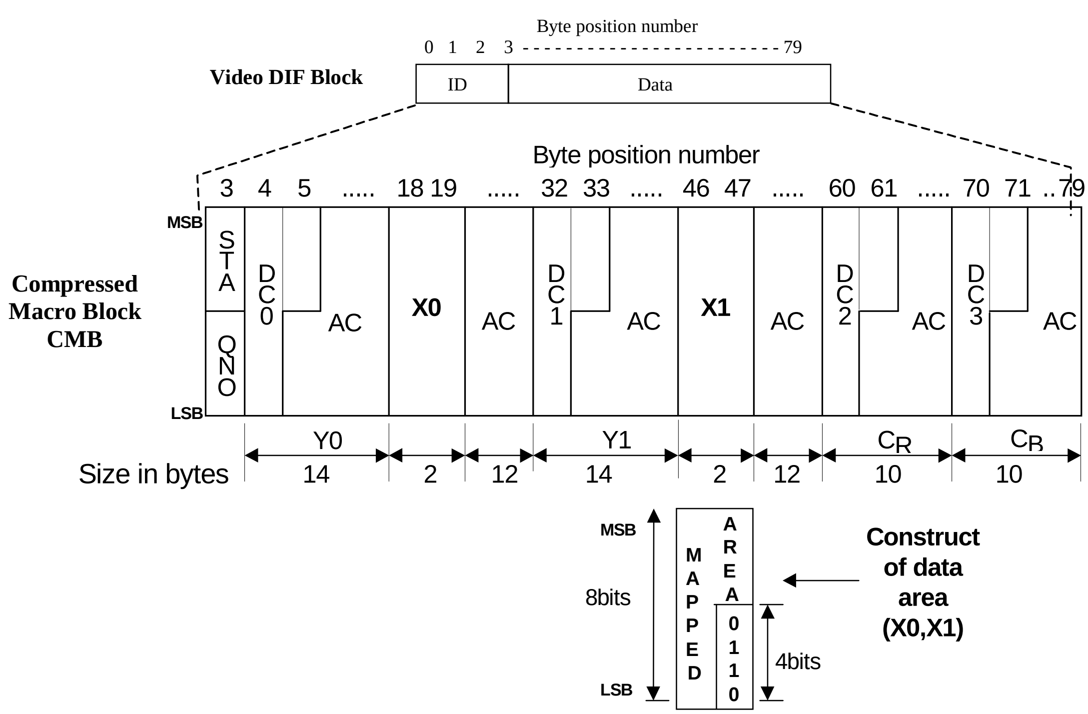

Figure 2 – Construct of a 50-Mb/s DV-based compressed macro block (CMB)

Table 1 – Structure of a VAUX Source Pack

	MSB							LSB
PC0	0	1	1	0	0	0	0	0
PC1	Res							
PC2	B/W	EN	CLF		**EXT**			
PC3	Res		50/60	STYPE (00100)				
PC4	VISC							

EXT: Extension flag – defines use of CMB data areas in a 50 Mb/s DV-based DIF block
Note: EXT bits in SMPTE 314M are "Reserved" bits.

MSB LSB
1001b = ELA data - Data Reduced Video Recoding Data set (defined in a separate document.)
1010b = ELA data
1011b = ELA data and DANC (VANC) data
1101b = ELA and ELB data
Other = Reserved

ELA: Extended Video Line data of line A
A = content of line 525 in 525/60 or 623 in 625/50 system

ELB: Extended Video Line data of lines B
B = content of lines 20, 21, 22, 263, ½ of 282, 283, and 284 in 525/60 system
B = content of lines 19, 20, 21, 22, 331, 332, 333, and 334 in 625/50 system

DANC: A string of DIF ancillary data packets carrying mapped SDI VANC packets

4.1 Structural division of the CMB space in a single DIF frame

The available CMB data area for mapping external data consists of multiple CMBs located in DIF blocks within a single frame. This total area is divided into two areas, called "1st CMB data area" and "2nd CMB data area", as shown in tables 2 and 3. The size of each area is dependent on the number of DIF sequences relative to the television line system that is used. The 50 Mb/s DIF frame of a 525/60 system contains 20 DIF sequences, while a 625/50 DIF frame contains 24 DIF sequences.

4.2.1 Description of EXT flag control bits of a VAUX source pack

In case that EXT bits are set to 1010 code, non-valid data is mapped into the 2nd CMB data area. In addition content of an extended video line (ELA) from the bottom of a video frame is mapped into the 1st CMB data area (see table 2 or 3).

When the EXT bits are set to 1011 code, the DANC packet string (VANC data) is mapped into the 2nd CMB data area. Similarly the content of an extended video line (ELA) from the bottom of a video frame is mapped in to the 1st CMB data area (see table 2 or 3).

When the EXT bits are set to 1101 code, the content of multiple extended video lines (ELB) is mapped into the 2nd CMB data area and content of an extended video line (ELA) from the bottom of a frame is mapped into the 1st CMB data area (see table 2 or 3).

