

**Telecommunications and Internet converged Services and
Protocols for Advanced Networking (TISPAN);
Dynamic synchronous Transfer Mode (DTM);
Part 11: Mapping of video streams over DTM**



Reference

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Foreword

This ETSI Standard (ES) has been produced by ETSI Technical Committee Telecommunications and Internet converged Services and Protocols for Advanced Networking (TISPAN).

The present document is part 11 of a multi-part deliverable covering the Dynamic synchronous Transfer Mode (DTM), as identified below:

- ES 201 803-1: "System description";
- ES 201 803-2: "System characteristics";
- ES 201 803-3: "Physical protocol";
- ES 201 803-4: "Mapping of DTM frames into SDH containers";
- ES 201 803-5: "Mapping of PDH over DTM";
- ES 201 803-6: "Mapping of Synchronous Digital Hierarchy (SDH) over DTM";
- ES 201 803-7: "Ethernet over DTM Mapping";
- ES 201 803-9: "Mapping of ATM over DTM";
- TR 101 803-10: "Routing and switching of IP traffic over DTM";
- ES 201 803-11: "Mapping of video streams over DTM";**
- ES 201 803-12: "Mapping of MPLS over DTM";
- ES 201 803-13: "System description of sub-rate DTM".

1 Scope

The present document specifies:

- the functional requirements for transport of ITU-R Recommendation BT.601 [7] encoded video over DTM;
- the functional requirements for transport of DVB/MPEG-2 TS encoded video over DTM;
- the characteristics of transport of ITU-R Recommendation BT.601 [7] encoded video over DTM;
- the characteristics of transport of DVB/MPEG-2 TS encoded video over DTM.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication and/or edition number or version number) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

Referenced documents which are not found to be publicly available in the expected location might be found at <http://docbox.etsi.org/Reference>.

- [1] CENELEC EN 50083-9: "Cable networks for television signals, sound signals and interactive services - Part 9: Interfaces for CATV/SMATV headends and similar professional equipment for DVB/MPEG-2 transport streams".
- [2] ETSI EN 300 421: "Digital Video Broadcasting (DVB); Framing structure, channel coding and modulation for 11/12 GHz satellite services".
- [3] ETSI EN 300 429: "Digital Video Broadcasting (DVB); Framing structure, channel coding and modulation for cable systems".
- [4] Void.
- [5] ETSI ES 201 803-2-3: "Dynamic synchronous Transfer Mode (DTM); Part 2: System Characteristics; Sub-part 3: Transport network and channel adaptation aspects".
- [6] ITU-R Recommendation BT.470: "Conventional television systems".
- [7] ITU-R Recommendation BT.601: "Studio encoding parameters of digital television for standard 4:3 and wide-screen 16:9 aspect ratios".
- [8] ITU-R Recommendation BT.656: "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)".
- [9] ITU-R Recommendation BT.709: "Parameter values for the HDTV standards for production and international programme exchange".
- [10] ITU-T Recommendation H.222.0: "Information technology - Generic coding of moving pictures and associated audio information: Systems".
- [11] SMPTE 240M: "Television - Signal Parameters - 1125-Line High-Definition Production Systems".
- [12] SMPTE 259M: "Television - 10-Bit 4:2:2 Component and 4fsc Composite Digital Signals - Serial Digital Interface".

- [13] SMPTE 260M: "Television - 1125/60 High-Definition Production System - Digital Representation and Bit-Parallel Interface".
- [14] SMPTE 274M: "Television - 1920 x 1080 Scanning and Analog and Parallel Digital Interfaces for Multiple Picture Rates".
- [15] SMPTE 292M: "Television - Bit-Serial Digital Interface for High-Definition Television Systems".
- [16] SMPTE 295M: "Television - 1920 x 1080 50-Hz - Scanning and Interfaces".

3 Abbreviations

For the purposes of the present document, the following abbreviations apply:

AES/EBU	Advanced Encryption Standard/European Broadcasting Union
AGC	Automatic Gain Control
AI	Adapted Information
AIS	Alarm Indication Signal
AP	Adaptation Point
ASI	Asynchronous Serial Interface
CI	Characteristic Information
CP	Connection Point
DCAP-0	DTM Channel Adaptation Protocol 0
DTM	Dynamic synchronous Transfer Mode
DTV	Definition TeleVision
DVB	Digital Video Broadcasting
EAV	End of Active Video
HD	Header Data
HDTV	High Definition TeleVision
IF	In Frame
MI	Management Information
MP	Management Point
MPEG	Moving Pictures Experts Group
NTSC	National Television System Committee
OOF	Out Of Frame
PAL	Phase Alternating Line
SDI	Serial Digital Interface
TI	Timing Information
TNRM	Transport Network Reference Model
TP	Timing Point
TRS	Timing Reference Signal
TS	Transport Stream

4 Overview

The digital transmission of video exists in numerous uncompressed formats and a few compressed formats. Within the present document the mapping of the digital encoding of PAL and NTSC (see ITU-R Recommendations BT.470 [6] and BT.601 [7]) in 4:3 (270 Mb/s) and 16:9 (360 Mb/s) (see ITU-R Recommendation BT.656 [8] and SMPTE 259M [12]) as well as a variety of HDTV (see ITU-R Recommendation BT.709 [9], SMPTEs 260M [13], 295M [16] and 274M [14]) signals (1,485 Gb/s and 1,4835 Gb/s) (see SMPTE 292M [15]) over DTM will be specified. These formats are listed in tables 1 and 2.

Further will the transport of MPEG-2 Transport Streams and DVB streams (see EN 300 429 [3]) be specified. The MPEG-2 TS/DVB streams can be accessed over a number of physical interfaces such as DVB-ASI.

This provides the professional transport formats in studio, contribution networks as well as distribution networks a transport service over a DTM network. In order to aid the modelling and understanding of the broadcast standards for digital television, annexes A and B provides the SDI TNRM model while annexes C, D and E provides the DVB/ASI TNRM model as an informative part of the present document. This modelling does not include all functions and options, but a framework for which further modelling can be done.

NOTE 1: While modelling of physical interfaces have been done for electrical interfaces only, similar modelling may be performed for optical interfaces or other electrical interfaces.

NOTE 2: Additional services can be transported over SDI using auxiliary data, including AES/EBU signals etc.

NOTE 3: Additional forms of DVB/MPEG-2 TS transport interfaces exist. The present document provides the transport mapping of the DVB/MPEG-2 transport stream regardless of the type of interface.

Table 1: Standard definition serial digital interface mapping properties

System	PAL 4:3	NTSC 4:3	PAL 16:9	NTSC 16:9
Analogue standard	BT.470	BT.470	BT.470	BT.470
Digital format standard	BT.601	BT.601	BT.601	BT.601
Digital interface standard	BT.656	BT.656	BT.656	BT.656
Active lines	576	486	576	486
Active samples	720	720	960	960
Total lines	625	525	625	525
Lum samples	864	858	1 152	1 144
Total samples	1 728	1 716	2 304	2 288
Frame rate	25	30	25	30
Drop-frame ratio	1	1,001	1	1,001
Fields/frame	2	2	2	2
Blanking codewords	140	134	188	180
Bitrate (Mb/s)	270	270	360	360
x (Physical/DataLink type)	1	1	2	2
Blocks/line	54	53,625	72	71,5
EAV alignments	1	8	1	2
Blocks/frame	33 750	28 153,1	45 000	37 537,5
Blocks/s	843 750	843 750	1 125 000	1 125 000
Blocks/DTM frame	105,469	105,469	140,625	140,625
Slots/DTM frame	528	528	704	704
Overcapacity (kb/s)	336	336	448	448

Table 2: High Definition Serial Digital Interface mapping properties

System	HDTV	HDTV	HDTV	HDTV	HDTV	HDTV	HDTV	HDTV	HDTV	HDTV	HDTV
Analogue standard	SMPTE 240M	SMPTE 240M	ITU-R BT.709	ITU-R BT.709	ITU-R BT.709	ITU-R BT.709	ITU-R BT.709	ITU-R BT.709	ITU-R BT.709	ITU-R BT.709	ITU-R BT.709
Digital format standard	SMPTE 260M	SMPTE 260M	SMPTE 295M-2	SMPTE 274M-4	SMPTE 274M-5	SMPTE 274M-6	SMPTE 274M-7	SMPTE 274M-8	SMPTE 274M-9	SMPTE 274M-10	SMPTE 274M-11
Digital interface standard	SMPTE 292M-A	SMPTE 292M-B	SMPTE 292M-C	SMPTE 292M-D	SMPTE 292M-E	SMPTE 292M-F	SMPTE 292M-G	SMPTE 292M-H	SMPTE 292M-I	SMPTE 292M-J	SMPTE 292M-K
Active lines	1 035	1 035	1 080	1 080	1 080	1 080	1 080	1 080	1 080	1 080	1 080
Active samples	1 920	1 920	1 920	1 920	1 920	1 920	1 920	1 920	1 920	1 920	1 920
Total lines	1 125	1 125	1 250	1 125	1 125	1 125	1 125	1 125	1 125	1 125	1 125
Lum samples	2 200	2 200	2 376	2 200	2 200	2 640	2 200	2 200	2 640	2 750	2 750
Total samples	4 400	4 400	4 752	4 400	4 400	5 280	4 400	4 400	5 280	5 500	5 500
Frame rate	30	30	25	30	30	25	30	30	25	24	24
Drop-frame ratio	1	1,001	1	1	1,001	1	1	1,001	1	1	1,001
Fields/frame	2	2	2	2	2	2	1	1	1	1	1
Blanking codewords	272	272	448	272	272	712	272	272	712	822	822
Bitrate (Mb/s)	1 485	1 483,5	1 485	1 485	1 483,5	1 485	1 485	1 483,5	1 485	1 485	1 483,5
x (Physical/Data Link type)	4	3	4	4	3	4	4	3	4	4	3
Blocks/line	137,5	137,5	148,5	137,5	137,5	165	137,5	137,5	165	171,875	171,875
EAV alignments	2	2	2	2	2	1	2	2	1	8	8
Blocks/frame	154 687	154 687	185 625	154 687	154 687	185 625	154 687	154 687	185 625	193 359	193 359
Blocks/s	4 640 625	4 635 989	4 640 625	4 640 625	4 635 989	4 640 625	4 640 625	4 635 989	4 640 625	4 640 625	4 635 989
Blocks/DTM frame	580,078	579,499	580,078	580,078	579,499	580,078	580,078	579,499	580,078	580,078	579,499
Slots/DTM frame	2 901	2 898	2 901	2 901	2 898	2 901	2 901	2 898	2 901	2 901	2 898
Overcapacity (kb/s)	312	259,516	312	312	259,516	312	312	259,516	312	312	259,516

5 DTM SDI Video transport application layer model

The SDI 270 Mb/s, 360 Mb/s, 1 483 Mb/s and 1 485 Mb/s transport over DTM is specified as the adaptation function on top of the DCAP-0 (see ES 201 803-2-3 [5]) application trail terminators.

