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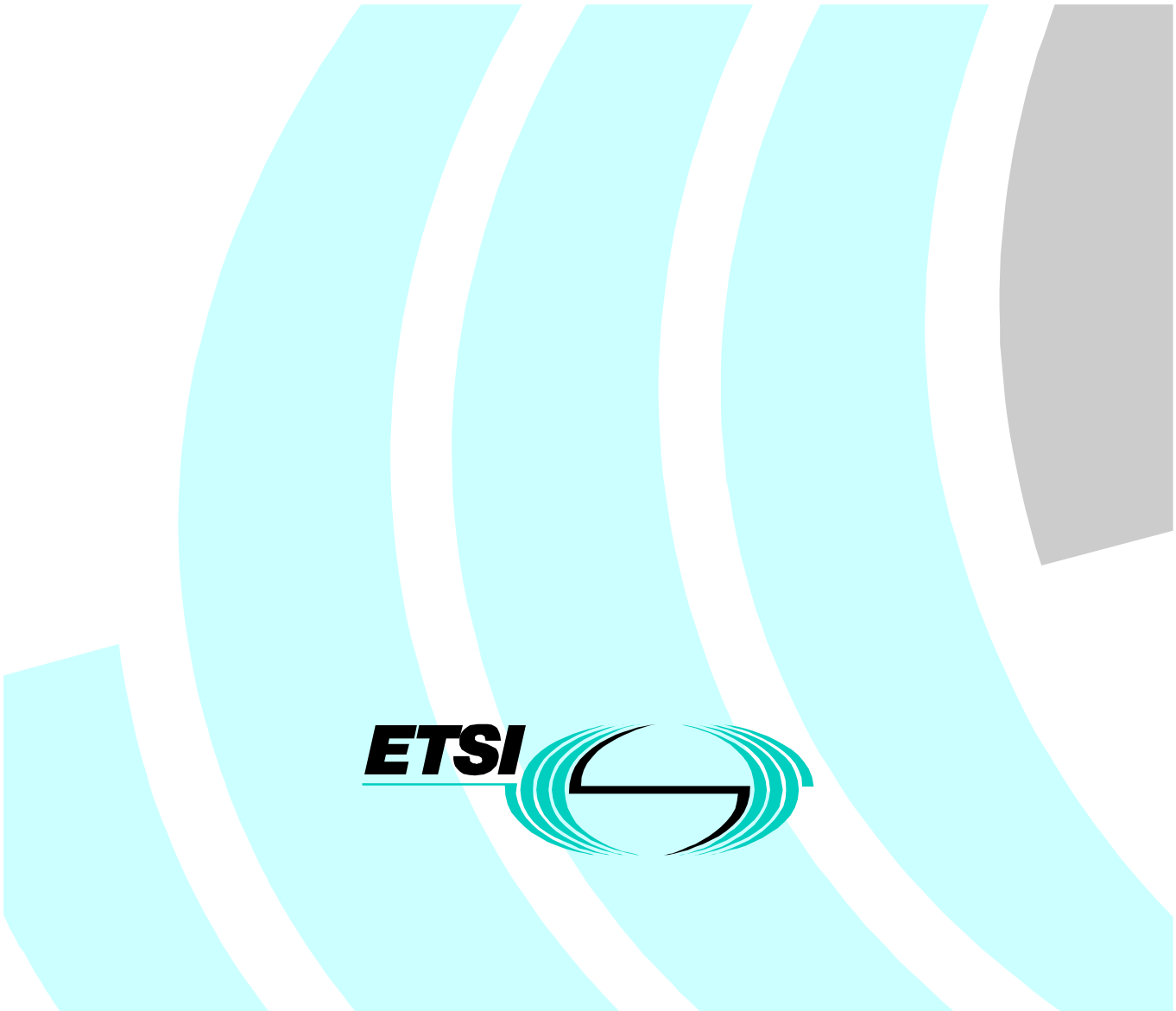
European Standard (Telecommunications series)

Transmission and Multiplexing (TM); Generic requirements of transport functionality of equipment; Part 9: Synchronous Digital Hierarchy (SDH) concatenated path layer functions; Sub-part 1: Requirements



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Foreword

This European Standard (Telecommunications series) has been produced by ETSI Technical Committee Transmission and Multiplexing (TM), and is now submitted for the ETSI standards One-step Approval Procedure.

The present document is part of a library of functional blocks for the functional description of the European Transmission Hierarchy.

The present document is part 9, sub-part 1 of a multi-part deliverable covering Transmission and Multiplexing (TM);Generic requirements of transport functionality of equipment, as identified below:

Part 1: "Generic processes and performance";

Part 2: "Synchronous Digital Hierarchy (SDH) and Plesiochronous Digital Hierarchy (PDH) physical section layer functions";

Part 3: "Synchronous Transport Module-N (STM-N) regenerator and multiplex section layer functions";

Part 4: "Synchronous Digital Hierarchy (SDH) path layer functions";

Part 5: "Plesiochronous Digital Hierarchy (PDH) path layer functions";

Part 6: "Synchronization layer functions";

Part 7: "Equipment management and auxiliary layer functions";

Part 9: "Synchronous Digital Hierarchy (SDH) concatenated path layer functions";

Sub-part 1: "Requirements".

Proposed national transposition dates	
Date of latest announcement of this EN (doa):	3 months after ETSI publication
Date of latest publication of new National Standard or endorsement of this EN (dop/e):	6 months after doa
Date of withdrawal of any conflicting National Standard (dow):	6 months after doa

1 Scope

The present document specifies requirements of transport functionality of equipment, which processes SDH concatenated path layers. The functionality is described by a set of functional building blocks and a set of rules by which they are combined. The generic description method and generic functionality is described in ETS 300 417-1-1 [1] and ITU-T Recommendation G.806 [2].

For equipment which is compliant with the present document the processing of SDH concatenated path layers with in the equipment shall be describable as an interconnection of a subset of the functional blocks contained within the present document.

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.

[1] ETSI EN 300 417-1-1: "Transmission and Multiplexing (TM); Generic requirements of transport functionality of equipment; Part 1-1: Generic processes and performance".

[2] ITU-T Recommendation G.806 (2000): "Characteristics of Transport Equipment – Description Methodology and Generic Functionality".

[3] ETSI EN 300 417-4-1: "Transmission and Multiplexing (TM); Generic requirements of transport functionality of equipment; Part 4-1: Synchronous Digital Hierarchy (SDH) path layer functions".

[4] ITU-T Recommendation G.783 (2000): "Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks".

[5] ETSI EN 300 147: "Transmission and Multiplexing (TM); Synchronous Digital Hierarchy (SDH); Multiplexing structure".

[6] ETSI EN 301 163-2-1: "Transmission and Multiplexing (TM); Generic requirements of Asynchronous Transfer Mode (ATM) transport functionality within equipment; Part 2-1: Functional model for the transfer and layer management plane".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

concatenation: procedure whereby a multiplicity of Virtual Containers is associated one with another with the result that their combined capacity can be used as a single container across which bit sequence integrity is maintained
Two versions exists:

- Contiguous concatenation;
- Virtual concatenation.

3.2 Symbols

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

c	contiguous concatenation
v	virtual concatenation

3.3 Abbreviations

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

_I	Interworking Function
S4-X	Concatenated VC-4 path layer
S4-Xc	Contiguous concatenated VC-4 path layer
S4-Xv	Virtual concatenated VC-4 path layer
S3-X	Concatenated VC-3 path layer
S3-Xv	Virtual concatenated VC-3 path layer
S2-X	Concatenated VC-2 path layer
S2-Xv	Virtual concatenated VC-2 path layer
S12-X	Concatenated VC-12 path layer
S12-Xv	Virtual concatenated VC-12 path layer
S11-X	Concatenated VC-11 path layer
S11-Xv	Virtual concatenated VC-11 path layer

4 Generic Processes

4.1 Layer network interworking function

Refer to ITU-T Recommendation G.806 [2], clause 5.6.4 " Layer network interworking function ".

4.2 Virtual concatenation multiframe alignment

Refer to ITU-T Recommendation G.783 [4], clause 8.2.5 "Virtual concatenation multiframe alignment".

5 Concatenated VC-4 path layer functions

5.1 Atomic functions overview

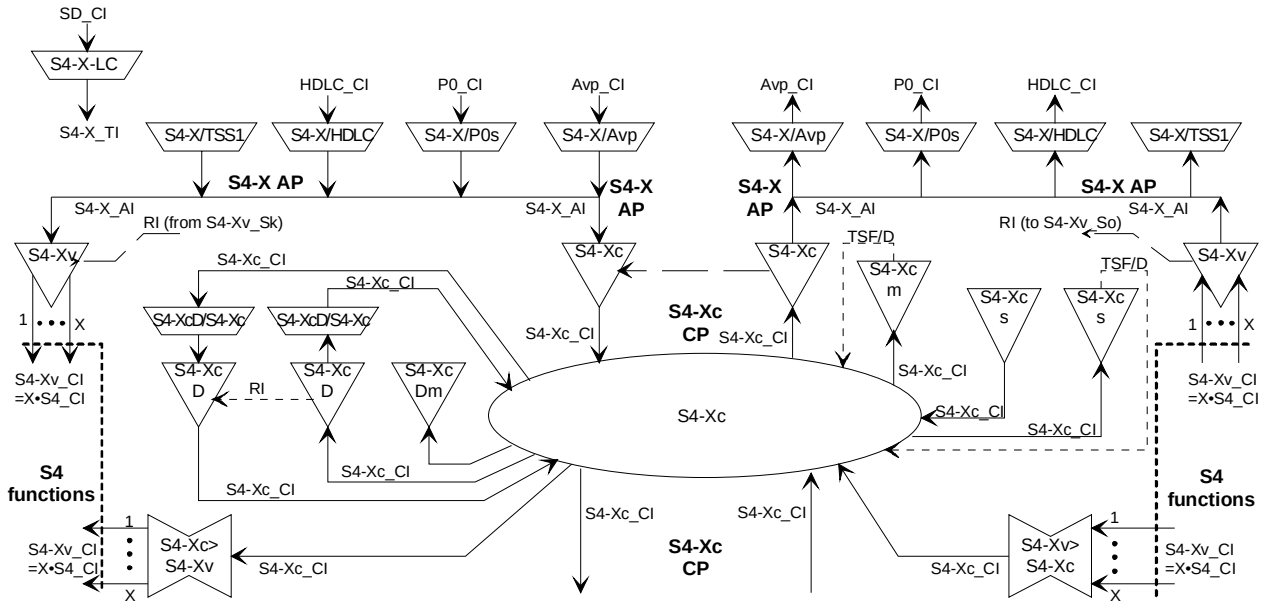


Figure 1: Concatenated VC-4 path layer atomic functions

Figure 1 shows the set of atomic functions for the concatenated VC-4 path layer. Figure 2 shows the additional functions for the concatenated VC-4 layer trail protection. It should be noted that the S4-X/P0s_A function can be absent, or connected before or after the protection functions S4-XP_C. When connected before S4-XP_C the transport of the user channel signal is not protected, otherwise it is protected.