When the EXT bits are set to 1001 code, the data reduced video recoding data set is mapped into the 2nd CMB data area content of an extended video line (ELA) from the bottom of a frame is mapped into the 1st CMB data area. The mapping method of the data reduced video recoding data set is specified in a separate document.

The size of the ELA data area is equal to 1080 bytes per frame regardless of the television line system that is used. The size of the ELB data area or the capacity of the DANC data space is 7020 bytes per a frame for a 525/60 system or 8640 bytes per a frame for a 625/50 system.

4.2.2 525-line television system

The 1st CMB data area of a 525-line television system is located in part of DIF sequences 8 (video DIF blocks 90 through 134) and all of DIF sequence 9 with video DIF blocks 0 through 134 (see lower part of table 2).

The 2nd CMB data area is located in DIF sequences 0 through 8 and uses video DIF blocks 0 through 134 in all of the DIF sequences with the exception of DIF sequence 8. DIF sequence 8 uses only video DIF blocks 0 through 89 (see upper part of table 2).

4.2.3 625 line-television system

The 1st CMB data area of a 625-line television system is located in part of DIF sequences 10 (video DIF blocks 90 through 134) and all of DIF sequence 11 with video DIF blocks 0 through 134 (see lower part of table 3).

The 2nd CMB data area is located in DIF sequences 0 through 10 and uses video DIF blocks 0 through 134 in all of the DIF sequences, with the exception of DIF sequence 10. DIF sequence 10 uses only video DIF blocks 0 through 89 (see upper part of table 3).

Table 2 - CMB data areas of a DIF frame in 525/60 system

<table>
<tr><th rowspan="2">DIF sequence Number</th><th rowspan="2">DIF Block</th><th colspan="3">EXT</th><th rowspan="2">CMB data Area</th></tr>
<tr><th>1010
ELA</th><th>1011
ELA+ DANC</th><th>1101
ELA+ELB</th></tr>
<tr><td rowspan="7">0</td><td>V 0,0</td><td rowspan="11">-Invalid data-</td><td rowspan="11">DANC(VANC)</td><td rowspan="11">ELB</td><td rowspan="11">2nd</td></tr>
<tr><td>V 0,1</td></tr>
<tr><td>V 1,0</td></tr>
<tr><td>V 1,1</td></tr>
<tr><td>:</td></tr>
<tr><td>V 134,0</td></tr>
<tr><td>V 134,1</td></tr>
<tr><td>:</td><td>:</td></tr>
<tr><td rowspan="6">8</td><td>:</td></tr>
<tr><td>V 89,0</td></tr>
<tr><td>V 89,1</td></tr>
<tr><td>V 90,0</td><td rowspan="6">ELA</td><td rowspan="6">ELA</td><td rowspan="6">ELA</td><td rowspan="6">1st</td></tr>
<tr><td>V 90,1</td></tr>
<tr><td>:</td></tr>
<tr><td rowspan="3">9</td><td>:</td></tr>
<tr><td>V 134,0</td></tr>
<tr><td>V 134,1</td></tr>
</table>

NOTE – DANC area data space is equal 7020 bytes/frame. This area contains VANC data.
ELB area data space contains lines 20, 21, 22, 263, ½ of 282, 283 and 284.
ELA area data space contains line 525.

Table 3 - CMB data areas of a DIF frame in 625/50 system

<table>
<tr><th rowspan="2">DIF sequence number</th><th rowspan="2">DIF Block</th><th colspan="3">EXT</th><th rowspan="2">CMB data Area</th></tr>
<tr><th>1010
ELA</th><th>1011
ELA+DANC</th><th>1101
ELA+ELB</th></tr>
<tr><td rowspan="7">0</td><td>V 0,0</td><td rowspan="11">-Invalid data</td><td rowspan="11">DANC(VANC)</td><td rowspan="11">ELB</td><td rowspan="11">2nd</td></tr>
<tr><td>V 0,1</td></tr>
<tr><td>V 1,0</td></tr>
<tr><td>V 1,1</td></tr>
<tr><td>:</td></tr>
<tr><td>V 134,0</td></tr>
<tr><td>V 134,1</td></tr>
<tr><td>:</td><td>:</td></tr>
<tr><td rowspan="6">10</td><td>:</td></tr>
<tr><td>V 89,0</td></tr>
<tr><td>V 89,1</td></tr>
<tr><td>V 90,0</td><td rowspan="6">ELA</td><td rowspan="6">ELA</td><td rowspan="6">ELA</td><td rowspan="6">1st</td></tr>
<tr><td>V 90,1</td></tr>
<tr><td>:</td></tr>
<tr><td rowspan="3">11</td><td>:</td></tr>
<tr><td>V 134,0</td></tr>
<tr><td>V 134,1</td></tr>
</table>

NOTE – DANC area data space is equal to 8640 bytes/frame. This area contains VANC data.
ELB area data space contains lines 19, 20, 21, 22, 331, 332, 333 and 334.
ELA area data space contains line 623.

5 Conversion and mapping process of VANC data packets

SMPTE 291M VANC data packets present on the 10-bit SDI interface are converted into DANC packets. Figure 3 shows the relationship between a VANC and a DANC packet.