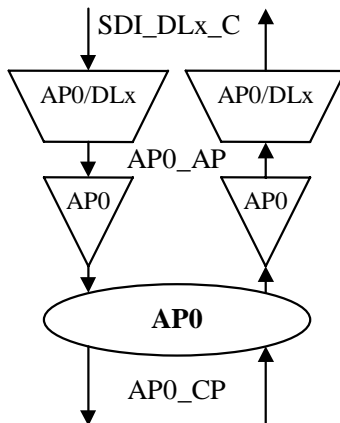


Figure 1: SDI Video transport atomic functions

5.1 Access point information

5.1.1 Characteristic Information

The Characteristic Information (CI) of the Connection Point (CP) is:

- the 10 bit wide data signal for data link type x DLx_CI_D;
- the clock signal for data link type x DLx_CI_CK;
- the TRS Frame Start type x DLx_CI_FS;
- the server signal failure signal for data link type x DLx_CI_SSF.

NOTE: See annexes A and B for additional information on SDI modelling and signals.

5.1.2 Adapted Information

The Adapted Information (AI) of the Adaptation Point (AP) is described in (see ES 201 803-2-3 [5]) as the Application 0 adapted information.

5.1.3 Management Information

The Management Information (MI) of the Management Point (MP) is:

- the 1 second timer signal AP0/SDI_DLx_A_So_MI_1second;
- the positive frequency justification 1 second performance counter AP0/SDI_DLx_A_So_MI_pFJ+;
- the negative frequency justification 1 second performance counter AP0/SDI_DLx_A_So_MI_pFJ-;
- the loss of justification cause signal AP0/SDI_DLx_A_Sk_MI_cLOJ;
- the alarm indication signal cause signal AP0/SDI_DLx_A_Sk_MI_cAIS.

5.1.4 Timing Information

The Timing Information (TI) of the Timing Point (TP) is:

- the Application 0 data clock timing indication AP0_TI_CK;
- the Application 0 frame start timing indication AP0_TI_FS.

5.2 Connection function (AP0_C)

Not applicable. There is no connection functions defined for this layer.

5.3 Trail Termination functions

The trail termination functions are empty mappings between AI and CI.

5.3.1 Application 0 Trail Termination function (AP0_TT)

The Application 0 trail termination functions are empty mappings between AI and CI.

5.3.1.1 Application 0 Trail Termination Source function (AP0_TT_So)

Symbol



Figure 2: Application 0 Trail Termination Source (AP0_TT_So)

Interfaces

Table 3: AP0_TT_So Input and output signals

Input(s)	Output(s)
AP0_AI_D	AP0_CI_D
AP0_AI_CK	AP0_CI_CK
AP0_AI_II	AP0_CI_II
AP0_AI_PSI	AP0_CI_PSI
AP0_AI_TSF	AP0_CI_SSF

Processes and anomalies

None.

Defects

None.

Consequent actions

None.

Defect correlation

None.

Performance monitoring

None.

Output mapping

AP0_CI_D ← AP0_AI_D.

AP0_CI_CK ← AP0_AI_CK.

AP0_CI_II ← AP0_AI_II.

AP0_CI_PSI ← AP0_AI_PSI.

AP0_CI_SSF ← AP0_AI_TSF.

Fault management

None.

Long term performance monitoring

None.

5.3.1.2 Application 0 Trail Termination Sink function (AP0_TT_Sk)**Symbol****Figure 3: Application 0 Trail Termination Sink (AP0_TT_Sk)****Interfaces****Table 4: AP0_TT_Sk Input and output signals**

Input(s)	Output(s)
AP0_CI_D	AP0_AI_D
AP0_CI_CK	AP0_AI_CK
AP0_CI_II	AP0_AI_II
AP0_CI_PSI	AP0_AI_PSI
AP0_CI_SSF	AP0_AI_TSF

Processes and anomalies

None.

Defects

None.

Consequent actions

None.

Defect correlation

None.

Performance monitoring

None.

Output mapping

AP0_AI_D ← AP0_CI_D.

AP0_AI_CK ← AP0_CI_CK.

AP0_AI_II ← AP0_CI_II.

AP0_AI_PSI ← AP0_CI_PSI.

AP0_AI_TSF ← AP0_CI_SSF.

Fault management

None.

Long term performance monitoring

None.

5.4 Adaptation functions

5.4.1 Application 0 to SDI Data Link Adaptation function (AP0/SDI_DLx_A)

This clause describes the SDI adaptation using Application 0 trail terminators.

5.4.1.1 Application 0 to SDI Data Link Adaptation Source function (AP0/SDI_DLx_A_So)

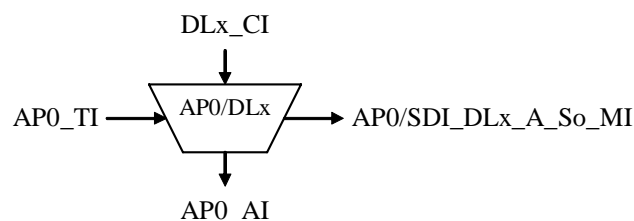
Symbol

Figure 4: Application 0 to SDI Data Link Adaptation Source (AP0/SDI_DLx_A_So)

Interfaces

Table 5: AP0/DLx_A_So Input and output signals

Input(s)	Output(s)
DLx_CI_D	AP0_AI_D
DLx_CI_CK	AP0_AI_CK
DLx_CI_FS	AP0_AI_II
DLx_CI_SSF	AP0_AI_PSI
AP0_TI_CK	AP0_AI_TSF
AP0_TI_FS	AP0/SDI_DLx_A_So_MI_pFJ-
AP0/SDI_DLx_A_So_MI_1second	AP0/SDI_DLx_A_So_MI_pFJ+

Processes and anomalies

The division of the DLx word stream into segments as specified in clause 7. See ES 201 803-2-3 [5], clause 6.1.13.

The multiplexing of 32 DLx words in the segment into 5 data slots. See ES 201 803-2-3 [5], clause 6.1.13.

The multiplexing of data slots into a slot stream on AI_D. See ES 201 803-2-3 [5], clause 6.1.13.

sII: The indirect multiplexing (performed by the TT_So) of 1 idle marker in between segments (see clause 6) by assertion of the Idle Insertion signal (sII). The number of idle markers is given by the frequency justification process, see ES 201 803-2-3 [5], clauses 6.1.12.1 and 6.1.13.6.

sPSI: The Performance Supervision Insertion signal (sPSI) is asserted when the performance supervision special marker of a segment is to be transmitted according to clause 6, else it is de-asserted. See ES 201 803-2-3 [5], clause 6.1.13.6.

The continuous monitoring of the deviation in phase between the incoming signal and the transmitted signal is performed in order to perform frequency justifications. See ES 201 803-2-3 [5], clause 6.1.8.1.

The performance of positive justification when the incoming signal rate is above the nominal signal rate, by the transmission of a data in replacement of an idle-marker where positive justification is allowed. See ES 201 803-2-3 [5], clause 6.1.8.1. For justification opportunity, see clause 6.1.

The performance of negative justification when the incoming signal rate is below the nominal signal rate, by the transmission of an idle-marker in place of data where negative justification is allowed. See ES 201 803-2-3 [5], clause 6.1.8.1. For justification opportunity, see clause 6.1.

nFJ+: The positive frequency justification anomaly (nFJ+) is asserted when a positive frequency justification has occurred, else it is de-asserted. See ES 201 803-2-3 [5], clause 6.1.8.1.

nFJ-: The negative frequency justification anomaly (nFJ-) is asserted when a negative frequency justification has occurred, else it is de-asserted. See ES 201 803-2-3 [5], clause 6.1.8.1.

AIS: The Alarm Indication Signal (AIS) insertion into AI_D instead of received signal when the CI_SSF signal is asserted. See ES 201 803-2-3 [5], clause 6.1.5.1.

Defects

None.

Consequent actions

aAIS: The Alarm Indication Signal action (aAIS) is asserted when the Server Signal Fail (SSF) is asserted. See ES 201 803-2-3 [5], clause 6.3.1.1.

aAIS ← CI_SSF.

Defect correlation

None.

Performance monitoring

pFJ+ (A_So): The Positive Frequency Justification performance (pFJ+) is the number of positive frequency justifications anomalies (nFJ+) that has occurred during 1 s. See ES 201 803-2-3 [5], clause 6.5.3.1.

$$pFJ+ \leftarrow \Sigma nFJ+.$$

pFJ- (A_So): The Negative Frequency Justification performance (pFJ-) is the number of negative frequency justification anomalies (nFJ-) that has occurred during 1 s. See ES 201 803-2-3 [5], clause 6.5.3.2.

$$pFJ- \leftarrow \Sigma nFJ-.$$

Output mapping

$$AP0_AI_D \leftarrow AI_D.$$

$$AP0_AI_CK \leftarrow AP0_TI_CK.$$

$$AP0_AI_II \leftarrow sII.$$

$$AP0_AI_PSI \leftarrow sPSI.$$

$$AP0_AI_TSF \leftarrow S4_CI_SSF.$$

$$AP0/SDI_DLx_A_So_MI_pFJ+ \leftarrow pFJ+.$$

$$AP0/SDI_DLx_A_So_MI_pFJ- \leftarrow pFJ-.$$

Fault management

None.