Figures 1 and 2 show that more than one adaptation function exists in the S4-X layer that can be connected to one S4-X access point. For such cases, a subset of these adaptation source functions is allowed to be activated together, but only one adaptation source function may have access to a specific timeslot. Access to the same timeslot by other adaptation source functions shall be denied. In contradiction with the source direction, adaptation sink functions may be activated all together. This may cause faults to be detected and reported. To prevent this an adaptation sink function can be deactivated.

NOTE: If one adaptation function only is connected to the AP, it will be activated. If one or more other functions are connected to the same AP accessing the same timeslot, one out of the set of functions will be active.

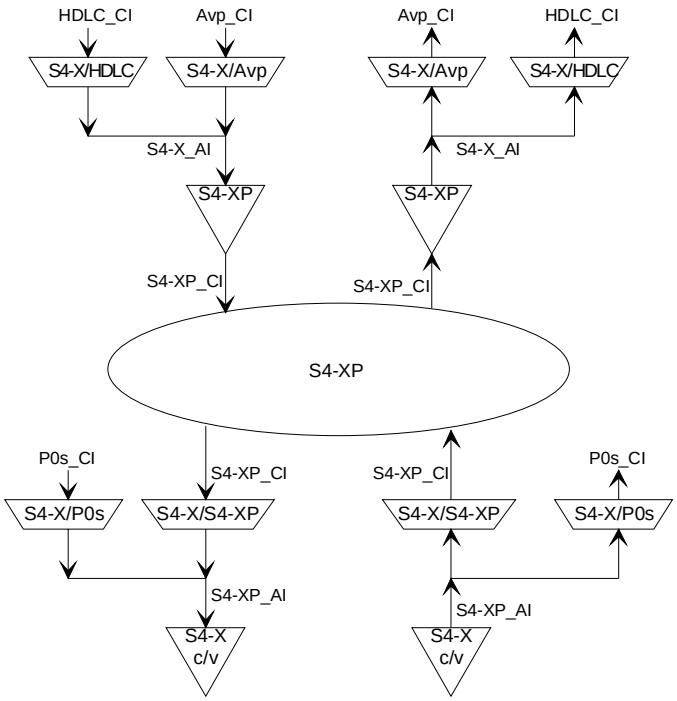


Figure 2: Concatenated VC-4 Layer Trail Protection atomic functions

5.2 Layer information

5.2.1 VC-4-X layer access point

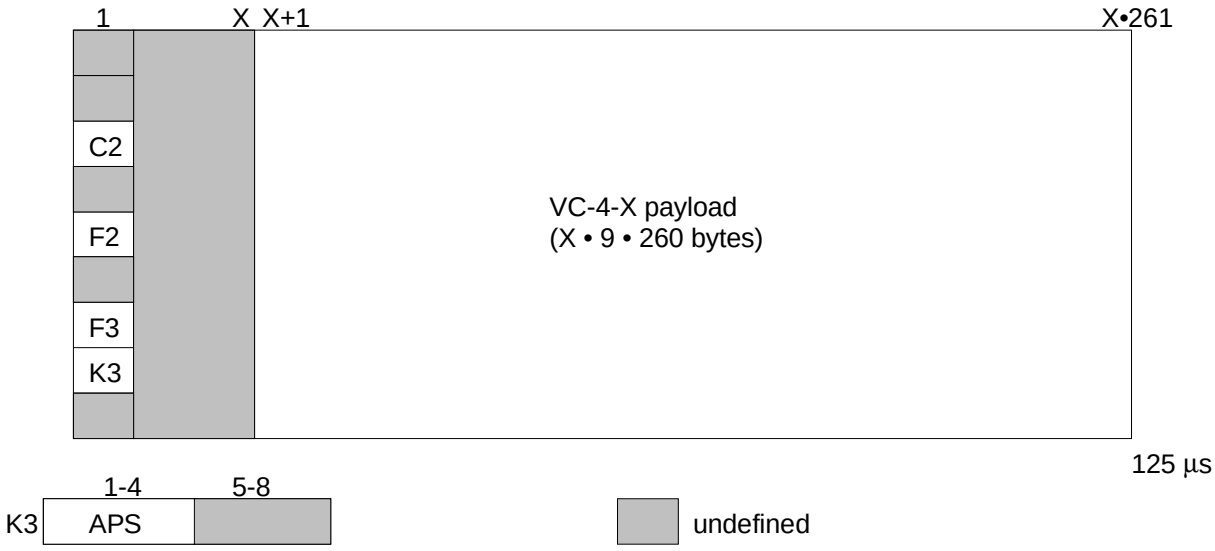


Figure 3: S4-X_AI_D

The VC-4-X AI (S4-x_AI_D) at this point is octet structured with a 125 µs frame. It represents adapted client layer information comprising X • 2 340 bytes of client layer information, the signal label byte C2, and the 2 path user channel bytes F2/3 as defined in ETS 300 147 [5]. For the case the signal has passed the trail protection sublayer, S4_AI has defined APS bits (1 to 4) in byte K3.

NOTE 1: The APS signal has not been defined; a multiframed APS signal might be required.

NOTE 2: Bits 1 to 4 of byte K3 will be undefined when the signal S4-X_AI has not been processed in a trail protection connection function S4-XP_C.

NOTE 3: Bytes F2 and F3 will be undefined when the adaptation functions sourcing these bytes are not present in the network element.

A VC-4-X comprises one of the following payloads:

- an ATM X • 149 760 kbit/s cell stream signal;
- a PPP X • 149 760 kbit/s cell stream signal;
- a Test Signal Structure (TSS1).

5.2.2 VC-4-X layer connection point

A VC-4 concatenated trail can be transported via contiguous concatenated VC-4 (VC-4-Xc) or virtual concatenated VC-4 (VC-4-Xv) connections.

If the concatenated VC-4-X trail is supported by a contiguous concatenated VC-4-Xc connection, the only allowed values for X are 4 and 16. If the concatenated VC-4-X trail is supported by a virtual concatenated VC-4-Xv connection all values for X ≥ 1 are allowed.

5.2.3 VC-4-Xc layer connection point

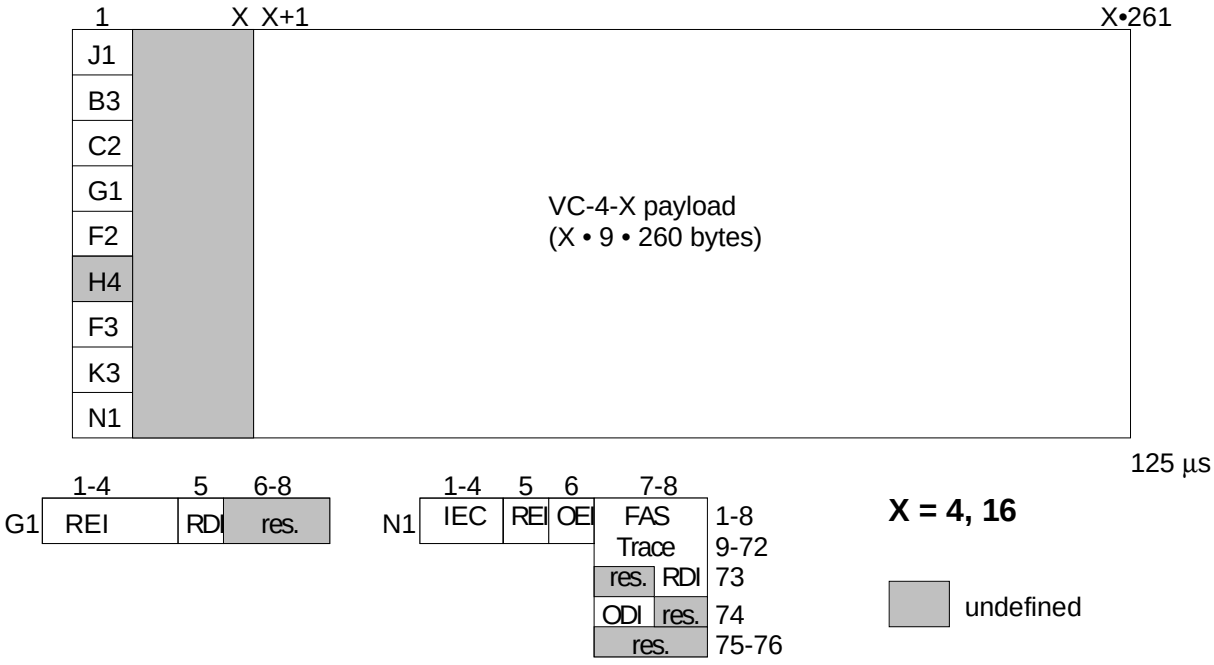


Figure 4: S4-Xc_CI_D

The CI of a VC-4-Xc (S4-Xc_CI_D) signal is octet structured with a 125 µs frame. Its format is characterized as S4-X_AI plus the VC-4 trail termination overhead in the J1, B3, and G1 locations as defined in ETS 300 147 [5]