A converted DANC packet is identical in length to the originating VANC packet. Of the DID, SDID (DBN), DC, UDW and CS, only the lower 8 bits of the 10-bit SMPTE 291M ancillary data words are processed. For definitions of ADF, DID, SDID, DBN, UDW, and CS of an ancillary packet, see SMPTE 291M.

During the conversion process, the three ADF data bytes are replaced by new information consisting of one LE bit (line enable flag), 11 LN bits (line number), and “Res” bits. “Res” bits are reserved for future use and default value is set to 1. LE bit defines validity of the present LN bits. These LN bits define the SDI line number on which the originating VANC packet resided at the start of the conversion process. The ADF bytes are discarded during this process.

All of the VANC packets present on the SDI interface are converted into DANC packets and these are assembled to form a string of DANC packets of total length “S” bytes. This string of DANC packets is then mapped into the 2nd CMB data area as indicated in table 2 or 3.

The LN bits identify a location of the originating VANC packet on the SDI interface and are used during a reverse mapping process. During that process, the DANC packets are converted back into VANC packets and re-located back into the VBI space of the SDI interface. Use of the LN bits assures that temporal skew of the VANC packets (based on field/frame location) is eliminated is not possible. When the data from a DANC packet is converted back to a VANC packet, the upper 2 bits are generated from the lower 8 bits.

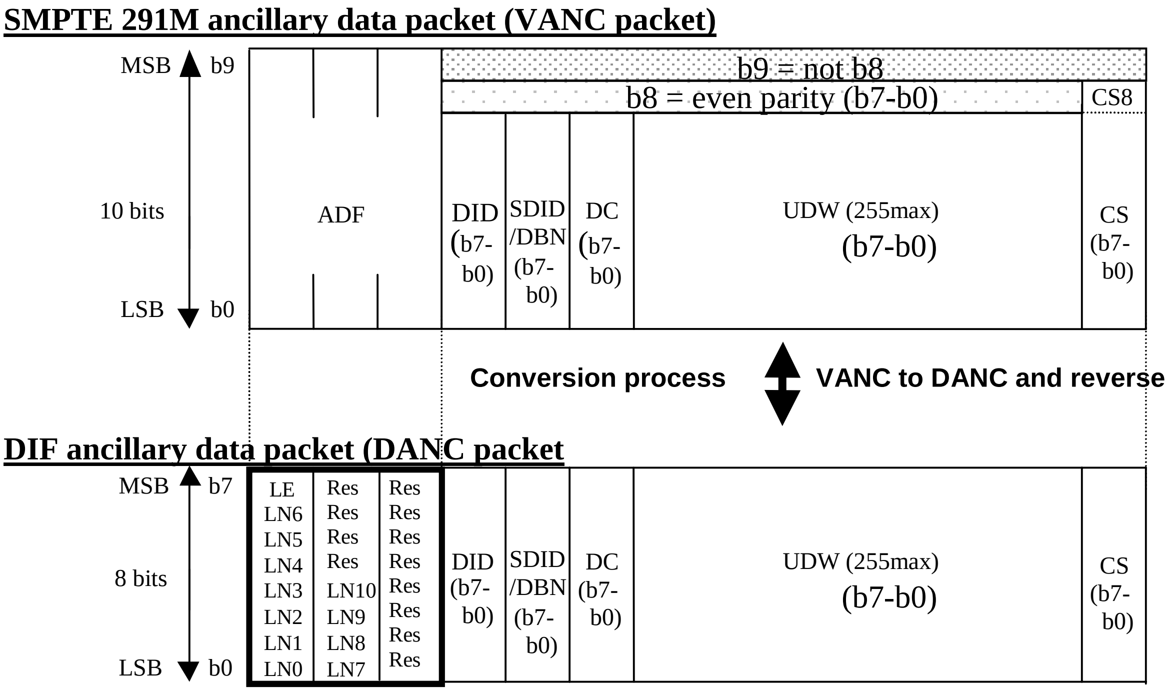

Figure 3 – SMPTE 291M ancillary data packet (VANC) and DIF ancillary data packet (DANC)

LE: Line number enable flag (see note 3)
LE = 0 then LN bits are invalid
LE = 1 then LN bits are valid

NOTE 3 – In the case of originally generated information to be placed in a DANC packet, (e.g., ancillary time code or UMID), LE may be set to 0 or 1, depending on which specific line might be preferred for the mapped data location on the interface.

LN: Line number – a line number identifying where the originating VANC ancillary packet was located.

Res: Reserved bit for future use; default value is set to 1.

5.1 Line number generation

A local television line number counter shall create a LN number. This counter is reset at the beginning of each frame and corresponds to the start of a frame as defined in a relevant system standard. The counter increments value from 1 to n.

For 525/60 system: LN0 -- LN10 = 1,..., 525
For 625/50 system: LN0 -- LN10 = 1,..., 625

5.2 Structure of a CMB data area for mapping DANC packet string

Figure 4 shows the relationship between a CMB data area (X0, X1) of a video DIF block and the mapped string of bytes corresponding to a string of DANC Packets. The B of the Bm indicates a byte of the string, and m indicates the order and byte number of the same string. Then, Bm, Bm+1, Bm+2, …, show the order of the mapped data corresponding to the DANC Packet string.