Long term performance monitoring

FJ+(t-10) (A_Sk): The delayed positive Frequency Justification performance counter (FJ+(t-10)) is the 10 s delayed value of the positive Frequency Justification performance counter (pFJ+). See ES 201 803-2-3 [5], clause 6.8.5.2.

FJ-(t-10) (A_Sk): The delayed negative Frequency Justification performance counter (FJ-(t-10)) is the 10 s delayed value of the negative Frequency Justification performance counter (pFJ-). See ES 201 803-2-3 [5], clause 6.8.5.2.

5.4.1.2 Application 0 to SDI Data Link Adaptation Sink function (AP0/SDI_DLx_A_Sk)

Symbol

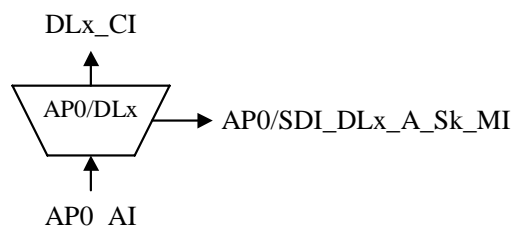


Figure 5: Application 0 to SDI Data Link Adaptation Sink (AP0/SDI_DLx_A_Sk)

Interfaces

Table 6: AP0/DLx_A_Sk Input and output signals

Input(s)	Output(s)
AP0_AI_D	DLx_CI_D
AP0_AI_CK	DLx_CI_CK
AP0_AI_II	DLx_CI_FS
AP0_AI_PSI	DLx_CI_SSF
AP0_AI_TSF	AP0/SDI_DLx_A_Sk_MI_cAIS
	AP0/SDI_DLx_A_Sk_MI_cLOJ

Processes and anomalies

The monitoring of frame alignment pattern in order to identify the initial data word of a segment in the SDI transport stream according to clause 7. See ES 201 803-2-3 [5], clause 6.1.9.4.

sFS: When the initial segment is detected and the first of its data words is transmitted on CI_D shall the Frame Start signal (sFS) be asserted, else it shall be de-asserted. See ES 201 803-2-3 [5], clause 6.1.9.4.

nLOJ: If the initial segment does not occur after the specified justification, then the Loss Of Justification anomaly (nLOJ) is asserted, else nLOJ is not asserted. See clause 6.2.1 and ES 201 803-2-3 [5], clause 6.1.9.4.

The demultiplexing of data slots from the slot stream on AI_D. See ES 201 803-2-3 [5], clause 6.1.13.6.

The demultiplexing of 5 data slots into 32 DLx data words. See ES 201 803-2-3 [5], clause 6.1.13.6.

The clock smoothing process in order to reduce phase deviations on the transmitted signal. The clock smoothing must comply with the jitter and wander requirements as defined in ITU-R Recommendation BT.656 [8] and SMPTE 259M [12]. The resulting clock is delivered as CI_CK. See ES 201 803-2-3 [5], clause 6.1.11.3.

The elastic buffering of the transported signal such that the buffer output is being clocked by the smoothed clock. See ES 201 803-2-3 [5], clause 6.1.11.3.

AIS (A_Sk): The Alarm Indication Signal (AIS) insertion into CI_D instead of received data when the Alarm Indication Signal defect (dAIS) is asserted. See ES 201 803-2-3 [5], clause 6.1.5.1.

nAIS: The Alarm Indication Signal anomaly (nAIS) is asserted when a AIS-marker is being detected in the AI_D stream. See ES 201 803-2-3 [5], clause 6.1.5.1.

Defects

The justification persistence state machine monitors the Loss Of Justification anomaly (nLOJ). The default state is Out Of Frame (OOF). When in the OOF state the nLOJ is not asserted on three consecutive justification opportunities, the state of the machine shall change to In Frame (IF). When in the IF state the nLOJ is asserted on five consecutive justification opportunities, the state of the machine shall change to OOF. See ES 201 803-2-3 [5], clause 6.2.4.2.

dLOJ: The Loss Of Justification defect (dLOJ) shall be asserted when the justification persistence state machine is in the OOF state. See ES 201 803-2-3 [5], clause 6.2.4.2.

dAIS (A_Sk): The Alarm Indication Signal defect (dAIS) is asserted when the Alarm Indication Signal anomaly (nAIS) is asserted for more than three consecutive DTM frames, else it is not asserted. See ES 201 803-2-3 [5], clause 6.2.6.1.

Consequent actions

aAIS: The Alarm Indication Signal action (aAIS) is asserted when the Loss Of Justification defect (dLOJ), the Alarm Indication Signal defect (dAIS) is asserted or the Trail Signal Fail (AI_TSF) is. See ES 201 803-2-3 [5], clause 6.3.1.1.

aAIS ← dLOJ or dAIS or AI_TSF.

aSSF: The Server Signal Fail action (aSSF) is asserted when the Alarm Indication Signal defect (dAIS) is asserted, the Trail Signal Fail (AI_TSF) is asserted or the Loss Of Justification defect (dLOJ) is asserted. See ES 201 803-2-3 [5], clause 6.3.1.2.

aSSF ← dAIS or AI_TSF or dLOJ.

Defect correlation

cLOJ: The Loss Of Justification cause (cLOJ) is asserted when the Loss Of Justification defect (dLOJ) is asserted, the Alarm Indication Signal defect (dAIS) not asserted and Trail Signal Fail (AI_TSF) is not asserted.
See ES 201 803-2-3 [5], clause 6.4.4.2.

$cLOJ \leftarrow dLOJ \text{ and (not dAIS) and (not AI_TSF)}$.

cAIS: The Alarm Indication Signal cause (cAIS) is asserted when the Alarm Indication Signal defect (dAIS) is asserted and the Trail Signal Failure (AI_TSF) is not asserted. See ES 201 803-2-3 [5], clause 6.4.6.1.

$cAIS \leftarrow dAIS \text{ and (not AI_TSF)}$.

Performance monitoring

None.

Output mapping

$DLx_CI_D \leftarrow CI_D$.

$DLx_CI_CK \leftarrow CI_CK$.

$DLx_CI_FS \leftarrow sFS$.

$DLx_CI_SSF \leftarrow aSSF$.

$AP0/DLx_A_Sk_MI_cLOJ \leftarrow cLOJ$.

$AP0/DLx_A_Sk_MI_cAIS \leftarrow cAIS$.

Fault management

fAIS (A_Sk): The Alarm Indication Signal fault (fAIS) is asserted when the Alarm Indication Signal cause (cAIS) is asserted consistently for $2,5 \pm 0,5$ seconds and not asserted when the cAIS have been not asserted for $10 \text{ s} \pm 0,5 \text{ s}$.
See ES 201 803-2-3 [5], clause 6.6.1.3.

fLOJ (A_Sk): The Loss Of Justification fault (fLOF) is asserted when the Loss Of Justification cause (cLOJ) is asserted consistently for $2,5 \pm 0,5$ seconds and not asserted when the cLOJ have been not asserted for $10 \text{ s} \pm 0,5 \text{ s}$.
See ES 201 803-2-3 [5], clause 6.6.1.6.

Long term performance monitoring

None.

6 DTM DVB Video transport application layer model

The MPEG-2 TS and DVB RS-encoded MPEG-2 TS transport over DTM is specified as the adaptation function on top of the DCAP-1 ES 201 803-2-3 [5] application trail terminators.

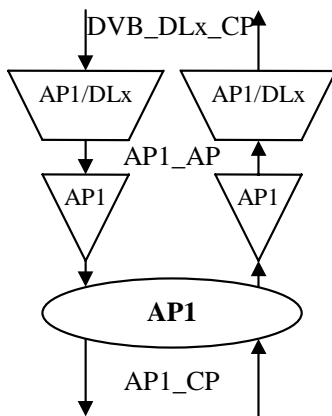


Figure 6: DVB Video transport atomic functions

6.1 Access point information

6.1.1 Characteristic Information

The Characteristic Information (CI) of the Connection Point (CP) is:

- the DVB data link type x octet data DVB_DLx_CI_D;
- the DVB data link type x data clock DVB_DLx_CI_CK;
- the DVB data link type x packet frame start DVB_DLx_CI_FS;
- the DVB data link type x server signal failure DVB_DLx_CI_SSF.

NOTE: See annexes C, D and E for further DVB/MPEG-2 transport modelling.

6.1.2 Adapted Information

The Adapted Information (AI) of the Adaptation Point (AP) is described in ES 201 803-2-3 [5] as the Application 1 adapted information.

6.1.3 Management Information

The Management Information (MI) of the Management Point (MP) is:

- the Channel Multiplex Identifier AP1/DVB_DLx_A_So_MI_CMI;
- the Priority field AP1/DVB_DLx_A_So_MI_PRI.

6.1.4 Timing Information

Not applicable. There is no timing information defined for this layer.

6.2 Connection function (AP1_C)

Not applicable. There is no connection function defined for this layer.

6.3 Trail Termination functions

The trail termination functions are empty mappings between AI and CI.

6.3.1 Application 1 Trail Termination function (AP1_TT)

The Application 1 trail termination functions are empty mappings between AI and CI.

6.3.1.1 Application 1 Trail Termination Source function (AP1_TT_So)

Symbol

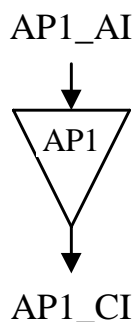


Figure 7: Application 1 Trail Termination Source (AP1_TT_So)

Interfaces

Table 7: AP1_TT_So Input and output signals

Input(s)	Output(s)
AP1_AI_D	AP1_CI_D
AP1_AI_CK	AP1_CI_CK
AP1_AI_FS	AP1_CI_FS
AP1_AI_LEN	AP1_CI_LEN
AP1_AI_CMI	AP1_CI_CMI
AP1_AI_PRI	AP1_CI_PRI
AP1_AI_TSF	AP1_CI_SSF

Processes and anomalies

None.