NOTE: H4 is not used in VC-4-Xc

5.2.4 VC-4-Xv layer connection point

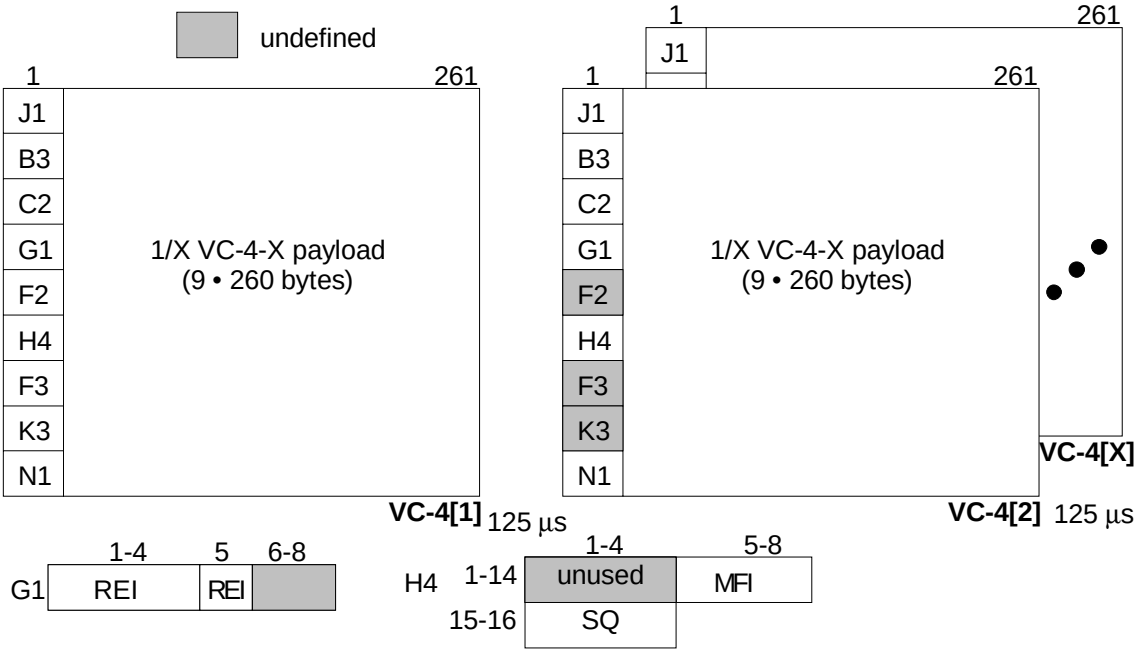


Figure 5: S4-Xv_CI_D

The CI of a VC-4-Xv (S4-Xv_CI_D) consists of X times S4_CI as defined in ETS 300 417-1-1 [1]. The H4 byte is generated as defined in ETS 300 147 [5].

The mapping of S4-X_AI to S4-Xv_CI is performed as shown in figure 6.

NOTE: F2, F3 and K3 of VC-4[2...X] are undefined.

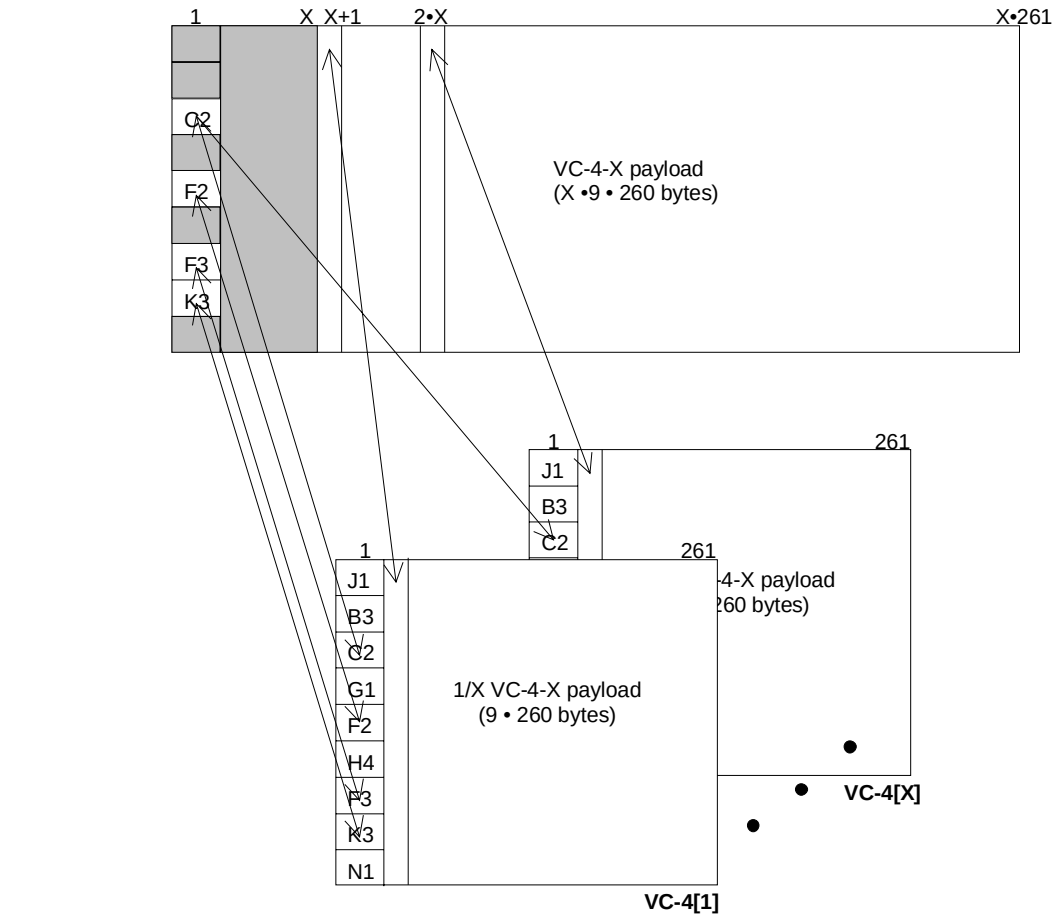


Figure 6: S4-X_AI_D to S4-Xv_CI_D mapping

5.2.5 VC-4-XP layer access point

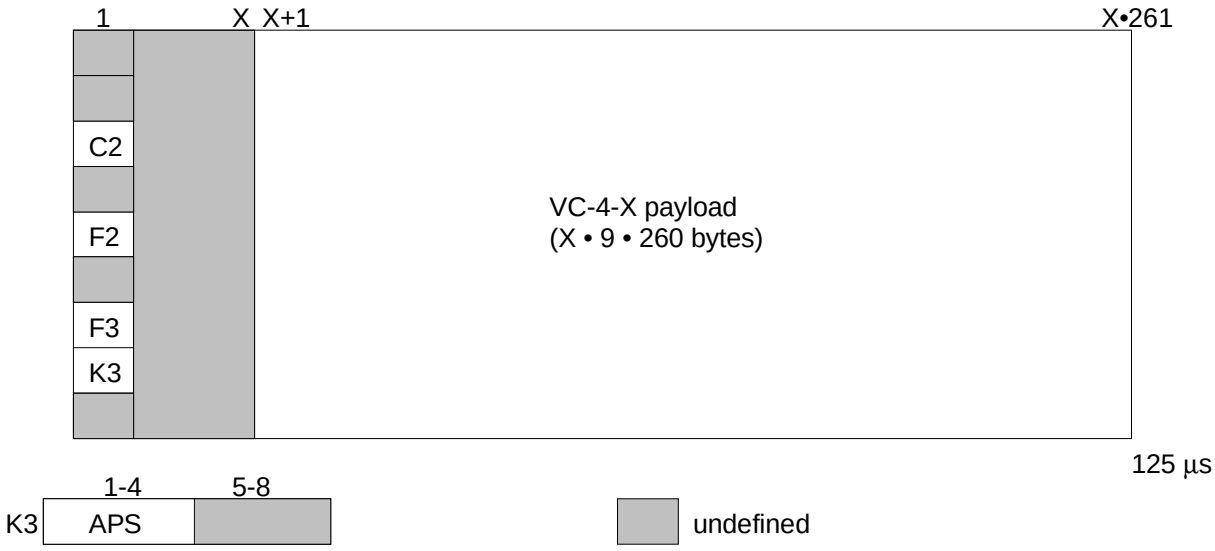


Figure 7: S4-XP_AI_D

The S4-XP AI is identical to the S4-X AI with defined APS information if the protection scheme uses it.

5.2.6 VC-4-XP layer connection point

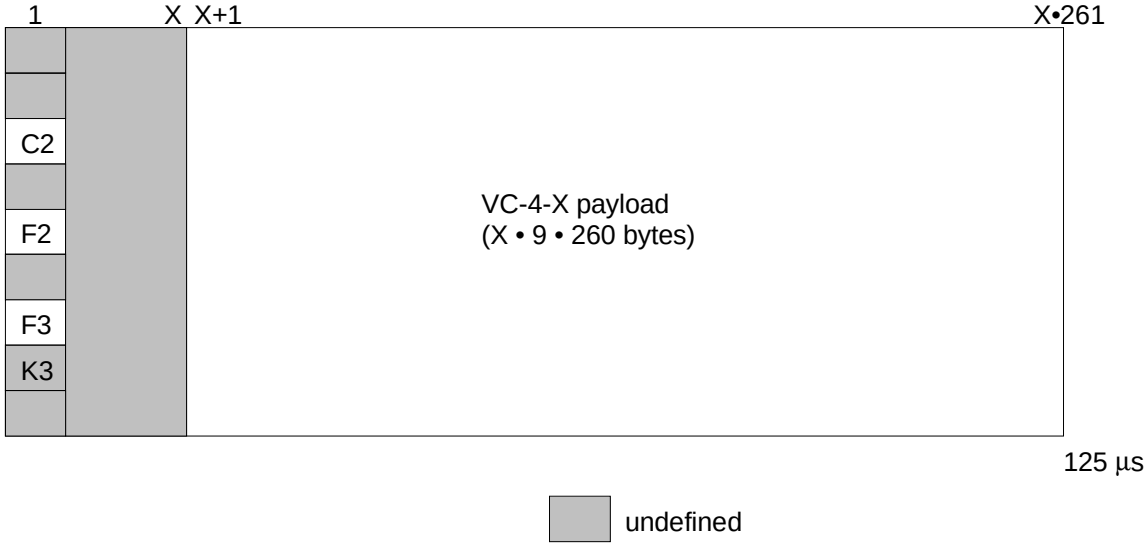


Figure 8: S4-XP_CI_D

The S4-XP CI is identical to the S4-X AI, with undefined APS information.

NOTE: The presence/absence of F2/F3 depends on the location of the S4-X/P0s_A function.

5.3 VC-4-Xc Layer Connection Function S4-Xc_C

Refer to ETS 300 417-4-1 [3], clause 4.1 "VC-4 Layer Connection Function S4_C" with:

- S4 => S4-Xc;
- VC-4 => VC-4-Xc.

5.3.1 SNC protection

Refer to ETS 300 417-4-1 [3], clause 4.1.1 "SNC protection" with:

- S4 => S4-Xc;
- VC-4 => VC-4-Xc.

5.4 VC-4-Xc Layer Trail Termination Functions S4-Xc_TT

5.4.1 VC-4-Xc Layer Trail Termination Source Function S4-Xc_TT_So

Refer to ETS 300 417-4-1 [3], clause 4.2.1 "VC-4 Layer Trail Termination Source S4_TT_So" with:

- S4 => S4-Xc;
- VC-4 => VC-4-Xc.