5.2.1 String of DANC packets and its mapping

The string of DANC packets with a length of S bytes is numbered from byte 0 to byte (S -1). This string is mapped into the 2nd CMB data area in the sequence and order of the byte sequence number Bm. The LSB of the DANC string is mapped in the order shown in Figure 4.

The total size S of all mapped DANC packets should be smaller, or up to the data capacity, available in CMB data area assigned for this purpose. If there is an excess of DANC packet data, management of the mapping process may be required as noted in clause 3 (see note 1 on page 2).

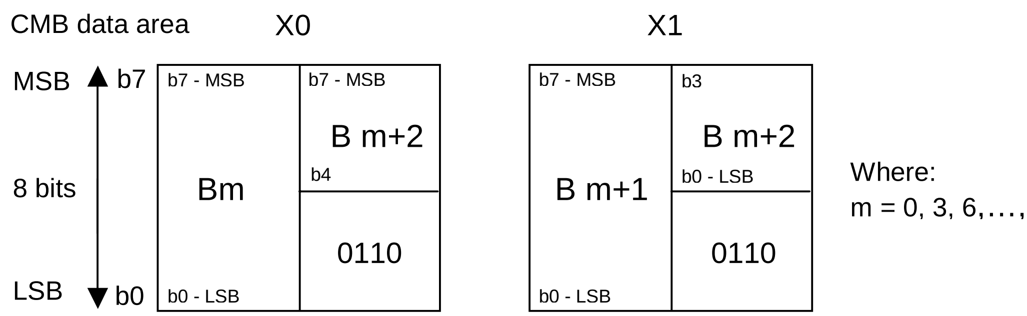

Figure 4 – Relation between CMB data area and a byte number of the DANC packet string

5.2.2 Interleaving of a DANC packet string into DIF sequences

The process of mapping of the DANC packet string starts by mapping byte B0 through B2 (sequence of Bm bytes) into the first video DIF block of the DIF sequence 0 belonging to the first channel of a DIF frame (see figure 1 and table 6 or 7). The subsequent Bm bytes B3 through B5 of the string are mapped into first video DIF block of the DIF sequence 0 belonging to the second channel of a same DIF frame (see figure 1 and table 6 or 7). This process continues until there are no more Bm bytes present. Any unused space within the DANC area shall be filled with FF_h.

5.2.3 Placement of VANC packets during data recovery

VANC packets recovered during the inverse DANC to VANC process shall be placed into the VBI space of a SDI interface. The placement of VANC packets into the VBI space shall be accomplished by following means:

a) If LE is set to zero:
The placement of the VANC packets into the VBI ancillary space starts one line after the vertical switching point line as defined in RP 168. The insertion of VANC packets continues to the last line of the VBI before the start of the first active video line in a field. The placement of packets shall conform to SMPTE 291M rules requiring that ancillary packets are contiguous and left justified. A single video line in VBI space can carry multiple VANC packets as long as space is available.

NOTE – In this case the recovered VANC data packets are not located at the same place on the interface where they were originally located.

b) If LE is set to one:
The placement of the packets within the VBI ancillary space shall be determined by the line number LN indicated in the header of the DANC packet. Recovered VANC data packets are located on the same horizontal line of the interface where they were originally found. The placement of packets shall conform to SMPTE 291M rules requiring that ancillary packets are contiguous and left justified.

6 Extended video line compression and mapping of coded pixels into the CMB data area

6.1 Extended video line pixel and a coded pixel

The value of each pixel of the extended video line is described as Pix j, l, k. During a mild compression process, each pixel Pix j, l, k is compressed from an 8-bit value into a 6-bit value by adopting modified PCM. This method adds prediction and adaptive shift quantization to the normal PCM coding. The value of the coded (compressed) pixel (CP) is expressed as CP j, l, k.

The symbol j is used for identification of the individual signal components regardless of a non-coded or coded form (j=0 for Y; j=1 for CB; j=2 for CR) of the pixel. The symbol l represents the line number and symbol k identifies the horizontal position in a line.