Defects

None.

Consequent actions

None.

Defect correlation

None.

Performance monitoring

None.

Output mapping

AP1_CI_D ← AP1_AI_D.

AP1_CI_CK ← AP1_AI_CK.

AP1_CI_FS ← AP1_AI_FS.

AP1_CI_LEN ← AP1_AI_LEN.

AP1_CI_CMI ← AP1_AI_CMI.

AP1_CI_PRI ← AP1_AI_PRI.

AP1_CI_SSF ← AP1_AI_TSF.

Fault management

None.

Long term performance monitoring

None.

6.3.1.2 Application 1 Trail Termination Sink function (AP1_TT_Sk)

Symbol

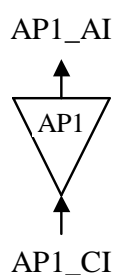


Figure 8: Application 1 Trail Termination Sink (AP1_TT_Sk)

Interfaces

Table 8: AP1_TT_Sk Input and output signals

Input(s)	Output(s)
AP1_CI_D	AP1_AI_D
AP1_CI_CK	AP1_AI_CK
AP1_CI_FS	AP1_AI_FS
AP1_CI_LEN	AP1_AI_LEN
AP1_CI_CMI	AP1_AI_CMI
AP1_CI_PRI	AP1_AI_PRI
AP1_CI_SSF	AP1_AI_TSF

Processes and anomalies

None.

Defects

None.

Consequent actions

None.

Defect correlation

None.

Performance monitoring

None.

Output mapping

AP1_AI_D ← AP1_CI_D.

AP1_AI_CK ← AP1_CI_CK.

AP1_AI_FS ← AP1_CI_FS.

AP1_AI_LEN ← AP1_CI_LEN.

AP1_AI_CMI ← AP1_CI_CMI.

AP1_AI_PRI ← AP1_CI_PRI.

AP1_AI_TSF ← AP1_CI_SSF.

Fault management

None.

Long term performance monitoring

None.

6.4 Adaptation functions

6.4.1 Application 1 to DVB Data Link type x Adaptation function (AP1/DVB_DLx_A)

This clause describe the MPEG-2 TS (x = 1) or DVB RS (x = 2) adaptation using Application 1 trail terminators.

6.4.1.1 Application 1 to DVB Data Link type x Adaptation Source function (AP1/DVB_DLx_A_So)

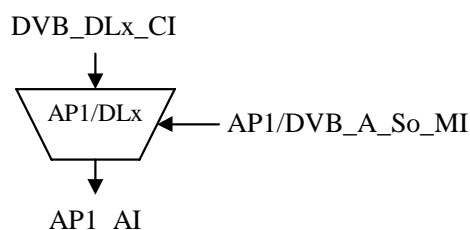
Symbol

Figure 9: Application 1 to DVB Data Link type x Adaptation Source (AP1/DVB_DLx_A_So)

Interfaces

Table 9: AP1/DVB_DLx_A_So Input and output signals

Input(s)	Output(s)
DLx_CI_D	AP1_AI_D
DLx_CI_CK	AP1_AI_CK
DLx_CI_FS	AP1_AI_FS
DLx_CI_SSF	AP1_AI_LEN
AP1/DVB_DLx_A_So_MI_CMI	AP1_AI_CMI
AP1/DVB_DLx_A_So_MI_PRI	AP1_AI_PRI
	AP1_AI_TSF

Processes and anomalies

The monitoring of packet frame start (CI_FS) and determination of packet length (1 to 8 packets per DCAP-1 packet). See clause 8.

sFS: The Frame Start signal (sFS) is asserted when CI_FS is asserted and the packet length state requires a new DCAP-1 packet. See clause 8.

sLEN: The generation of a 188 ($x = 1$) or 204 ($x = 2$) multiple of the determined packet length. See clause 8.

Defects

None.

Consequent actions

None.

Defect correlation

None.

Performance monitoring

None.

Output mapping

AP1_AI_D \leftarrow CI_D.

AP1_AI_CK \leftarrow CI_CK.

AP1_AI_FS \leftarrow sFS.

AP1_AI_LEN \leftarrow sLEN.

AP1_AI_CMI \leftarrow MI_CMI.

AP1_AI_PRI \leftarrow MI_PRI.

AP1_AI_TSF \leftarrow CI_SSF.

Fault management

None.

Long term performance monitoring

None.

6.4.1.2 Application 1 to DVB Data Link type x Adaptation Sink function (AP1/DVB_DLx_A_Sk)

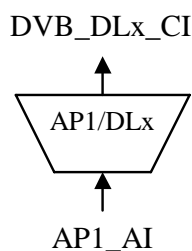
Symbol

Figure 10: Application 1 to DVB Data Link type x Adaptation Sink (AP1/DVB_DLx_A_Sk)

Interfaces

Table 10: AP1/DVB_DLx_A_Sk Input and output signals

Input(s)	Output(s)
AP1_AI_D	DLx_CI_D
AP1_AI_CK	DLx_CI_CK
AP1_AI_FS	DLx_CI_FS
AP1_AI_LEN	DLx_CI_SSF
AP1_AI_CMI	
AP1_AI_PRI	
AP1_AI_TSF	

Processes and anomalies

The monitoring of AI_D for sync bytes. See clause 8.

sFS: The Frame Start signal (sFS) is asserted when AI_D contains a legal sync byte. See clause 8.

The monitoring of the MPEG-2 TS PCR timestamps. See ITU-T Recommendation H.222.0 [10].

The clock smoothing process based on PCR in order to reduce phase deviation on the transmitted signal. The clock smoothing must comply with the jitter and wander requirements as defined in ITU-T Recommendation H.222.0 [10]. The resulting clock is delivered as CI_CK for each program stream. See also ES 201 803-2-3 [5], clause 6.1.11.3 and ITU-T Recommendation H.222.0 [10].

The elastic buffering of the transported signal such that the buffer output CI_D is being clocked to the smoothed clock CI_CK. See ES 201 803-2-3 [5], clause 6.1.11.3 and ITU-T Recommendation H.222.0 [10].

Defects

None.

Consequent actions

None.

Defect correlation

None.

Performance monitoring

None.

Output mapping

DVB_DLx_CI_D ← CI_D.

DVB_DLx_CI_CK ← CI_CK.

DVB_DLx_CI_FS ← sFS.

DVB_DLx_CI_SSF ← AP1_AI_TSF.

Fault management

None.

Long term performance monitoring

None.

7 SDI Transport mapping

The 10-bit words of the BT.656 and SMPTE 292M [15] digital formats does not evenly align to the 64-bit data slot word format of DCAP-0. This causes an alignment cycle of 32 10-bit words over 5 64-bit data slot words.

In order to synchronize the demultiplexing of the 64-bit slot words into 10-bit words will the EAV pattern be detected. This pattern is defined in the relevant digital format standards according to table 11.

Table 11: EAV encodings

Digital Format	BT-656	SMPTE 292M
EAV length	40	80
Word 0	1111_1111_11	1111_1111_11
Word 1	0000_0000_00	1111_1111_11
Word 2	0000_0000_00	0000_0000_00
Word 3	1xx1_xxxx_00	0000_0000_00
Word 4		0000_0000_00
Word 5		0000_0000_00
Word 6		1xx1_xxxx_00
Word 7		1xx1_xxxx_00

Depending on the number of total samples per line will there be 1, 2, 4, 8, 16 or 32 valid alignment positions. As can be found in tables 1 and 2 only the alignments of 1, 2 and 8 exists. By restricting which alignment positions is valid can hardware complexity be reduced. The valid alignment positions in a block of 5 data slot words is numbered 0 through 31 and is given in table 12. The individual bits are mapped in a one-on-one correspondence of the given ranges in table 12.

NOTE 1: The principle is that the highest bit number of a 10-bit word is assigned first to the highest free bit number in the data slot. The following bits are assigned in falling numbers. If a data slot is filled prior to the last bit of a word has been assigned, the next bit is assigned to the highest bit of the following data slot. Table 12 thus contains the condensed form where ranges have been given.

For a given number of valid EAV alignment positions (as found in table 2) has defined EAV positions as given in table 13.

NOTE 2: Since the number of legal positions for EAV is known for a certain digital format, the receiver detector may use this fact in order to implement a simplified alignment detector than a full-blown 32-alignment position detector. I.e. if the formats supported only require 1 or 2 EAV positions, the detector only requires to implement detection of EAV alignment positions 0 and 16.

Table 12: Alignment positions

Word	Block Bits	Block word	Bits
0	9 to 0	0	63 to 54
1	19 to 10	0	53 to 44
2	29 to 20	0	43 to 34
3	39 to 30	0	33 to 24
4	49 to 40	0	23 to 14
5	59 to 50	0	13 to 4
6	69 to 66	0	3 to 0
6	65 to 60	1	63 to 58
7	79 to 70	1	57 to 48
8	89 to 80	1	47 to 38
9	99 to 90	1	37 to 28
10	109 to 100	1	27 to 18
11	119 to 110	1	17 to 8
12	129 to 122	1	7 to 0
12	121 to 120	2	63 to 62
13	139 to 130	2	61 to 52
14	149 to 140	2	51 to 42
15	159 to 150	2	41 to 32
16	169 to 160	2	31 to 22
17	179 to 170	2	21 to 12
18	189 to 180	2	11 to 2
19	199 to 198	2	1 to 0
19	197 to 190	3	63 to 56
20	209 to 200	3	55 to 46
21	219 to 210	3	45 to 36
22	229 to 220	3	35 to 26
23	239 to 230	3	25 to 16
24	249 to 240	3	15 to 6
25	259 to 254	3	5 to 0
25	253 to 250	4	63 to 60
26	269 to 260	4	59 to 50
27	279 to 270	4	49 to 40
28	289 to 280	4	39 to 30
29	299 to 290	4	29 to 20
30	309 to 300	4	19 to 10
31	319 to 310	4	9 to 0

Table 13: Valid EAV alignment positions

Number of positions	Valid positions
1	0
2	0,16
8	0,4,8,12,16,20,24,28

8 DVB/MPEG-2 TS transport mapping

The DVB/MPEG-2 TS stream consists of 188 byte MPEG-2 TS packets (see ITU-T Recommendation H.222.0 [10]) or 204 byte DVB RS wrapped MPEG-2 TS packets (see EN 300 421 [2]). These are transported in DCAP-1 as single packets or contiguously concatenated with up to 8 packets per DCAP-1 packet. Each DCAP-1 packet starts with the sync byte of the first MPEG-2 TS/DVB RS wrapped packet. When contiguous packets exist in the same DCAP-1 packet, the sync byte of the following packet follow on the first free byte after the previous packet.