5.4.2 VC-4-Xc Layer Trail Termination Sink Function S4-Xc_TT_So

Refer to ETS 300 417-4-1 [3], clause 4.2.2 "VC-4 Layer Trail Termination Sink S4_TT_Sk" with:

- S4 => S4-Xc;
- VC-4 => VC-4-Xc.

5.5 VC-4-Xc Layer Monitoring Functions

5.5.1 VC-4-Xc Non-intrusive Monitoring Function S4-Xcm_TT_Sk

Refer to ETS 300 417-4-1 [3], clause 4.4.1 "VC-4 Layer Non-intrusive Monitoring Function S4m_TT_Sk" with:

- S4 => S4-Xc;
- VC-4 => VC-4-Xc.

5.5.2 VC-4-Xc Supervisory Unequipped Termination Source Function S4-Xcs_TT_So

Refer to ETS 300 417-4-1 [3], clause 4.4.2 "VC-4 Layer Supervisory-Unequipped Termination Source S4s_TT_So" with:

- S4 => S4-Xc;
- VC-4 => VC-4-Xc.

5.5.3 VC-4-Xc Supervisory Unequipped Termination Sink Function S4-Xcs_TT_Sk

Refer to ETS 300 417-4-1 [3], clause 4.4.3 "VC-4 Layer Supervisory-Unequipped Termination Sink S4s_TT_Sk" and with:

- S4 => S4-Xc;
- VC-4 => VC-4-Xc.

5.6 VC-4-Xc Tandem Connection Sublayer Functions

5.6.1 VC-4-Xc Tandem Connection Trail Termination Source Function S4-XcD_TT_So

Refer to ETS 300 417-4-1 [3], clause 4.6.1 "VC-4 Tandem Connection Trail Termination Source function (S4D_TT_So)" with:

- S4 => S4-Xc;
- VC-4 => VC-4-Xc.

5.6.2 VC-4-Xc Tandem Connection Trail Termination Sink Function S4-XcD_TT_Sk

Refer to ETS 300 417-4-1 [3], clause 4.6.2 "VC-4 Tandem Connection Trail Termination Sink function (S4D_TT_Sk)" with:

- S4 => S4-Xc;
- VC-4 => VC-4-Xc.

5.6.3 VC-4-Xc Tandem Connection Non-intrusive Monitoring Trail Termination Sink Function S4-XcDm_TT_Sk

Refer to ETS 300 417-4-1 [3], clause 4.6.5 "VC-4 Tandem Connection Non-intrusive Monitoring Trail Termination Sink function (S4Dm_TT_Sk)" with:

- S4 => S4-Xc;
- VC-4 => VC-4-Xc.

5.6.4 VC-4-Xc Tandem Connection to VC-4-Xc Adaptation Source Function S4-XcD/S4-Xc_A_So

Refer to ETS 300 417-4-1 [3], clause 4.6.3 "VC-4 Tandem Connection to VC-4 Adaptation Source function (S4D/S4_A_So)" with:

- S4 => S4-Xc;
- VC-4 => VC-4-Xc.

5.6.5 VC-4-Xc Tandem Connection to VC-4-Xc Adaptation Sink Function S4-XcD/S4-Xc_A_Sk

Refer to ETS 300 417-4-1 [3], clause 4.6.4 "VC-4 Tandem Connection to VC-4 Adaptation Sink function (S4D/S4_A_Sk)" with:

- S4 => S4-Xc;
- VC-4 => VC-4-Xc.

5.7 VC-4-Xv Layer Trail Termination Functions S4-Xc_TT

Refer to ITU-T Recommendation G.783 [4], clause 12.5.1.1 "VC-n-Xv Layer Trail Termination Function Sn-Xv_TT" with n = 4.

5.7.1 VC-4-Xv/VC-4-X Adaptation Source Function S4-Xv/S4-X_A_So

Refer to ITU-T Recommendation G.783 [4], clause 12.5.1.1.1 "VC-n-Xv/VC-n-X Adaptation Source Function Sn-Xv/Sn-X_A_So" with n = 4.

5.7.2 VC-4-Xv/VC-4-X Adaptation Sink Function S4-Xv/S4-X_A_Sk

Refer to ITU-T Recommendation G.783 [4], clause 12.5.1.1.2 "VC-n-Xv/VC-n-X Adaptation Sink Function Sn-Xv/Sn-X_A_Sk" with n = 4.

5.7.3 VC-4-Xv Layer Trail Termination Source Function S4-Xv_TT_So

Refer to ITU-T Recommendation G.783 [4], clause 12.5.1.1.3 "VC-n-Xv/VC-n-X Adaptation Source Function Sn-Xv/Sn-X_A_So" with n = 4.

5.7.4 VC-4-Xv Layer Trail Termination Sink Function S4-Xv_TT_Sk

Refer to ITU-T Recommendation G.783 [4], clause 12.5.1.1.4 "VC-n-Xv/VC-n-X Adaptation Sink Function Sn-Xv/Sn-X_A_Sk" with n = 4.

5.8 Interworking Functions

5.8.1 VC-4-Xc to VC-4-Xv Interworking Function S4-Xc>S4-Xv_I

Refer to ITU-T Recommendation G.783 [4], clause 12.5.2.1 "VC-4-Xc to VC-4-Xv Interworking Function S4-Xc>S4-Xv_I"

5.8.2 VC-4-Xv to VC-4-Xc Interworking Function S4-Xv>S4-Xc_I

Refer to ITU-T Recommendation G.783 [4], clause 12.5.2.2 "VC-4-Xv to VC-4-Xc Interworking Function S4-Xv>S4-Xc_I"

5.9 VC-4-X Layer Adaptation Functions

5.9.1 VC-4-X to P0s Adaptation Source Function S4-X/P0s_A_So

Refer to ETS 300 417-4-1 [3], clause 4.3.7 "VC-4 Layer to P0s Layer Adaptation Source S4/P0s_A_So" with:

- S4 => S4-Xc;
- VC-4 => VC-4-Xc.

5.9.2 VC-4-X to P0s Adaptation Sink Function S4-X/P0s_A_Sk

Refer to ETS 300 417-4-1 [3], clause 4.3.8 "VC-4 Layer to P0s Layer Adaptation Sink S4/P0s_A_Sk" with:

- S4 => S4-Xc;
- VC-4 => VC-4-Xc.

5.9.3 VC-4-X to HDLC Adaptation Source Function S4-X/HDLC_A_So

For further study.

5.9.4 VC-4-X to HDLC Adaptation Sink Function S4-X/HDLC_A_Sk

For further study.

5.9.5 VC-4-X to Avp Adaptation Source Function S4-X/Avp_A_So

The specification of this function is addressed in EN 301 163-2-1 [6].

5.9.6 VC-4-X to Avp Adaptation Sink Function S4-X/Avp_A_Sk

The specification of this function is addressed in EN 301 163-2-1 [6].

5.9.7 VC-4-X to TSS1 Adaptation Source Function S4-X/TSS1_A_So

Refer to ETS 300 417-4-1 [3], clause 4.3.11 "VC-4 Layer to TSS1 Adaptation Source S4/TSS1_A_So" with:

- S4 => S4-Xc;
- VC-4 => VC-4-Xc.

5.9.8 VC-4-X to TSS1 Adaptation Sink Function S4-X/TSS1_A_Sk

Refer to ETS 300 417-4-1 [3], clause 4.3.12 "VC-4 Layer to TSS1 Adaptation Sink S4/TSS1_A_Sk" with:

- S4 => S4-Xc;
- VC-4 => VC-4-Xc.

5.10 VC-4-X Layer Trail Protection Functions

5.10.1 VC-4-X Trail Protection Connection Functions S4-XP_C

5.10.1.1 VC-4-X Layer 1+1 uni-directional Protection Connection Function S4-XP1+1u_C

Refer to ETS 300 417-4-1 [3], clause 4.5.1.1 "VC-4 Layer 1+1 uni-directional Protection Connection Function S4P1+1u_C " with:

- S4 => S4-Xc;
- VC-4 => VC-4-Xc.

5.10.1.2 VC-4-X Layer 1+1 bi-directional Protection Connection Function S4-XP1+1b_C

Refer to ETS 300 417-4-1 [3], clause 4.5.1.2 "VC-4 Layer 1+1 bi-directional Protection Connection Function S4P1+1b_C " with:

- S4 => S4-Xc;
- VC-4 => VC-4-Xc.

5.10.2 VC-4 Layer Trail Protection Trail Termination Functions

5.10.2.1 VC-4-X Protection Trail Termination Source S4-XP_TT_So

Refer to ETS 300 417-4-1 [3], clause 4.5.2.1 "VC-4 Protection Trail Termination Source S4P_TT_So" with:

- S4 => S4-Xc;
- VC-4 => VC-4-Xc.

5.10.2.2 VC-4-X Protection Trail Termination Sink S4-XP_TT_Sk

Refer to ETS 300 417-4-1 [3], clause 4.5.2.2 "VC-4 Protection Trail Termination Sink S4P_TT_Sk" with:

- S4 => S4-Xc;
- VC-4 => VC-4-Xc.

5.10.3 VC-4 Layer Linear Trail Protection Adaptation Functions

5.10.3.1 VC-4-X trail to VC-4-X trail Protection Layer Adaptation Source S4-X/S4-XP_A_So

Refer to ETS 300 417-4-1 [3], clause 4.5.3.1 "VC-4 trail to VC-4 trail Protection Layer Adaptation Source S4/S4P_A_So" with:

- S4 => S4-Xc;
- VC-4 => VC-4-Xc.

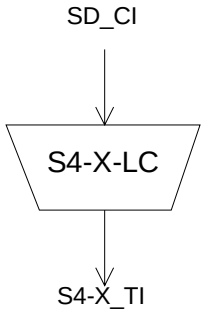
5.10.3.2 VC-4-X trail to VC-4-X trail Protection Layer Adaptation Sink S4-X/S4-XP_A_Sk

Refer to ETS 300 417-4-1 [3], clause 4.5.3.2 "VC-4 trail to VC-4 trail Protection Layer Adaptation Sink S4/S4P_A_Sk" with:

- S4 => S4-Xc;
- VC-4 => VC-4-Xc.

5.11 VC-4-X layer clock adaptation source (S4-X-LC_A_So)

Symbol and interfaces:



Input(s)	Output(s)
SD_CI_CK	S4-X_TI_CK S4-X_TI_FS S4-X_TI_MFS

Figure 9: S4-X-LC_A_So symbol and in/output signals

Processes:

This function performs the VC-4-X clock and frame start signal generation locked to the network element clock signal SD_CI_CK, to time the adaptation source and connection functions in this layer.