6.2 Pixel coding (compression) process

The compression process is shown below, where all the data operations are two's complement. The described decoding section shows a typical process of a decoder.

```
/* Line number */
line525[8] = { 20, 21, 22, 263, 282, 283, 284, 525 };
line625[9] = { 19, 20, 21, 22, 331, 332, 333, 334, 623 };
/* Pixel position */
start_p1[3] = { 0, 0, 0 };
start_p2[3] = { 360, 180, 180 };
end_p[3] = { 720, 360, 360 };

[ Encoding ]
if ( 525/60system ) e = 8 else e = 9;
if ( 525/60system ) line = line525 else line = line625;
color = 3;

for ( i = 0; i < e; i ++ )
  for ( j = 0; j < color; j ++ ) {
    if ( 525/60system && ( i == 4 ) ) start = start_p2[j] else start = start_p1[j];
    end = end_p[j];
    Pr = 0;           /* Beginning prediction value=0 */

    for ( k = start; k < end; k ++ ) {

      Pu = Pr >> 3;             /* MSB 5 bits */
      if ( Pu < 0 )         Sf = Pu+1;
      else if ( Pu > 0 )    Sf = Pu-1;
      else                  Sf = Pu;

      SI = Pix j,line[i],k  -  Sf;
      SP = Pr  -  Sf;

      /* limitter */
```

```
        if ( SI < -112 )        SI = -112;
        else if ( SI > 112 )  SI = 112;

        SR = SP & 00000011b;              /* LSB 2 bits */
        if ( SR == 10b )         RO = 2;
        else if ( SR == 01b )  RO = 1;
        else if ( SR == 00b )  RO = 0;
        else                          RO = -1;

        /* 8 bits to 6 bits */
        PQ = ( SP + 1 ) >> 2;
        IQ = ( SI - RO + 2 ) >> 2;
        E = SI - SP;

        if ( E < 0 )  { Q4 = IQ - 3;  E2 = ( E + 1 ) >> 1;  E3 = E2 - 1;}
        else          { Q4 = IQ + 3; E2 = E >> 1;           E3 = E2 + 1;}

        Q1 = PQ + E3;
        Q0 = PQ + E;
        P4 = ( IQ << 2 ) + RO;
        P1 = SP + ( E2 << 1 );
        P0 = SP + E;

        if ( | E3 | > 4)        { CP j,line[i],k = Q4; Pr = check_limit ( P4 + Sf ); }
        else if ( | E3 | > 1)  { CP j,line[i],k = Q1; Pr = check_limit ( P1 + Sf ); }
        else                        { CP j,line[i],k = Q0; Pr = check_limit ( P0 + Sf ); }
      }
   }

[ Decoding ]
if ( 525/60system ) e = 8 else e = 9;
if ( 525/60system ) line = line525 else line = line625;
color = 3;

for ( i = 0; i < e; i ++ )
   for ( j = 0; j < color; j ++ ) {
      if ( 525/60system && ( i == 4 ) ) start = start_p2[j] else start = start_p1[j];
      end = end_p[j];
      Pr = 0;     /* Beginning prediction value = 0 */

      for ( k = start; k < end; k ++ ) {

              Pu = Pr >> 3;                    /* MSB 5 bits */
        if ( Pu < 0 )            Sf = Pu +1;
        else if ( Pu > 0 )      Sf = Pu -1;
        else                         Sf = Pu;

        SP = Pr - Sf;

        SR = SP & 00000011b;              /* LSB 2 bits. */
        if ( SR == 10b )         RO = 2;
        else if ( SR == 01b )  RO = 1;
        else if ( SR == 00b )  RO = 0;
        else                          RO = -1;

        PQ = ( SP + 1 ) >> 2;
```

```
        E = CP j,line[i],k - PQ;

        if ( E < 0 )   { E3 = E + 1; IQ = CP j,line[i],k + 3; }
        else           { E3 = E - 1;  IQ = CP j,line[i],k - 3; }

        P4 = ( IQ << 2 ) + RO;
        P1 = SP + ( E3 << 1 );
        P0 = SP + E;

        if ( | E3 | > 4 )          Pr = check_limit ( P4 + Sf );
        else if ( | E3 | > 1 )     Pr = check_limit ( P1 + Sf );
        else                       Pr = check_limit ( P0 + Sf );
        Pix j,line[i],k = Pr;
      }
  }

  check_limit ( x ) {
      if ( x < -127 )       return( -127 );
      else if ( x > 126 )   return( 126 );
      else                  return( x );
  }
```

6.3 Organization of a coded pixel block

The coded values of the Y, CB and CR pixels (CP) are organized into a pixel block (PB). The structure of a single pixel block is shown in figure 5 and consists of two luminance pixels located on an extended video line. The two color difference pixels (CB, CR) are located on a horizontal line related to the luminance line. The pixel block is described as PB l, h, where the symbol l is the line number, and the symbol h is the horizontal count of the pixel blocks on the related line.