NOTE 1: The size of the DCAP-1 packet is either a multiple of 188 bytes or 204 bytes, depending on which packet form is being transported.

NOTE 2: This transport service is roughly equivalent to the DVB/ASI interface, and timing is represented in the MPEG-2 TS PCR timestamps.

Annex A (informative): SDI Physical type x model (SDI_PHx)

The SDI Physical x Layer provides a transport of 10-bit digital video of SD (see ITU-R Recommendation BT.601 [7]) and HD (see ITU-R Recommendation BT.709 [9]) type. The resulting signal is either 270 MBd ($x = 1$), 360 MBd ($x = 2$), 1,4835 GBd ($x = 3$) or 1,485 GBd ($x = 4$) over electrical or optical interface.

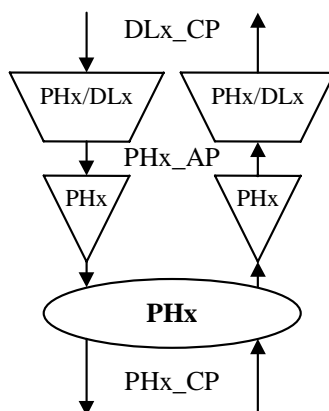


Figure 11: SDI Physical type x Layer atomic functions

A.1 Access point information

A.1.1 Characteristic Information

The Characteristic Information (CI) of the Connection Point (CP) is:

- the electrical signal for interface type x PHx_CI_D;
- the 10 bit wide data signal for data link type x DLx_CI_D;
- the clock signal for data link type x DLx_CI_CK;
- the TRS Frame Start type x DLx_CI_FS;
- the server signal failure signal for data link type x DLx_CI_SSF.

A.1.2 Adapted Information

The Adapted Information (AI) of the Adaptation Point (AP) is:

- the digital signal of data bits for interface type x PHx_AI_D;
- the Trail Server Failure signal PHx_AI_TSF.

A.1.3 Management Information

The Management Information (MI) of the Management Point (MP) is:

- the Loss Of Signal cause signal PHx_TT_Sk_MI_cLOS;
- the Loss Of Framing cause signal PHx/DLx_A_Sk_MI_cLOF.

A.1.4 Timing Information

Not applicable for this layer.

A.2 Connection function (PHx_C)

Not applicable. There is no connection functions defined for this layer.

A.3 Trail Termination functions

A.3.1 Physical type x Trail Termination function (PHx_TT)

The SDI physical trail terminators provide the physical signal adaptation and signal level supervision.

A.3.1.1 Physical type x Trail Termination Source function (PHx_TT_So)

Symbol



Figure 12: Physical type x Trail Termination Source (PHx_TT_So)

Interfaces

Table 14: PHx_TT_So Input and output signals

Input(s)	Output(s)
PHx_AI_D	PHx_CI_D

Processes and anomalies

The signal conditioning of the PHx_AP_D for transmission over the electrical medium at CI_D according to ITU-R Recommendation BT.656 [8] (for x = 1 or 2), SMPTE 259M [12] (for x = 1 or 2) and SMPTE 292M [15] (for x = 3 or 4). See ES 201 803-2-3 [5], clause 6.1.1.1.

Defects

None.

Consequent actions

None.

Defect correlation

None.

Performance monitoring

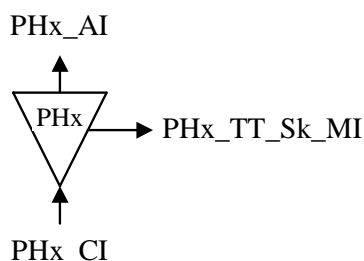
None.

Output mappingPH_x_CI_D ← CI_D.**Fault management**

None.

Long term performance monitoring

None.

A.3.1.2 Physical type x Trail Termination Sink function (PH_x_TT_Sk)**Symbol****Figure 13: Physical type x Trail Termination Sink (PH_x_TT_Sk)****Interfaces****Table 15: PH_x_TT_Sk Input and output signals**

Input(s)	Output(s)
PH _x _CI_D	PH _x _AI_D
	PH _x _AI_TSF
	PH _x _TT_Sk_MI_cLOS

Processes and anomalies

The signal conditioning of the electrical signal at PH_x_CI_D and conversion into the digital format of AI_D. The signal conditioning includes an Automatic Gain Control (AGC) loop which monitors the average signal level of the received electrical signal at PH_CI_D. See ITU-R Recommendation BT.656 [8] (for x = 1 or 2), SMPTE 259M [12] (for x = 1 or 2) and SMPTE 292M [15] (for x = 3 or 4). See ES 201 803-2-3 [5], clause 6.1.1.1.

nLOS: The average signal level is being monitored (by the signal conditioning Automatic Gain Control loop). The Loss Of Signal anomaly (nLOS) is asserted when the monitored signal level is below the LOS threshold level. See ES 201 803-2-3 [5], clause 6.1.2.1.

NOTE: The reaction time for a complete loss of signal is due to the AGC loop reaction time.

Defects

dLOS: The Loss Of Signal defect (dLOS) is asserted when the Loss of Signal anomaly (nLOS) have been asserted, else it is deasserted. See ES 201 803-2-3 [5], clause 6.2.1.1.

Consequent actions

aTSF: The Trail Signal Fail action (aTSF) is asserted when the Loss Of Signal defect (dLOS) is asserted. See ES 201 803-2-3 [5], clause 6.3.1.3.

aTSF \leftarrow dLOS.

Defect correlation

cLOS: The Loss Of Signal cause (cLOS) is asserted when the Loss Of Signal defect (dLOS) is asserted. See ES 201 803-2-3 [5], clause 6.4.1.1.

cLOS \leftarrow dLOS.

Performance monitoring

None.

Output mapping

PH_x_AI_D \leftarrow AI_D.

PH_x_AI_TSF \leftarrow aTSF.

PH_x_TT_Sk_MI_cLOS \leftarrow cLOS.

Fault management

fLOS: The Loss Of Signal fault (fLOS) is asserted when the Loss Of Signal cause (cLOS) is asserted consistently for 2,5 s \pm 0,5 s and deasserted when the cLOS have been deasserted for 10 s \pm 0,5 s. See ES 201 803-2-3 [5], clause 6.6.1.1.

Long term performance monitoring

None.

A.4 Adaptation functions

A.4.1 Physical type x to Data Link type x Adaptation function (PH_x/DL_x_A)

The SDI Physical to Data Link adaptation function provides the multiplexing, alignment and demultiplexing of the 10 bit words, the clock smoothing and clock recovery and the line encoding/decoding through scrambling.

A.4.1.1 Physical type x to Data Link type x Adaptation Source function (PH_x/DL_x_A_So)

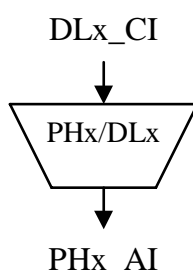
Symbol

Figure 14: Physical type x to Data Link type x Adaptation Source (PH_x/DL_x_A_So)

Interfaces

Table 16: PHx/DLx_A_So Input and output signals

Input(s)	Output(s)
DLx_CI_D	PHx_AI_D
DLx_CI_CK	

Processes and anomalies

The smoothing of the received clock (CI_CK) in order to ensure a maximum output jitter of 0,2 UI as specified in ITU-R Recommendation BT.656 [8] (for x = 1 or 2), SMPTE 259M [12] (for x = 1 or 2) and SMPTE 292M [15] (for x = 3 or 4). See ES 201 803-2-3 [5], clause 6.1.11.1.

NOTE: For some interfaces different values may be given for maximum output jitter. The value may also be specified for different frequency ranges. Make sure to read the details in the appropriate relevant standard.

The multiplexing of bits in DL_CI_D into the bitstream of AI_D1. The bit multiplexing is according to ITU-R Recommendation BT.656 [8] (for x = 1 or 2), SMPTE 259M [12] (for x = 1 or 2) and SMPTE 292M [15] (for x = 3 or 4). See ES 201 803-2-3 [5], clause 6.1.13.1.

The scrambling of the unscrambled bit stream AI_D1 into the scrambled bit stream AI_D2 using a self-synchronous scrambler with the polynomial $X^9 + X^4 + 1$ according to ITU-R Recommendation BT.656 [8], SMPTEs 259M [12] and 292M [15]. See ES 201 803-2-3 [5], clause 6.1.6.1.

The scrambling of the unscrambled bit stream AI_D2 into the scrambled bit stream AI_D using a self-synchronous scrambler with the polynomial $X+1$ according to ITU-R Recommendation BT.656 [8], SMPTEs 259M [12] and 292M [15]. See ES 201 803-2-3 [5], clause 6.1.6.1.

Defects

None.

Consequent actions

None.

Defect correlation

None.

Performance monitoring

None.

Output mapping

$PHx_AI_D \leftarrow AI_D$.

Fault management

None.

Long term performance monitoring

None.