Clock generation: The function shall generate the clock (bit) reference signal S4-X_TI_CK for the VC-4-X signal. The S4-X_TI_CK frequency shall be X • 150 336 kHz locked to the input signal SD_CI_CK.

Jitter limiter: For Further study.

Frame Start signal generation: The function shall generate the frame start reference signal S4-X_TI_FS for the VC-4-X signal. The S4-X_TI_FS signal shall be active once per X • 18 792 clock cycle and the multiframe reference S4-X_TI_MFS shall be active once every 4 096 frames.

Defects: None.

Consequent Actions: None.

Defect Correlations: None.

Performance Monitoring: None.

6 Concatenated VC-3 path layer functions

6.1 Atomic functions overview

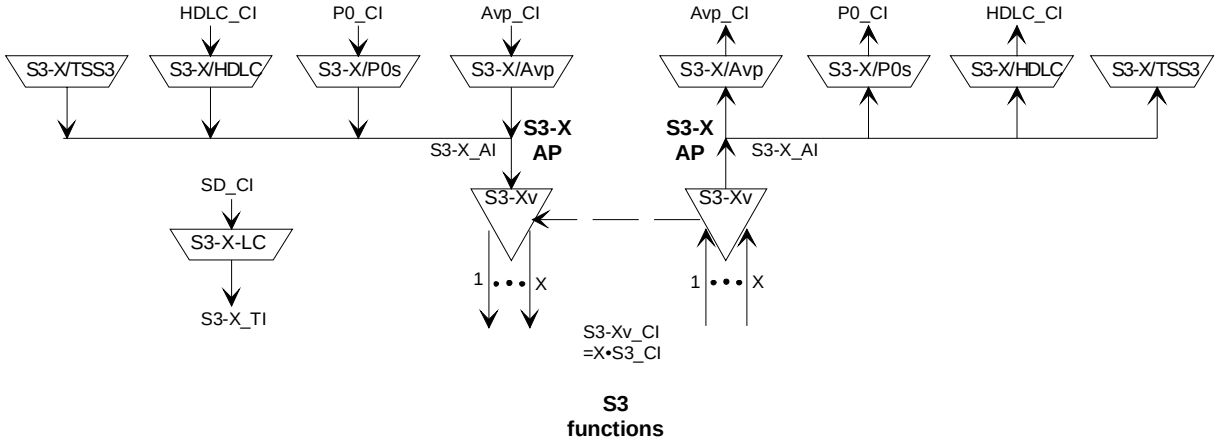


Figure 10: Concatenated VC-3 path layer atomic functions

Figure 10 shows the set of atomic functions for the concatenated VC-3 path layer. Figure 11 shows the additional functions for the concatenated VC-3 layer trail protection. It should be noted that the S3-X/P0s_A function can be absent, or connected before or after the protection functions S3-XP_C. When connected before S3-XP_C the transport of the user channel signal is not protected, otherwise it is protected.

Figures 10 and 11 show that more than one adaptation function exists in the S3-X layer that can be connected to one S3-X access point. For such cases, a subset of these adaptation source functions is allowed to be activated together, but only one adaptation source function may have access to a specific timeslot. Access to the same timeslot by other adaptation source functions shall be denied. In contradiction with the source direction, adaptation sink functions may be activated all together. This may cause faults to be detected and reported. To prevent this an adaptation sink function can be deactivated.

NOTE: If one adaptation function only is connected to the AP, it will be activated. If one or more other functions are connected to the same AP accessing the same timeslot, one out of the set of functions will be active.

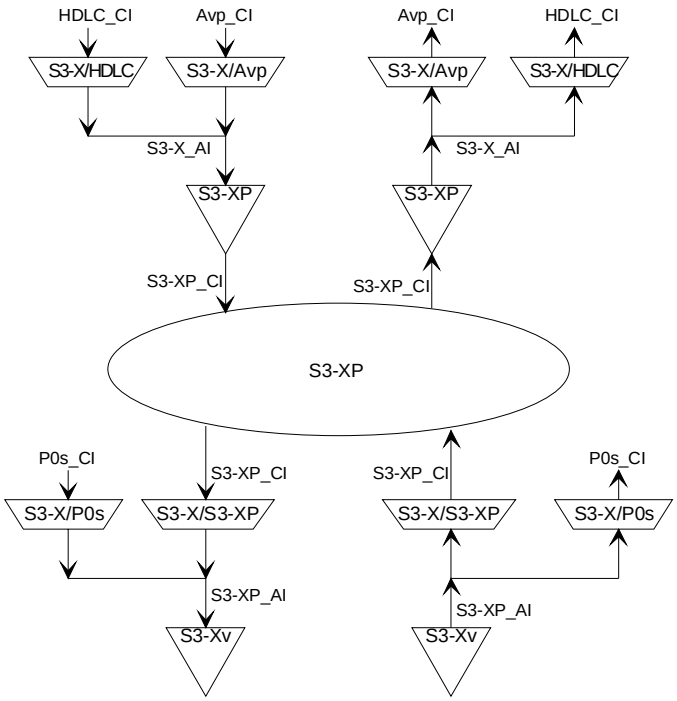


Figure 11: Concatenated VC-3 Layer Trail Protection atomic functions

6.2 Layer information

6.2.1 VC-3-X layer access point

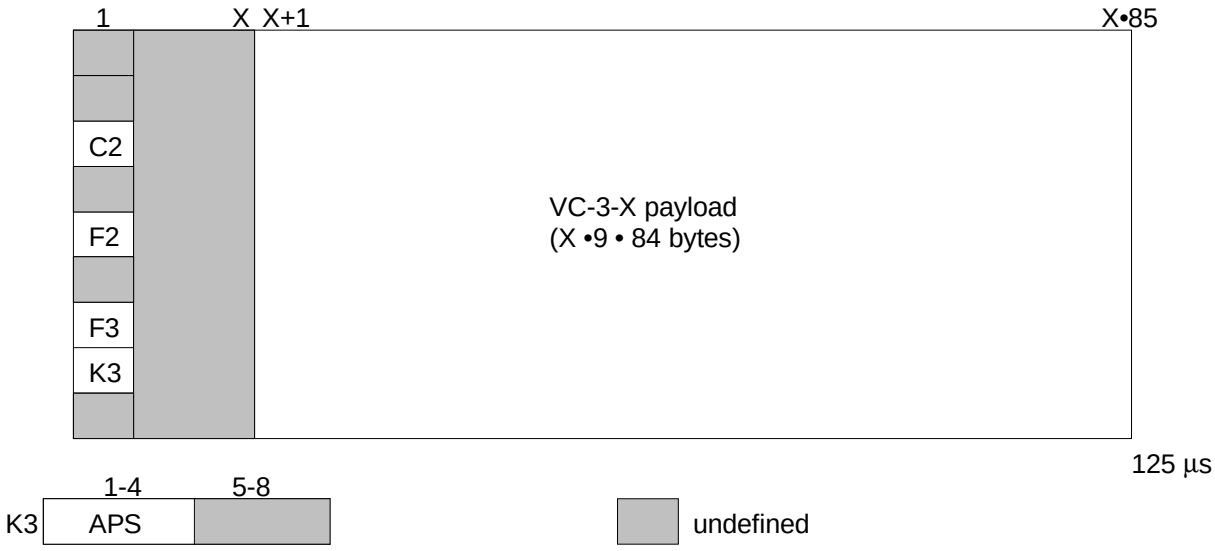


Figure 12: S3-X_AI_D

The VC-3-X AI (S3-X_AI_D) at this point is octet structured with an 125 µs frame. It represents adapted client layer information comprising X • 756 bytes of client layer information, the signal label byte C2, and the 2 path user channel bytes F2/3 as defined in ETS 300 147 [5]. For the case the signal has passed the trail protection sublayer, S3_AI has defined APS bits (1 to 4) in byte K3.

NOTE 1: The APS signal has not been defined; a multiframed APS signal might be required.

NOTE 2: Bits 1 to 4 of byte K3 will be undefined when the signal S3-X_AI has not been processed in a trail protection connection function S3-XP_C.

NOTE 3: Bytes F2 and F3 will be undefined when the adaptation functions sourcing these bytes are not present in the network element.

A VC-3-X comprises one of the following payloads:

- an ATM X • 48 384 kbit/s cell stream signal;
- an PPP X • 48 384 kbit/s cell stream signal;
- a Test Signal Structure (TSS3).

6.2.2 VC-3-X layer connection point

A VC-3 concatenated trail is transported via virtual concatenated VC-3 (VC-3-Xv) connections.

For a virtual concatenated VC-3-Xv connection all values for X ≥ 1 are allowed.

6.2.3 VC-3-Xv layer connection point

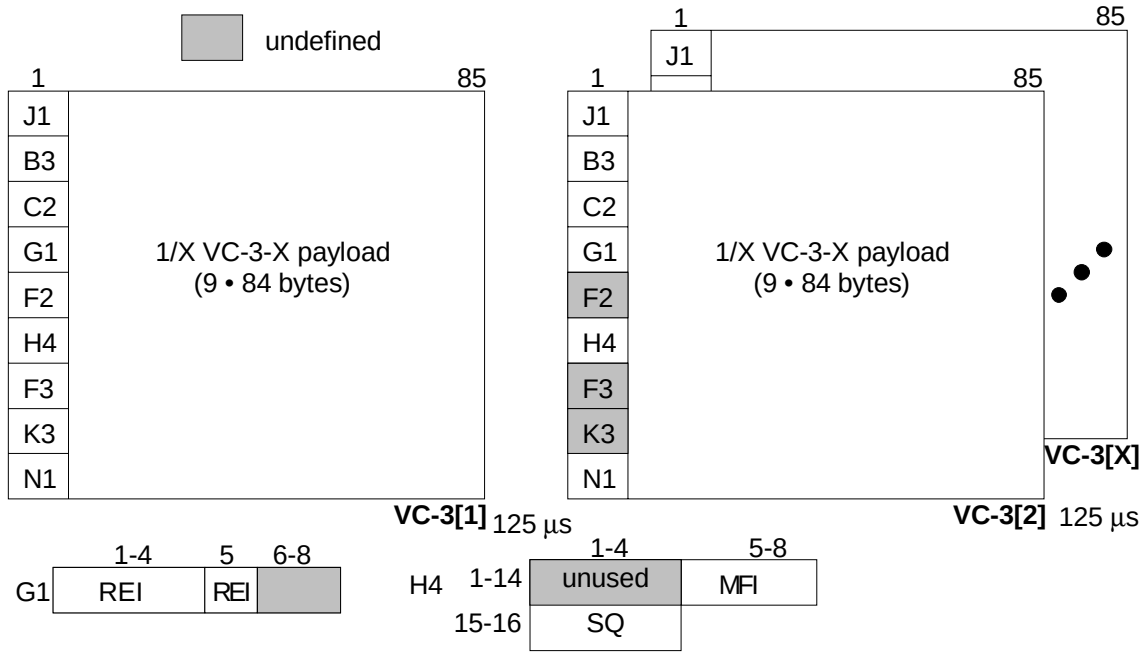


Figure 13: S3-Xv_CI_D

The CI of a VC-3-Xv (S3-Xv_CI_D) consists of X times S3_CI as defined in ETS 300 417-1-1 [1]. The H4 byte is generated as defined in ETS 300 147 [5].