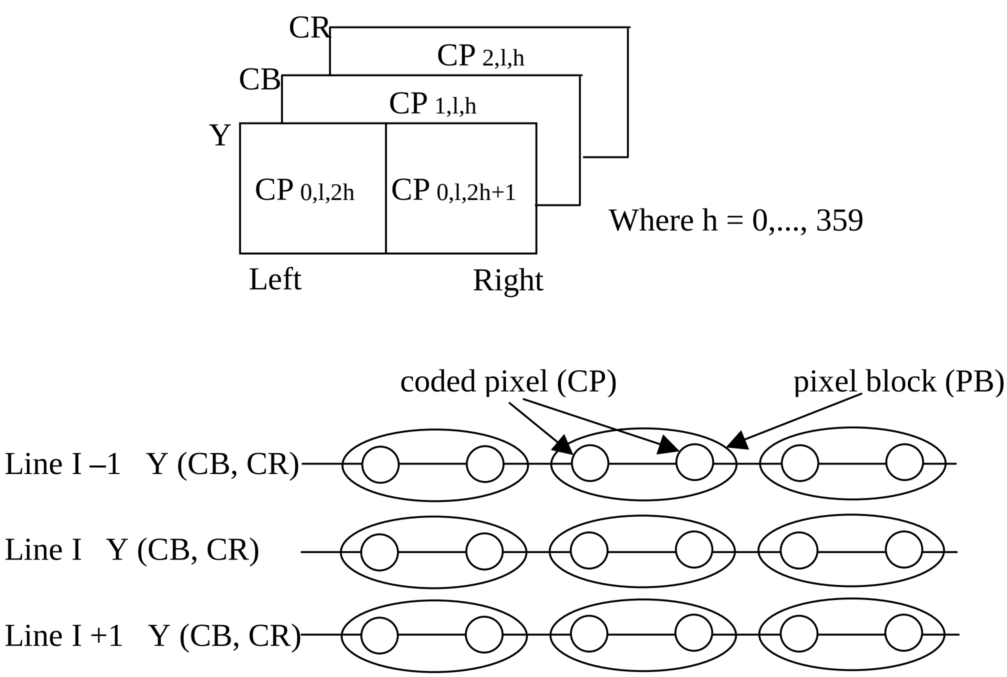

Figure 5 – Organization of a pixel block (PB) and coded pixels (CP)

6.4 Structure of a CMB data area for mapping extended video line data

Figure 6 shows the relationship between a CMB data area (X0, X1) and the pixel block of data contained in an extended video line. A single pixel block is mapped into a single CMB block of a video DIF block. The pixel block contains four coded pixels, two coded luminance samples and two color difference samples CB and CR, as shown in figure 5. The coded pixels are mapped in a bit order shown in figure 6.

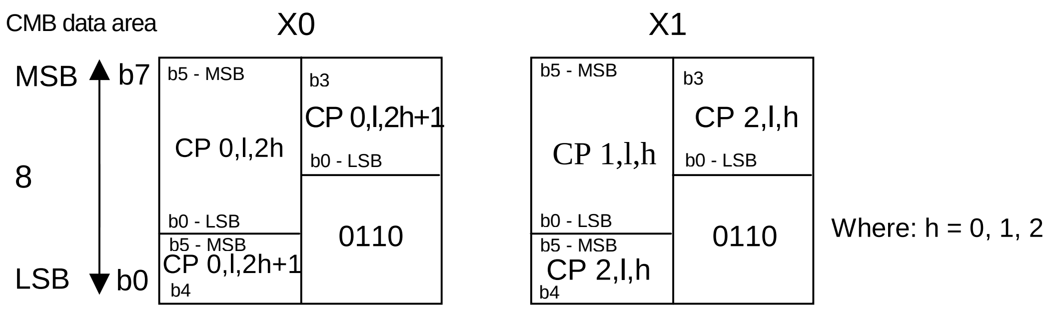

Figure 6 – Structure of a CMB data area and coded pixels of an extended video line data

6.4.1 Coded Pixel Blocks mapping order

The mapping order of the coded PB pixel from the extended video line data, into the CMB data space of the video DIF blocks contained within a frame, is defined in tables 4 through 9 and the bits are mapped as shown in figure 6.

7 Mapping of VANC data and Extended Video Line data CMBs into a video DIF Blocks of a DIF Frame

Tables 4 through 9 define the order of how the VANC (DANC) data CMBs are mapped into video DIF blocks of a DIF frame. The same tables also define the mapping order of extended video line data CMBs into the same DIF frame.

The tables are organized according to the television line system that is used and the type mapping scheme used as described in section 3.

7.1 Mapping of extended video line data from the end of a video frame (ELA scheme)

Table 4 shows the relationship between the video DIF Blocks and ELA data for a 525/60 system. Table 5 shows the same for a 625/50 system. The data of the CMB data areas in the 2nd CMB area are considered invalid and may be filled with FFh. The 1st CMB data area is filled with the ELA data (see also 4.2.2 and 4.2.3). The unused space of the 1st CMB data space shall be filled with 100001b for CP 0,l,2h or CP 0,l,2h+1 and 000000b for CP 1,l,h or CP 2,l,h.

Table 4 – Video DIF blocks and ELA in a 525/60 system

DIF sequence number	DIF block	Pixel block
0	V 0,0	- Invalid data
	V 0,1	- Invalid data
	V 1,0	- Invalid data
	V 1,1	- Invalid data
	:	:
	V 134,0	- Invalid data
	V 134,1	- Invalid data
:	:	:
8	:	:
	V 89,0	- Invalid data
	V 89,1	- Invalid data
	V 90,0	PB 525,0
	V 90,1	PB 525,1
	:	:
9	:	:
	V 134,0	PB 525,358
	V 134,1	PB 525,359

Table 5 – Video DIF blocks and ELA in a 625/50 system

DIF sequence number	DIF block	Pixel block
0	V 0,0	- Invalid data
	V 0,1	- Invalid data
	V 1,0	- Invalid data
	V 1,1	- Invalid data
	:	:
	V 134,0	- Invalid data
	V 134,1	- Invalid data
:	:	:
10	:	:
	V 89,0	- Invalid data
	V 89,1	- Invalid data
	V 90,0	PB 623,0
	V 90,1	PB 623,1
	:	:
11	:	:
	V 134,0	PB 623,358
	V 134,1	PB 623,359

7.2 Mapping of VANC data and extended video line data from an end of a video frame (ELA+VANC)

Table 6 shows the relationship between the video DIF blocks, ELA data and DANC packet string (VANC data) for the 525/60 system. Table 7 shows the same for the 625/50 system. The data space of the 2nd CMB data area is filled with the DANC packet string data and the 1st CMB data area is filled with the ELA data (see also 4.2.2 and 4.2.3). Unused space within the 1st CMB data space shall be filled with 100001b for CP 0,l,2h or CP 0,l,2h+1 and 000000b for CP 1,l,h or CP 2,l,h. Unused space within the 2nd CMB data space shall be filled with FFh for Bm.