A.4.1.2 Physical type x to Data Link type x Adaptation Sink function (PHx/DLx_A_Sk)

Symbol

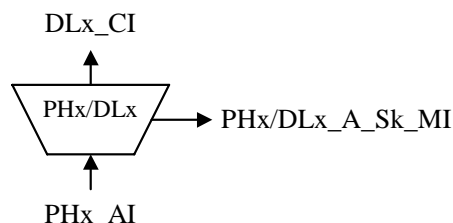


Figure 15: Physical type x to Data Link type x Adaptation Sink (PHx/DLx_A_Sk)

Interfaces

Table 17: PHx/DLx_A_Sk Input and output signals

Input(s)	Output(s)
PHx_AI_D	DLx_CI_D
PHx_AI_TSF	DLx_CI_CK
	DLx_CI_FS
	DLx_CI_SSF
	PHx/DLx_A_Sk_MI_cLOF

Processes and anomalies

The timing recovery from PHx_AI_D to form the regenerated clock CI_CK as specified in ITU-R Recommendation BT.656 [8] (for x = 1 or 2), SMPTE 259M [12] (for x = 1 or 2) and SMPTE 292M [15] (for x = 3 or 4). See ES 201 803-2-3 [5], clause 6.1.10.

The descrambling of the scrambled bit stream PHx_AI_D into the unscrambled bit stream AI_D1 using a self-synchronous descrambler with the polynomial $X+1$ according to ITU-R Recommendation BT.656 [8] (for x = 1 or 2), SMPTE 259M [12] (for x = 1 or 2) and SMPTE 292M [15] (for x = 3 or 4). See ES 201 803-2-3 [5], clause 6.1.6.1.

The descrambling of the scrambled bit stream AI_D1 into the unscrambled bit stream AI_D2 using a self-synchronous descrambler with the polynomial $X^9 + X^4 + 1$ according to ITU-R Recommendation BT.656 [8] (for x = 1 or 2), SMPTE 259M [12] (for x = 1 or 2) and SMPTE 292M [15] (for x = 3 or 4). See ES 201 803-2-3 [5], clause 6.1.6.1.

The bit alignment is achieved by detection of the TRS sequence in the AI_D2 bitstream. The bit alignment is according to ITU-R Recommendation BT.656 [8] (for x = 1 or 2), SMPTE 259M [12] (for x = 1 or 2) and SMPTE 292M [15] (for x = 3 or 4). See ES 201 803-2-3 [5], clause 6.1.9.1.

sFS: If a TRS is detected, then the Frame Start signals (sFS) is asserted, else is sFS deasserted. See ITU-R Recommendation BT.656 [8] (for x = 1 or 2), SMPTE 259M [12] (for x = 1 or 2) and SMPTE 292M (for x = 3 or 4). See ES 201 803-2-3 [5], clause 6.1.9.1.

The slot/frame alignment is achieved and maintained by a state machine process. The slot/frame alignment is according to clause 7. See ES 201 803-2-3 [5], clause 6.1.9.3.

nLOF: If the frame synchronization state machine is in the Init or Verify states, then the Loss Of Frame anomaly (nLOF) is asserted, else is nLOF deasserted. See ES 201 803-2-3 [5], clause 6.1.9.3.

The demultiplexing of the bitstream AI_D2 into the 10 bits of CI_D. The bit demultiplexing is according to ITU-R Recommendation BT.656 [8] (for x = 1 or 2), SMPTE 259M [12] (for x = 1 or 2) and SMPTE 292M [15] (for x = 3 or 4). See ES 201 803-2-3 [5], clause 6.1.13.1.

Defects

The justification persistence state machine monitors the Loss Of Frame anomaly (nLOF). The default state is Out Of Frame (OOF). When in the OOF state the nLOF is deasserted on three consecutive justification opportunities, the state of the machine shall change to In Frame (IF). When in the IF state the nLOF is asserted on five consecutive justification opportunities, the state of the machine shall change to OOF. See ES 201 803-2-3 [5], clause 6.2.4.1.

dLOF: The Loss Of Frame defect (dLOF) shall be asserted when the justification persistence state machine is in the OOF state. See ES 201 803-2-3 [5], clause 6.2.4.1.

Consequent actions

aSSF: The Server Signal Fail action (aSSF) is asserted when the Trail Signal Fail (AI_TSF) is asserted or the Loss Of Frame defect (dLOF) is asserted. See ES 201 803-2-3 [5], clause 6.3.1.2.

aSSF ← AI_TSF or dLOF.

Defect correlation

cLOF: The Loss Of Frame cause (cLOF) is asserted when the Loss Of Frame defect (dLOF) is asserted and the Trail Signal Fail (AI_TSF) is deasserted. See ES 201 803-2-3 [5], clause 6.4.4.1.

cLOF ← dLOF and (not AI_TSF).

Performance monitoring

None.

Output mapping

PH_x_CI_D ← CI_D.

PH_x_CI_CK ← CI_CK.

PH_x_CI_FS ← sFS.

PH_x_CI_SSF ← aSSF.

PH_x/DL_x_A_Sk_MI_cLOF ← cLOF.

Fault management

fLOF: The Loss Of Frame alignment fault (fLOF) is asserted when the Loss Of Frame cause (cLOF) is asserted consistently for 2,5 s ± 0,5 s and deasserted when the cLOF have been deasserted for 10 s ± 0,5 s. See ES 201 803-2-3 [5], clause 6.6.1.5.

Long term performance monitoring

None.

Annex B (informative): SDI Data Link type x model (SDI_DLx)

The SDI Data Link type x layer provides the transport service for digital video, timing reference and Auxiliary data in type x format.

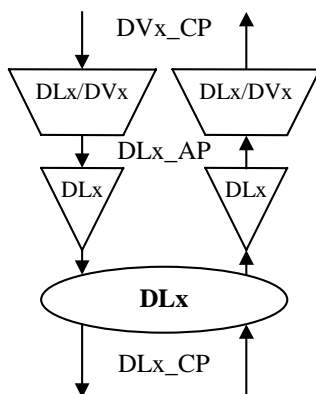


Figure 16: SDI Data Link type x Layer atomic functions

B.1 Access point information

B.1.1 Characteristic Information

The Characteristic Information (CI) of the Connection Point (CP) is:

- the digital video type x 10-bit wide data samples DVx_CI_D;
- the digital video type x data clock DVx_CI_CK;
- the digital video type x first Line Frame Start DVx_CI_LFS;
- the digital video type x first Sample Frame Start DVx_CI_SFS;
- the digital video type x server signal failure DVx_CI_SSF.

B.1.2 Adapted Information

The Adapted Information (AI) of the Adaptation Point (AP) is:

- the digital video type x 10-bit wide data DVx_AI_D;
- the digital video type x data clock DVx_AI_CK;
- the digital video type x Timing Reference Signal Frame Start DVx_AI_FS;
- the digital video type x Trail Signal Failure DVx_AI_TSF.

B.1.3 Management Information

Not applicable. There is no management information defined for this layer.

B.1.4 Timing Information

Not applicable. There is no timing information defined for this layer.

B.2 Connection function (DLx_C)

Not applicable. There is no connection functions defined for this layer.

B.3 Trail Termination functions

B.3.1 SDI Data Link type x Trail Termination function (DLx_TT)

The SDI Data Link type trail termination functions does not contain any functionality at this point.

NOTE: This is the ideal place to insert error detection mechanisms of ITU-R Recommendation BT.1304.

B.3.1.1 SDI Data Link type x Trail Termination Source function (DLx_TT_So)

Symbol



Figure 17: SDI Data Link type x Trail Termination Source (DLx_TT_So)

Interfaces

Table 18: DLx_TT_So Input and output signals

Input(s)	Output(s)
DLx_AI_D	DLx_CI_D
DLx_AI_CK	DLx_CI_CK

Processes and anomalies

None.

Defects

None.

Consequent actions

None.

Defect correlation

None.

Performance monitoring

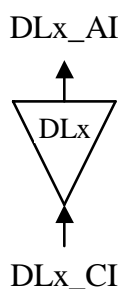
None.

Output mappingDL_x_CI_D ← AI_D.DL_x_CI_CK ← AI_CK.**Fault management**

None.

Long term performance monitoring

None.

B.3.1.2 SDI Data Link type x Trail Termination Sink function (DL_x_TT_Sk)**Symbol****Figure 18: SDI Data Link type x Trail Termination Sink (DL_x_TT_Sk)****Interfaces****Table 19: DL_x_TT_Sk Input and output signals**

Input(s)	Output(s)
DL _x _CI_D	DL _x _AI_D
DL _x _CI_CK	DL _x _AI_CK
DL _x _CI_FS	DL _x _AI_FS
DL _x _CI_SSF	DL _x _AI_TSF

Processes and anomalies

None.

Defects

None.

Consequent actions

None.

Defect correlation

None.

Performance monitoring

None.

Output mappingDL_x_AI_D ← DL_x_CI_D.DL_x_AI_CK ← DL_x_CI_CK.DL_x_AI_FS ← DL_x_CI_FS.DL_x_AI_TSF ← DL_x_CI_SSF.**Fault management**

None.

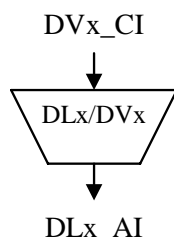
Long term performance monitoring

None.

B.4 Adaptation functions

B.4.1 SDI Data Link type x Adaptation function (DL_x/DV_x_A)

B.4.1.1 SDI Data Link type x to Digital Video type x Adaptation Source function (DL_x/DV_x_A_So)

Symbol**Figure 19: SDI Data Link type x to Digital Video type x Adaptation Source (DL_x/DV_x_A_So)****Interfaces****Table 20: DL_x/DV_x_A_So Input and output signals**

Input(s)	Output(s)
DV _x _CI_D	DL _x _AI_D
DV _x _CI_CK	DL _x _AI_CK
DV _x _CI_LFS	
DV _x _CI_SFS	

Processes and anomalies

The multiplexing of the two luminance samples and the two chrominance samples of CI_D into the data stream of AI_D as specified in ITU-R Recommendation BT.656 [8] (for x = 1 or 2), SMPTE 259M [12] (for x = 1 or 2) and SMPTE 292M [15] (for x = 3 or 4).

The maintenance of line state and sample state as indicated by CI_CK, CI_LFS and CI_SFS.