The mapping of S3-X_AI to S3-Xv_CI is performed as shown in figure 14.

NOTE: F2, F3 and K3 of VC-3[2...X] are undefined.

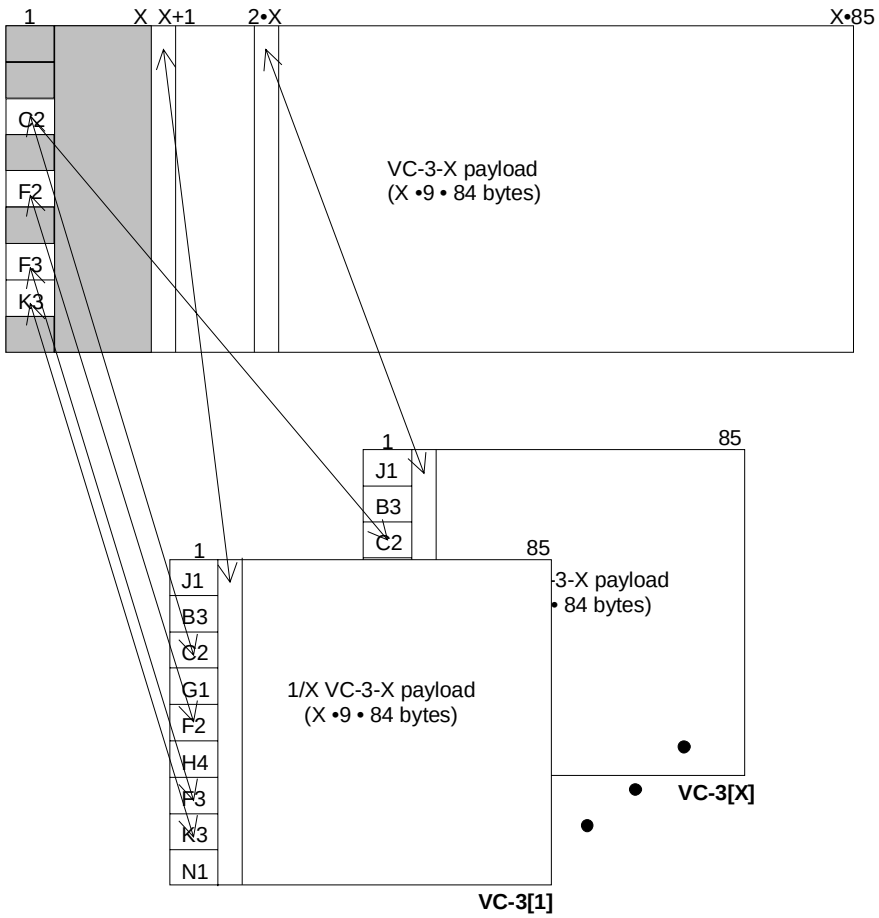


Figure 14: S3-X_AI_D to S3-Xv_CI_D mapping

6.2.4 VC-3-XP layer access point

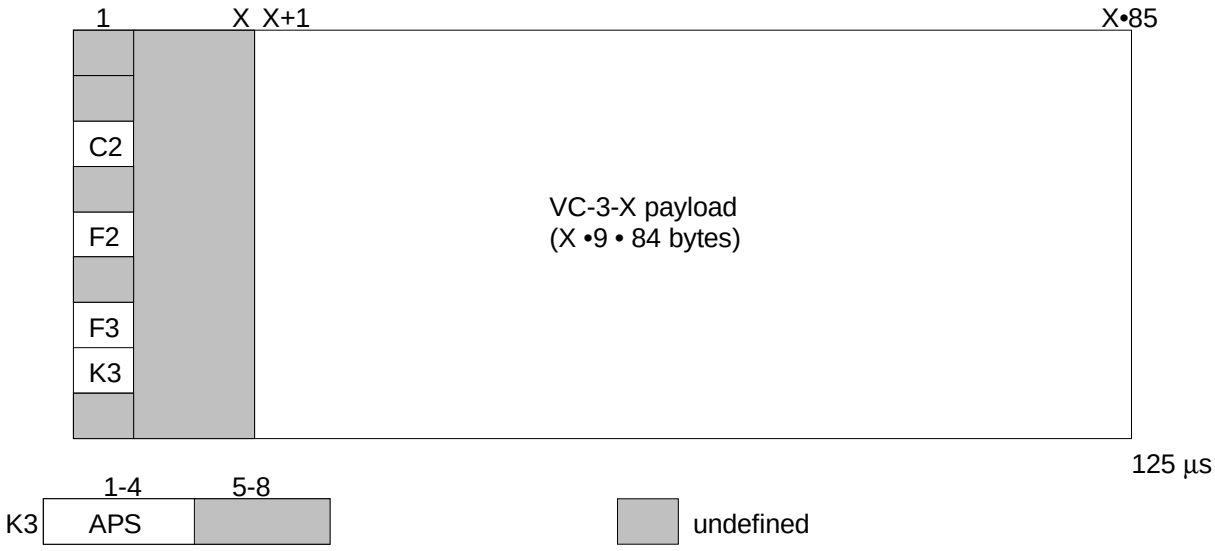


Figure 15: S3-XP_AI_D

The S3-XP AI is identical to the S3-X AI with defined APS information if the protection scheme uses it.

6.2.5 VC-3XP layer connection point

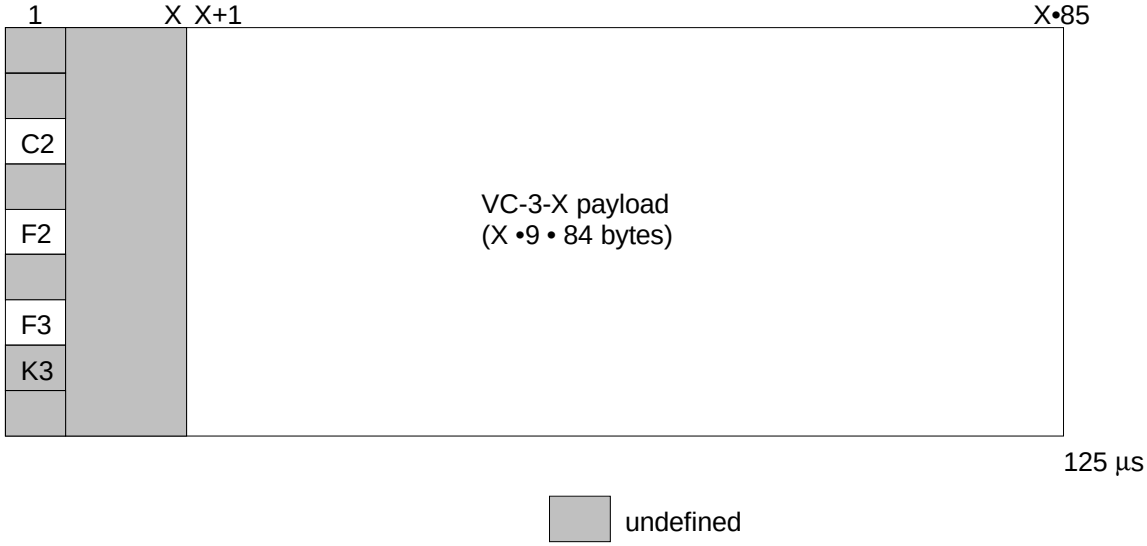


Figure 16: S3-XP_CI_D

The S3-XP CI is identical to the S3-X AI, with undefined APS information.

NOTE: The presence/absence of F2/F3 depends on the location of the S3-X/P0s_A function.

6.3 VC-3-Xv Layer Trail Termination Functions S3-Xc_TT

Refer to ITU-T Recommendation G.783 [4], clause 12.5.1.1 "VC-n-Xv Layer Trail Termination Function Sn-Xv_TT" with n = 3.

6.3.1 VC-3-Xv/VC-3-X Adaptation Source Function S3-Xv/S3-X_A_So

Refer to ITU-T Recommendation G.783 [4], clause 12.5.1.1.1 "VC-n-Xv/VC-n-X Adaptation Source Function Sn-Xv/Sn-X_A_So" with n = 4.

6.3.2 VC-3-Xv/VC-3-X Adaptation Sink Function S3-Xv/S3-X_A_Sk

Refer to ITU-T Recommendation G.783 [4], clause 12.5.1.1.2 "VC-n-Xv/VC-n-X Adaptation Sink Function Sn-Xv/Sn-X_A_Sk" with n = 3.

6.3.3 VC-3-Xv Layer Trail Termination Source Function S3-Xv_TT_So

Refer to ITU-T Recommendation G.783 [4], clause 12.5.1.1.3 "VC-n-Xv/VC-n-X Adaptation Source Function Sn-Xv/Sn-X_A_So" with n = 3.

6.3.4 VC-3-Xv Layer Trail Termination Sink Function S3-Xv_TT_Sk

Refer to ITU-T Recommendation G.783 [4], clause 12.5.1.1.4 "VC-n-Xv/VC-n-X Adaptation Sink Function Sn-Xv/Sn-X_A_Sk" with n = 3.

6.4 VC-3-x Layer Adaptation Functions

6.4.1 VC-3-x to P0s Adaptation Source Function S3-x/P0s_A_So

Refer to ETS 300 417-4-1 [3], clause 5.3.5 "VC-3 Layer to P0s Layer Adaptation Source S3/P0s_A_So" with:

- S3 => S3-xc;
- VC-3 => VC-3-xc.

6.4.2 VC-3-x to P0s Adaptation Sink Function S3-x/P0s_A_Sk

Refer to ETS 300 417-4-1 [3], clause 5.3.6 "VC-3 Layer to P0s Layer Adaptation Sink S3/P0s_A_Sk" with:

- S3 => S3-xc;
- VC-3 => VC-3-xc.

6.4.3 VC-3-x to HDLC Adaptation Source Function S3-x/HDLC_A_So

For further study.