Table 6 - Video DIF Blocks and DANC / ELA in the 525/60 system

DIF sequence number	DIF Block	Byte number / Pixel block
0	V 0,0	B 0, B 1, B 2
	V 0,1	B 3, B 4, B 5
	V 1,0	B 6, B 7, B 8
	V 1,1	B 9, B 10, B 11
	:	:
	V 134,0	B 804, B 805, B 806
	V 134,1	B 807, B 808, B 809
:	:	:
8	:	:
	V 89,0	B 7014, B 7015, B 7016
	V 89,1	B 7017, B7018, B 7019
	V 90,0	PB 525,0
	V 90,1	PB 525,1
	:	:
9	:	:
	V 134,0	PB 525,358
	V 134,1	PB 525,359

Table 7 - Video DIF Blocks and DANC / ELA in the 625/50 system

DIF Sequence number	Video DIF Block	Byte number / Pixel block
0	V 0,0	B 0, B 1, B 2
	V 0,1	B 3, B 4, B 5
	V 1,0	B 6, B 7, B 8
	V 1,1	B 9, B 10, B 11
	:	:
	V 134,0	B 804, B 805, B 806
	V 134,1	B 807, B 808, B 809
:	:	:
10	:	:
	V 89,0	B 8634, B 8635, B 8636
	V 89,1	B 8637, B 8638, B 8639
	V 90,0	PB 623,0
	V 90,1	PB 623,1
	:	:
11	:	:
	V 134,0	PB 623,358
	V 134,1	PB 623,359

7.3 Mapping of extended video line data (ELA) from the end of a video frame and multiple line extended video lines (ELB) data from VBI space in a frame (ELA & ELB)

Table 8 defines the relationship between the video DIF blocks and ELA and ELB data for the 525/60 system. Table 9 shows the same for the 625/50 system.

The data space of the 2nd CMB data area is filled with the ELB data content and the 1st CMB data area is filled with the ELA data. (See also sections 4.2.2 and 4.2.3). The unused space of the 1st or 2nd CMB data area shall be filled with 100001b for CP 0,l,2h or CP 0,l,2h+1, and 000000b for CP 1,l,h or CP 2,l,h

Table 8 - Video DIF Blocks and ELA + ELB in a 525/60 system

DIF sequence number	Video DIF vlock	Pixel block
0	V 0,0	PB 20,0
	V 0,1	PB 20,1
	V 1,0	PB 20,2
	V 1,1	PB 20,3
	:	:
	V 134,0	PB 20,268
	V 134,1	PB 20,269
1	V 0,0	PB 20,270
	V 0,1	PB 20,271
	:	:
	V 44,1	PB 20,359
	V 45,0	PB 21,0
	:	:
2	:	:
	V 89,1	PB 21,359
	V 90,0	PB 22,0
	:	:
3	:	:
	V 134,1	PB 22,359
4	V 0,0	PB 263,0
	:	:
5	:	:
	V 44,1	PB 263,359
	V 45,0	PB 282,0
	:	:
	V 134,1	PB 282,179
6	V 0,0	PB 283,0
	:	:
7	:	:
	V 44,1	PB 283,359
	V 45,0	PB 284,0
	:	:
8	:	:
	V 89,1	PB 284,359
	V 90,0	PB 525,0
	:	:
9	:	:
	V134,0	PB 525,358
	V134,1	PB 525,359

Table 9 – Video DIF blocks and ELA + ELB in a 625/50 system

DIF sequence number	Video DIF block	Pixel block
0	V 0,0	PB 19,0
	V 0,1	PB 19,1
	V 1,0	PB 19,2
	V 1,1	PB 19,3
	:	:
	V 134,0	PB 19,268
	V 134,1	PB 19,269
1	V 0,0	PB 19,270
	V 0,1	PB 19,271
	:	:
	V 44,1	PB 19,359
	V 45,0	PB 20,0
	:	:
2	:	:
	V 89,1	PB 20,359
	V 90,0	PB 21,0
	:	:
3	:	:
	V 134,1	PB 21,359
4	V 0,0	PB 22,0
	:	:
5	:	:
	V 44,1	PB 22,359
	V 45,0	PB 331,0
	:	:
6	:	:
	V 89,1	PB 331,359
	V 90,0	PB 332,0
	:	:
7	:	:
	V 134,1	PB 332,359
8	V 0,0	PB 333,0
	:	:
9	:	:
	V 44,1	PB 333,359
	V 45,0	PB 334,0
	:	:
10	:	:
	V 89,1	PB 334,359
	V 90,0	PB 623,0
	:	:
11	:	:
	V 134,0	PB 623,358
	V 134,1	PB 623,359