The insertion of Timing Reference Signal (TRS) into the AI_D data stream as specified in ITU-R Recommendation BT.656 [8] (for x = 1 or 2), SMPTE 259M [12] (for x = 1 or 2) and SMPTE 292M [15] (for x = 3 or 4).

The generation of TRS protection bits P0, P1, P2 and P3 as specified in ITU-R Recommendation BT.656 [8] (for x = 1 or 2), SMPTE 259M [12] (for x = 1 or 2) and SMPTE 292M [15] (for x = 3 or 4).

Defects

None.

Consequent actions

None.

Defect correlation

None.

Performance monitoring

None.

Output mapping

$DLx_AI_D \leftarrow AI_D$.

$DLx_AI_CK \leftarrow DVx_CI_CK$.

Fault management

None.

Long term performance monitoring

None.

B.4.1.2 SDI Data Link type x to Digital Video type x Adaptation Sink function (DLx/DVx_A_Sk)

Symbol

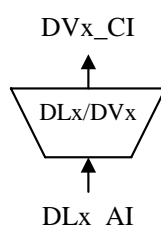


Figure 20: SDI Data Link type x to Digital Video type x Adaptation Sink (DLx/DVx_A_Sk)

Interfaces

Table 21: DLx/DVx_A_Sk Input and output signals

Input(s)	Output(s)
DLx_AI_D	DVx_CI_D
DLx_AI_CK	DVx_CI_CK
DLx_AI_FS	DVx_CI_LFS
DLx_AI_TSF	DVx_CI_SFS
	DVx_CI_SSF

Processes and anomalies

The correction of TRS bits F, V and H based on F, V, H, P0, P1, P2 and P3 as specified in ITU-R Recommendation BT.656 [8] (for x = 1 or 2), SMPTE 259M [12] (for x = 1 or 2) and SMPTE 292M [15] (for x = 3 or 4).

The maintenance of line state and sample state as indicated by AI_CK, AI_FS and TRS bits F, V and H as specified in ITU-R Recommendation BT.656 [8] (for x = 1 or 2), SMPTE 259M [12] (for x = 1 or 2) and SMPTE 292M [15] (for x = 3 or 4).

The assertion of CI_LFS when first line is active, else deasserted.

The assertion of CI_SFS when first sample on line is active, else deasserted.

The demultiplexing of AI_D into the two luminance samples and two chrominance samples of CI_D as specified in ITU-R Recommendation BT.656 [8] (for x = 1 or 2), SMPTE 259M [12] (for x = 1 or 2) and SMPTE 292M [15] (for x = 3 or 4).

Defects

None.

Consequent actions

None.

Defect correlation

None.

Performance monitoring

None.

Output mapping

$DV_x_CI_D \leftarrow CI_D.$

$DV_x_CI_CK \leftarrow DL_x_AI_CK.$

$DV_x_CI_LFS \leftarrow CI_LFS.$

$DV_x_CI_SFS \leftarrow CI_SFS.$

$DV_x_CI_SSF \leftarrow DL_x_AI_TSF.$

Fault management

None.

Long term performance monitoring

None.

Annex C (informative): DVB Physical interface model (DVB_PH)

The DVB/MPEG-2 TS physical interface is represented by the DVB/ASI interface (see EN 50083-9 [1]) layer 1 and 2.

NOTE: Additional physical interfaces may be defined in a similar fashion. DVB/SPI, SVB/SSI and SDTI may be equivalent.

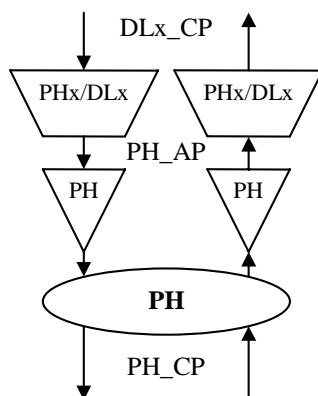


Figure 21: DVB Physical interface atomic functions

C.1 Access point information

C.1.1 Characteristic Information

The Characteristic Information (CI) of the Connection Point (CP) is:

- the DVB physical interface electrical signal DVB_PH_CI_D;
- the DVB data link type x octet data DVB_DLx_CI_D;
- the DVB data link type x data clock DVB_DLx_CI_CK;
- the DVB data link type x packet frame start DVB_DLx_CI_FS;
- the DVB data link type x server signal failure DVB_DLx_CI_SSF.

C.1.2 Adapted Information

The Adapted Information (AI) of the Adaptation Point (AP) is:

- the DVB physical interface data signal DVB_PH_AI_D;
- the DVB physical interface trail signal failure signal DVB_PH_AI_TSF.

C.1.3 Management Information

The Management Information (MI) of the Management Point (MP) is:

- the DVB physical interface loss of signal cause DVB_PH_TT_Sk_MI_cLOS.

C.1.4 Timing Information

Not applicable. There are no timing information defined for this layer.

C.2 Connection function (PH_C)

Not applicable. There are no connection function defined for this layer.

C.3 Trail Termination functions

C.3.1 Physical interface Trail Termination function (PH_TT)

The DVB physical interface trail termination functions represent the DVB/ASI (see EN 50083-9 [1]) layer 1 functionality.

C.3.1.1 Physical interface Trail Termination Source function (PH_TT_So)

Symbol

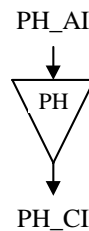


Figure 22: Physical interface Trail Termination Source (PH_TT_So)

Interfaces

Table 22: PH_TT_So Input and output signals

Input(s)	Output(s)
PH_AI_D	PH_CI_D

Processes and anomalies

The signal conditioning of the PH_AP_D for transmission over the electrical medium at CI_D according to EN 50083-9 [1], clause B.3.1. See ES 201 803-2-3 [5], clause 6.1.1.1.

Defects

None.

Consequent actions

None.

Defect correlation

None.

Performance monitoring

None.

Output mapping

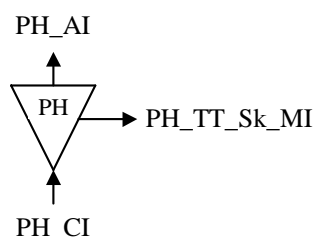
PH_CI_D ← CI_D.

Fault management

None.

Long term performance monitoring

None.

C.3.1.2 Physical interface Trail Termination Sink function (PH_TT_Sk)**Symbol****Figure 23: Physical Trail Termination Sink (PH_TT_Sk)****Interfaces****Table 23: PH_TT_Sk Input and output signals**

Input(s)	Output(s)
PH_CI_D	PH_AI_D
	PH_AI_TSF
	PH_TT_Sk_MI_cLOS

Processes and anomalies

The signal conditioning of the electrical signal at PH_CI_D and conversion into the digital format of AI_D. The signal conditioning includes an Automatic Gain Control (AGC) loop which monitors the average signal level of the received electrical signal at PH_CI_D. See EN 50083-9 [1], clause B.3.1. See ES 201 803-2-3 [5], clause 6.1.1.1.

nLOS: The average signal level is being monitored (by the signal conditioning Automatic Gain Control loop). The Loss Of Signal anomaly (nLOS) is asserted when the monitored signal level is below the LOS threshold level. See ES 201 803-2-3 [5], clause 6.1.2.1.

NOTE: The reaction time for a complete loss of signal is due to the AGC loop reaction time.

Defects

dLOS: The Loss Of Signal defect (dLOS) is asserted when the Loss of Signal anomaly (nLOS) have been asserted, else it is deasserted. See ES 201 803-2-3 [5], clause 6.2.1.1.

Consequent actions

aTSF: The Trail Signal Fail action (aTSF) is asserted when the Loss Of Signal defect (dLOS) is asserted. See ES 201 803-2-3 [5], clause 6.3.1.3.

aTSF ← dLOS.

Defect correlation

cLOS: The Loss Of Signal cause (cLOS) is asserted when the Loss Of Signal defect (dLOS) is asserted.
See ES 201 803-2-3 [5], clause 6.4.1.1.

cLOS \leftarrow dLOS.

Performance monitoring

None.

Output mapping

PH_AI_D \leftarrow AI_D.

PH_AI_TSF \leftarrow aTSF.

PH_TT_Sk_MI_cLOS \leftarrow cLOS.

Fault management

fLOS: The Loss Of Signal fault (fLOS) is asserted when the Loss Of Signal cause (cLOS) is asserted consistently for $2,5 \text{ s} \pm 0,5 \text{ s}$ and deasserted when the cLOS have been deasserted for $10 \text{ s} \pm 0,5 \text{ s}$. See ES 201 803-2-3 [5], clause 6.6.1.1.

Long term performance monitoring

None.

C.4 Adaptation functions

C.4.1 Physical to Data Link type x Adaptation function (PH/DLx_A)

The DVB physical interface adaptation functions represent the DVB/ASI (see EN 50083-9 [1]) layer 2 functionality. The transport support native MPEG-2 TS ($x = 1$) and DVB RS encoded ($x = 2$) traffic.

C.4.1.1 Physical to Data Link type x Adaptation Source function (PH/DLx_A_So)

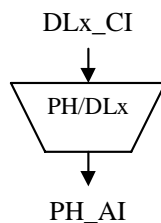
Symbol

Figure 24: Physical interface to Data Link type x Adaptation Source (PH/DLx_A_So)

Interfaces

Table 24: PH/DLx_A_So Input and output signals

Input(s)	Output(s)
DLx_CI_D	PH_AI_D
DLx_CI_CK	
DLx_CI_FS	

Processes and anomalies

The 8B10B encoding of bits in DLx_CI_D into the 10-bit code group of AI_D1 according to EN 50083-9 [1]. See ES 201 803-2-3 [5], clause 6.1.7.1.

The smoothing of the received clock (CI_CK) in order to ensure a maximum output jitter of 0,1 UI as specified in EN 50083-9 [1], clauses 8 and 6.1.11.1.

The multiplexing of bits in AI_D1 into the bitstream of AI_D. The bit multiplexing is according to EN 50083-9 [1], clause B.3.2. See ES 201 803-2-3 [5], clause 6.1.13.1.