6.4.4 VC-3-x to HDLC Adaptation Sink Function S3-x/HDLC_A_Sk

For further study.

6.4.5 VC-3-x to Avp Adaptation Source Function S3-x/Avp_A_So

The specification of this function is addressed in EN 301 163-2-1 [6].

6.4.6 VC-3-x to Avp Adaptation Sink Function S3-x/Avp_A_Sk

The specification of this function is addressed in EN 301 163-2-1 [6].

6.4.7 VC-3-x to TSS3 Adaptation Source Function S3-x/TSS3_A_So

Refer to ETS 300 417-4-1 [3], clause 5.3.7 "VC-3 Layer to TSS3 Adaptation Source S3/TSS3_A_So" with:

- S3 => S3-xc;
- VC-3 => VC-3-xc.

6.4.8 VC-3-x to TSS3 Adaptation Sink Function S3-x/TSS3_A_Sk

Refer to ETS 300 417-4-1 [3], clause 5.3.8 "VC-3 Layer to TSS3 Adaptation Sink S3/TSS3_A_Sk" with:

- S3 => S3-xc;
- VC-3 => VC-3-xc.

6.5 VC-3-X Layer Trail Protection Functions

6.5.1 VC-3-X Trail Protection Connection Functions S3-XP_C

6.5.1.1 VC-3-X Layer 1+1 uni-directional Protection Connection Function S3-XP1+1u_C

Refer to ETS 300 417-4-1 [3], clause 5.5.1.1 "VC-3 Layer 1+1 uni-directional Protection Connection Function S3P1+1u_C" with:

- S3 => S3-Xc;
- VC-3 => VC-3-Xc.

6.5.1.2 VC-3-X Layer 1+1 bi-directional Protection Connection Function S3-XP1+1b_C

Refer to ETS 300 417-4-1 [3], clause 5.5.1.2 "VC-3 Layer 1+1 bi-directional Protection Connection Function S3P1+1b_C" with:

- S3 => S3-Xc;
- VC-3 => VC-3-Xc.

6.5.2 VC-3 Layer Trail Protection Trail Termination Functions

6.5.2.1 VC-3-X Protection Trail Termination Source S3-XP_TT_So

Refer to ETS 300 417-4-1 [3], clause 5.5.2.1 "VC-3 Protection Trail Termination Source S3P_TT_So" with:

- S3 => S3-Xc;
- VC-3 => VC-3-Xc.

6.5.2.2 VC-3-X Protection Trail Termination Sink S3-XP_TT_Sk

Refer to ETS 300 417-4-1 [3], clause 5.5.2.2 "VC-3 Protection Trail Termination Sink S3P_TT_Sk" with:

- S3 => S3-Xc;
- VC-3 => VC-3-Xc.

6.5.3 VC-3 Layer Linear Trail Protection Adaptation Functions

6.5.3.1 VC-3-X trail to VC-3-X trail Protection Layer Adaptation Source S3-X/S3-XP_A_So

Refer to ETS 300 417-4-1 [3], clause 5.5.3.1 "VC-3 trail to VC-3 trail Protection Layer Adaptation Source S3/S3P_A_So" with:

- S3 => S3-Xc;
- VC-3 => VC-3-Xc.

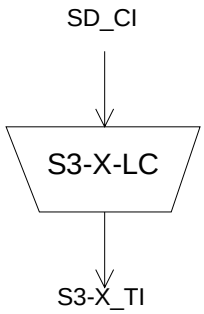
6.5.3.2 VC-3-X trail to VC-3-X trail Protection Layer Adaptation Sink S3-X/S3-XP_A_Sk

Refer to ETS 300 417-4-1 [3], clause 5.5.3.2 "VC-3 trail to VC-3 trail Protection Layer Adaptation Sink S3/S3P_A_Sk" with:

- S3 => S3-Xc;
- VC-3 => VC-3-Xc.

6.6 VC-3-X layer clock adaptation source (S3-X-LC_A_So)

Symbol and interfaces:



Input(s)	Output(s)
SD_CI_CK	S3-X_TI_CK S3-X_TI_FS S3-X_TI_MFS

Figure 17: S3-X-LC_A_So symbol and in/output signals

Processes:

This function performs the VC-3-X clock and frame start signal generation locked to the network element clock signal SD_CI_CK, to time the adaptation source and connection functions in this layer.

Clock generation: The function shall generate the clock (bit) reference signal S3-X_TI_CK for the VC-3-X signal. The S3-X_TI_CK frequency shall be X • 48 960 kHz locked to the input signal SD_CI_CK.

Jitter limiter: For Further study.

Frame Start signal generation: The function shall generate the frame start reference signal S3-X_TI_FS for the VC-3-X signal. The S3-X_TI_FS signal shall be active once per X • 6 120 clock cycle and the multiframe reference S3-X_TI_MFS shall be active once every 4 096 frames.

Defects: None.

Consequent Actions: None.

Defect Correlations: None.

Performance Monitoring: None.

7 Concatenated VC-2 path layer functions

7.1 Atomic functions overview

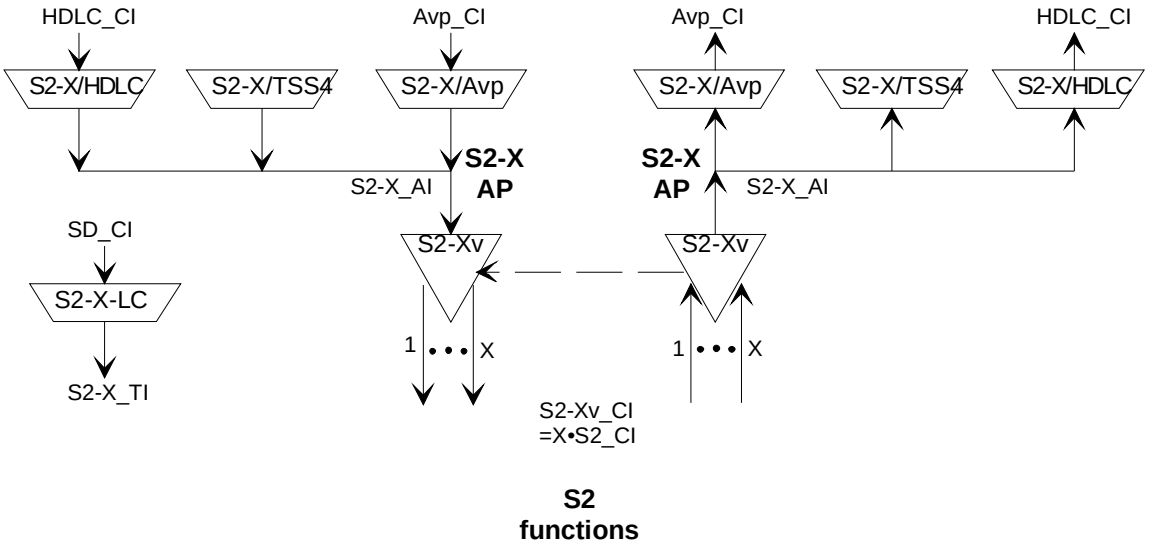


Figure 18: Concatenated VC-2 path layer atomic functions

Figure 18 shows the set of atomic functions for the concatenated VC-2 path layer. Figure 19 shows the additional functions for the concatenated VC-2 layer trail protection.

Figures 18 and 19 show that more than one adaptation function exists in the S2-X layer that can be connected to one S2-X access point. For such cases, a subset of these adaptation source functions is allowed to be activated together, but only one adaptation source function may have access to a specific timeslot. Access to the same timeslot by other adaptation source functions shall be denied. In contradiction with the source direction, adaptation sink functions may be activated all together. This may cause faults to be detected and reported. To prevent this an adaptation sink function can be deactivated.

NOTE: If one adaptation function only is connected to the AP, it will be activated. If one or more other functions are connected to the same AP accessing the same timeslot, one out of the set of functions will be active.

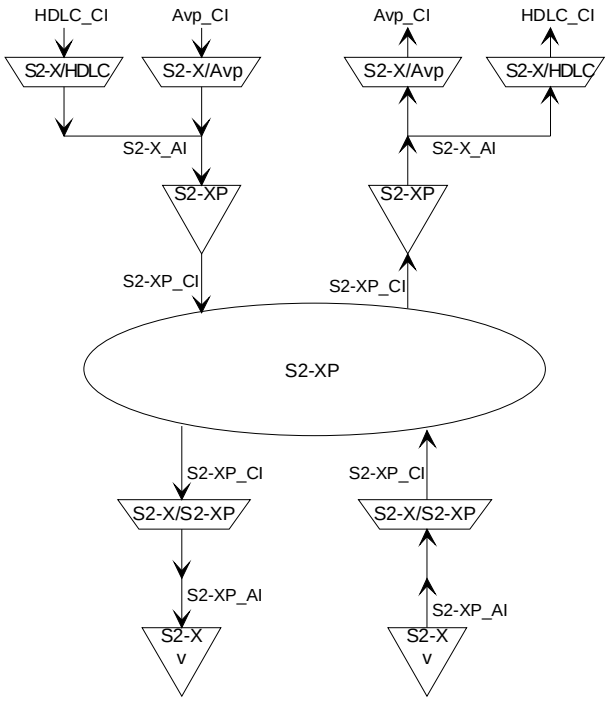


Figure 19: Concatenated VC-2 Layer Trail Protection atomic functions

7.2 Layer information

7.2.1 VC-2-X layer access point

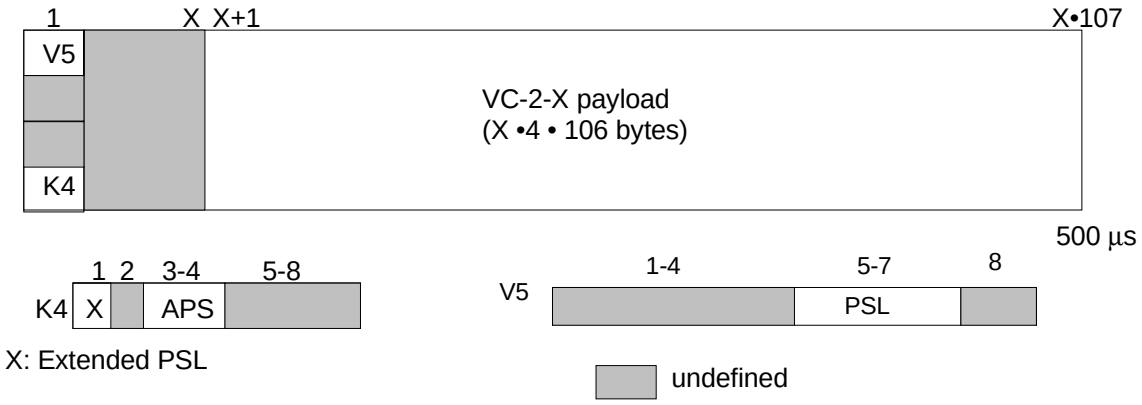


Figure 20: S2-X_AI_D

The VC-2-X AI (S2-X_AI_D) at this point is octet structured with an 500 µs frame. It represents adapted client layer information comprising X • 424 bytes of client layer information, the signal label in bits 5-7 of the V5 byte as defined in ETS 300 147 [5]. For the case the signal has passed the trail protection sublayer, S2_AI has defined APS bits (3 to 4) in byte K4.