Annex A (informative)
Abbreviations

ANC:	Ancillary data packet located in ancillary space.
Bm:	A byte name (B) and a byte number (m) of a DANC packet string.
CMB:	Compressed macro block.
CP:	Coded pixel.
DANC packet:	A DIF ancillary data packet is a VANC packet converted into DANC space and is the same length as the original VANC packet.
DANC packet string:	A string of DANC packets that are contiguous and left justified.
DIF :	Digital interface format.
DIF sequence:	A sequence of 150 DIF blocks that form a DIF sequence. Several DIF sequences form a compressed DIF stream frame.
ELA:	Extended video line data of line A (from the end of a frame).
ELB:	Extended video line data of lines B (from the VBI space of the SDI interface).
EXT:	Extension control flag.
LE:	Line number enable flag.
LN:	Line number.
PB:	Pixel block.
Res:	A bit reserved for future use.
S:	Size of a DANC packet string.
SDI:	Serial digital interface.
VANC:	Vertical ancillary data packets located in the vertical blanking interval of the SDI interface.
VAUX DIF block:	A DIF block carrying VAUX data .
VAUX pack:	A pack that subdivides the payload space of a DIF VAUX block. VAUX pack may be 5-byte, 45-byte, or 75-byte long.
VBI:	Vertical blanking interval where VANC packets are located.
Video DIF block:	DIF block carrying DV-based compressed video data.
VS:	VAUX source pack defined in SMPTE 314M

Annex B (informative)
Bits from SDI VANC

This standard maps only the eight least significant bits from the SDI VANC data words, bits b7 through b0, into the DIF blocks of the DV-based stream. For the reverse process of converting DIF blocks into VANC packets, the two most significant bits b8 and b9 are derived. Bit b8 is calculated as the even parity of bits b7 through b0 and bit b9 is the inverse of bit b8. This reverse conversion process is correct for the VANC DID, SDID, DBN, and DC bytes. For most applications this will be correct for the UDW bytes because most applications use this same technique to avoid generating the prohibited byte values. Bit b8 of the CS byte can be calculated to create a valid checksum value.

NOTE – Designers should be aware of the above limitation and should take precautions to avoid using this technique for mapping VANC packets that do not use this technique, into DIF Blocks.

Annex C (informative)
Structure of the mapping process

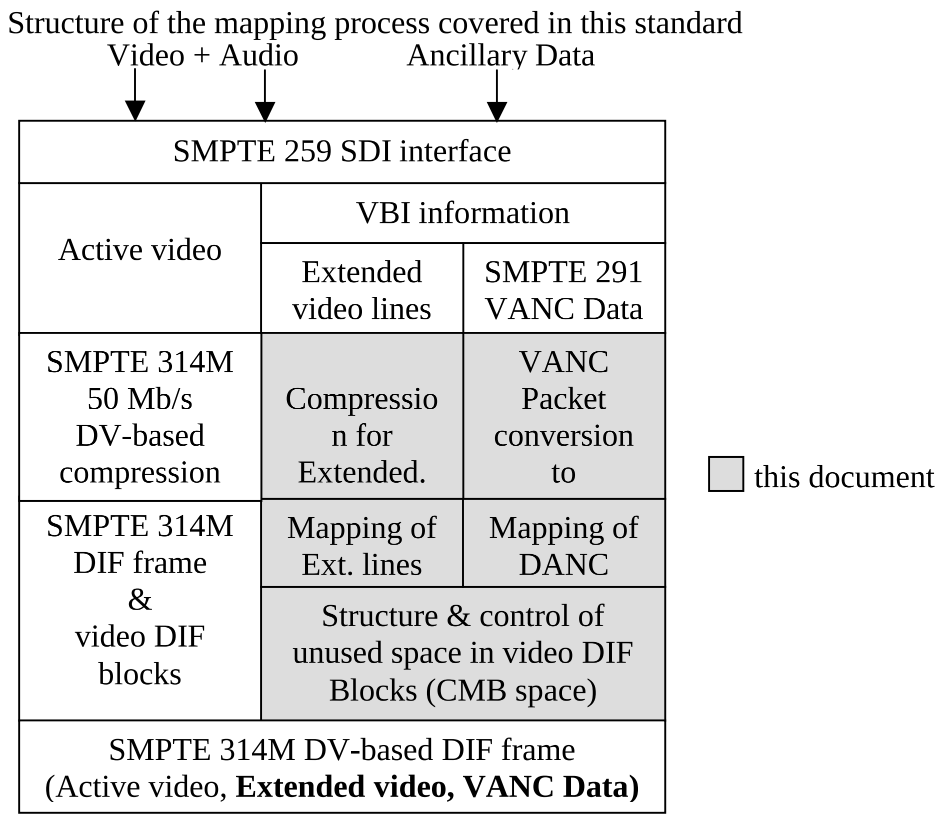

Figure C.1 – Structure of the mapping process