Defects

None.

Consequent actions

None.

Defect correlation

None.

Performance monitoring

None.

Output mapping

PH_AI_D ← AI_D.

Fault management

None.

Long term performance monitoring

None.

C.4.1.2 Physical interface to Data Link type x Adaptation Sink function (PH/DLx_A_Sk)

Symbol

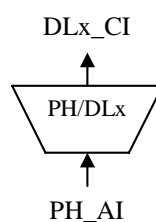


Figure 25: Physical interface to Data Link type x Adaptation Sink (PH/DLx_A_Sk)

Interfaces

Table 25: PH/DLx_A_Sk Input and output signals

Input(s)	Output(s)
PH_AI_D	DLx_CI_D
PH_AI_TSF	DLx_CI_CK
	DLx_CI_FS
	DLx_CI_SSF

Processes and anomalies

The timing recovery from PH_AI_D to form the regenerated clock CI_CK as specified in EN 50083-9 [1]. See ES 201 803-2-3 [5], clause 6.1.10.

The bit alignment is achieved by detection of the comma sequence (1111100) in the PH_AI_D bitstream. The bit alignment is according to EN 50083-9 [1], clause B.3.2. See ES 201 803-2-3 [5], clause 6.1.9.1.

sFS: If a comma sequence is detected, then the Frame Start signal (sFS) is asserted, else is sFS deasserted. See EN 50083-9 [1] clause B.3.2 and ES 201 803-2-3 [5], clause 6.1.9.1.

The demultiplexing of the bitstream PH_AI_D into the code group bits of AI_D1. The demultiplexing is according to EN 50083-9 [1], clause B.3.2. See ES 201 803-2-3 [5], clause 6.1.13.1.

The decoding of the 10 bit code group of AI_D1 into the 8 + 1 bit code group of CI_D1 according to EN 50083-9 [1], clause B.3.2.

The monitoring of the MPEG-2 TS PCR timestamps in the CI_D1 octet stream. See ITU-T Recommendation H.222.0 [10].

The clock smoothing process based on PCR in order to reduce phase deviation on the transmitted signal. The clock smoothing must comply with the jitter and wander requirements as defined in ITU-T Recommendation H.222.0 [10]. The resulting clock is delivered as CI_CK for each program stream. See ES 201 803-2-3 [5], clause 6.1.11.3 and ITU-T Recommendation H.222.0 [10].

The elastic buffering of the transported signal such that the buffer output CI_D is being clocked to the smoothed clock CI_CK. See ES 201 803-2-3 [5] clause 6.1.11.3 and ITU-T Recommendation H.222.0 [10].

Defects

None.

Consequent actions

None.

Defect correlation

None.

Performance monitoring

None.

Output mapping

PH_CI_D ← CI_D.

PH_CI_CK ← CI_CK.

PH_CI_FS ← sFS.

PH_CI_SSF ← AI_TSF.

Fault management

None.

Long term performance monitoring

None.

Annex D (informative): DVB Data Link type x model (DVB_DLx)

The DVB/MPEG-2 TS Data Link type x layer provides either no ($x = 1$) error correction, or the DVB RS error correction ($x = 2$) (see EN 300 421 [2] and EN 300 429 [3]) for the basic MPEG-2 transport stream (see ITU-T Recommendation H.222.0 [10]) in the DVB/MPEG-2 Transport Layer.

NOTE: The DVB transport layer and further modelling of the MPEG-2 layers is out of the scope for the present document.

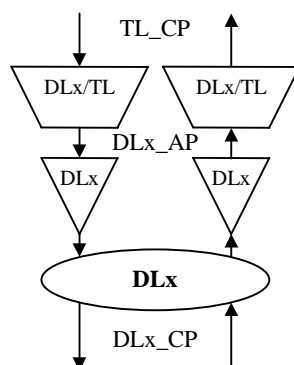


Figure 26: DVB Data Link type x atomic functions

D.1 Access point information

D.1.1 Characteristic Information

The Characteristic Information (CI) of the Connection Point (CP) is:

- the Transmission Layer data signal TL_CI_D;
- the Transmission Layer data clock TL_CI_CK;
- the Transmission Layer Server Signal Failure signal TL_CI_SSF.

D.1.2 Adapted Information

The Adapted Information (AI) of the Adaptation Point (AP) is:

- the Data Link type x data signal DLx_AI_D;
- the Data Link type x data clock DLx_AI_CK;
- the Data Link type x frame start DLx_AI_FS;
- the Data Link Trail Signal Failure DLx_AI_TSF.

D.1.3 Management Information

Not applicable. There are no management information defined for this layer.

D.1.4 Timing Information

Not applicable. There are no timing information defined for this layer.

D.2 Connection function (DLx_C)

Not applicable. There are no connection function defined for this layer.

D.3 Trail Termination functions

D.3.1 DVB Data Link type x Trail Termination function (DLx_TT)

D.3.1.1 DVB Data Link type x Trail Termination Source function (DLx_TT_So)

Symbol



Figure 27: DVB Data Link type x Trail Termination Source (DLx_TT_So)

Interfaces

Table 26: DLx_TT_So Input and output signals

Input(s)	Output(s)
DLx_AI_D	DLx_CI_D
DLx_AI_CK	DLx_CI_CK

Processes and anomalies

None.

Defects

None.

Consequent actions

None.

Defect correlation

None.

Performance monitoring

None.

Output mapping

$DLx_CI_D \leftarrow DLx_AI_D.$

$DLx_CI_CK \leftarrow DLx_AI_CK.$

Fault management

None.

Long term performance monitoring

None.

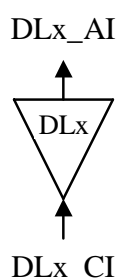
D.3.1.2 DVB Data Link type x Trail Termination Sink function (DLx_TT_Sk)**Symbol**

Figure 28: DVB Data Link type x Trail Termination Sink (DLx_TT_Sk)

Interfaces

Table 27: DLx_TT_Sk Input and output signals

Input(s)	Output(s)
DLx_CI_D	DLx_AI_D
DLx_CI_CK	DLx_AI_CK
DLx_CI_FS	DLx_AI_FS
DLx_CI_SSF	DLx_AI_TSF

Processes and anomalies

None.

Defects

None.

Consequent actions

None.

Defect correlation

None.

Performance monitoring

None.

Output mapping

$DLx_AI_D \leftarrow DLx_CI_D$.

$DLx_AI_CK \leftarrow DLx_CI_CK$.

$DLx_AI_FS \leftarrow DLx_CI_FS$.

$DLx_AI_TSF \leftarrow DLx_CI_SSF$.

Fault management

None.

Long term performance monitoring

None.

D.4 Adaptation functions

D.4.1 DVB Data Link type x Adaptation function (DLx/TL_A)

D.4.1.1 DVB Data Link type x to Transport Layer Adaptation Source function (DLx/TL_A_So)

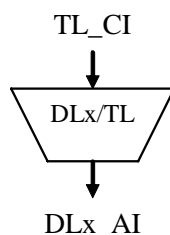
Symbol

Figure 29: DVB Data Link type x to Transport Layer Adaptation Source (DLx/TL_A_So)

Interfaces

Table 28: DLx/TL_A_So Input and output signals

Input(s)	Output(s)
TL_CI_D	DLx_AI_D
TL_CI_CK	DLx_AI_CK

Processes and anomalies

For $x = 1$, the mapping of TL_CI_D to AI_D.

For $x = 2$, the error correction code encoding of TL_CI_D to AI_D according to EN 300 421 [2].

Defects

None.

Consequent actions

None.

Defect correlation

None.

Performance monitoring

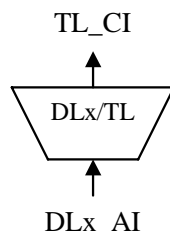
None.

Output mappingDL_x_AI_D ← AI_D.DL_x_AI_CK ← TL_CI_CK.**Fault management**

None.

Long term performance monitoring

None.

D.4.1.2 DVB Data Link type x to Transport Layer Adaptation Sink function (DL_x/TL_A_Sk)**Symbol****Figure 30: DVB Data Link type x to Transport Layer Adaptation Sink (DL_x/TL_A_Sk)****Interfaces****Table 29: DL_x/TL_A_Sk Input and output signals**

Input(s)	Output(s)
DL _x _AI_D	TL_CI_D
DL _x _AI_CK	TL_CI_CK
DL _x _AI_FS	TL_CI_SSF
DL _x _AI_TSF	

Processes and anomaliesFor x = 1, the mapping of DL_x_AI_D to CI_D.For x = 2, the error correction of DL_x_AI_D into corrected data CI_D according to EN 300 421 [2].**Defects**

None.

Consequent actions

None.

Defect correlation

None.

Performance monitoring

None.

Output mapping

TL_CI_D ← CI_D.

TL_CI_CK ← DL_x_AI_CK.

TL_CI_SSF ← DL_x_AI_TSF.

Fault management

None.

Long term performance monitoring

None.

Annex E (informative): Bibliography

- DVB Document A010 rev. 1: "Interfaces for CATV/SMATV Headends".
- ETSI TR 101 290: "Digital Video Broadcasting (DVB); Measurement guidelines for DVB systems".
- ITU-R Recommendation BT.1304: "Checksum for Error Detection and Status information in interfaces conforming with recommendation ITU-R Recommendation BT.656 and ITU-R Recommendation BT.799".
- ITU-R Recommendation BT.1364: "Format of Ancillary Data signals carried in digital component studio interfaces".
- ITU-R Recommendation BT.1381: "SDI-Based Transport Interface for compressed television signals in networked television production based on recommendation ITU-R Recommendation BT.656 and ITU-R Recommendation BT.1302".
- SMPTE 310M: "Synchronous Serial Interface for MPEG-2 Digital Transport Stream".

History

Document history		
V1.1.1	July 2004	Membership Approval Procedure MV 20040910: 2004-07-13 to 2004-09-10
V1.1.1	September 2004	Publication