NOTE 1: The APS signal has not been defined; a multiframed APS signal might be required.

NOTE 2: Bits 3 to 4 of byte K4 will be undefined when the signal S2-X_AI has not been processed in a trail protection connection function S2-XP_C.

A VC-2-X comprises one of the following payloads:

- an ATM X • 6 784 kbit/s cell stream signal;
- an PPP X • 6 784 kbit/s cell stream signal;
- a Test Signal Structure (TSS4).

7.2.2 VC-2-X layer connection point

A VC-2 concatenated trail is transported via virtual concatenated VC-2 (VC-2-Xv) connections.

For a virtual concatenated VC-2-Xv connection all values for X ≥ 1 are allowed.

7.2.3 VC-2-Xv layer connection point

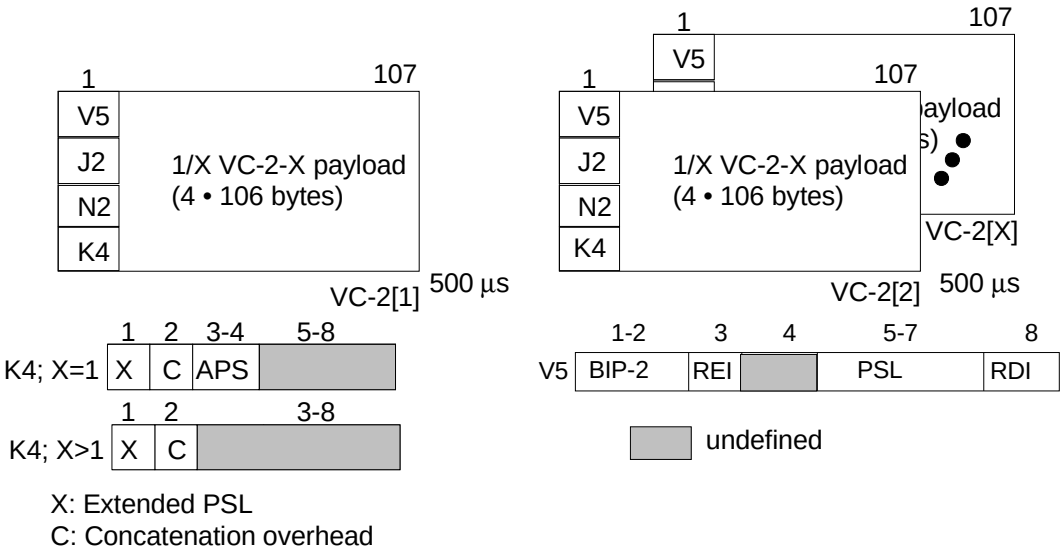


Figure 21: S2-Xv_CI_D

The CI of a VC-2-Xv (S2-Xv_CI_D) consists of X times S2_CI as defined in ETS 300 417-1-1 [1]. The H4 byte is generated as defined in ETS 300 147 [5].

The mapping of S2-X_AI to S2-Xv_CI is performed as shown in figure 22.

NOTE: K4, bits 3-4 (APS) of VC-2[2...X] are undefined.

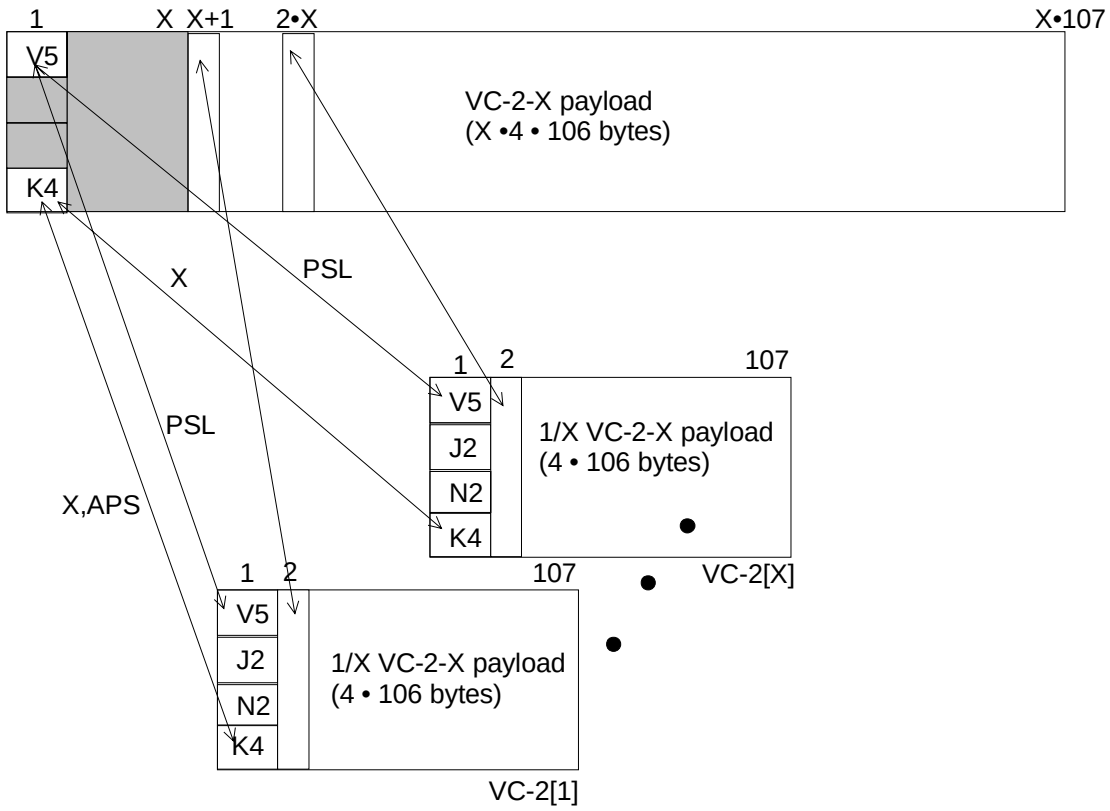


Figure 22: S2-X_AI_D to S2-Xv_CI_D mapping

7.2.4 VC-2-XP layer access point

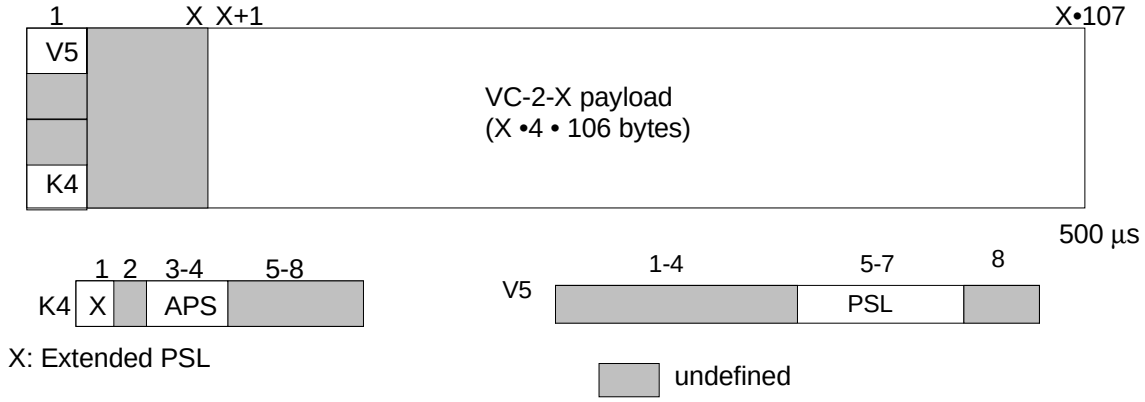


Figure 23: S2-XP_AI_D

The S2-XP AI is identical to the S2-X AI with defined APS information if the protection scheme uses it.

7.2.5 VC-2XP layer connection point

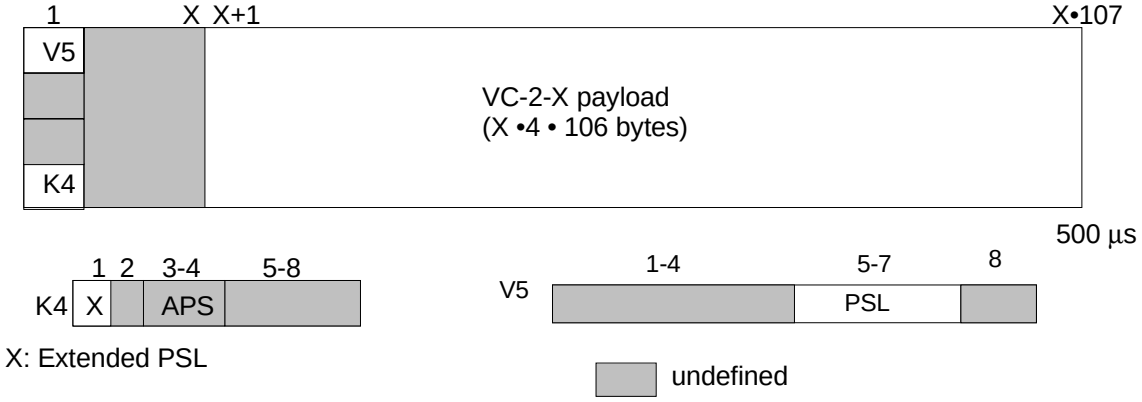


Figure 24: S2-XP_CI_D

The S2-XP CI is identical to the S2-X AI, with undefined APS information.

7.3 VC-2-Xv Layer Trail Termination Functions S2-Xc_TT

Refer to ITU-T Recommendation G.783 [4], clause 13.5.1.1 "VC-m-Xv Layer Trail Termination Function Sm-Xv_TT" with m = 2.

7.3.1 VC-2-Xv/VC-2-X Adaptation Source Function S2-Xv/S2-X_A_So

Refer to ITU-T Recommendation G.783 [4], clause 13.5.1.1.1 "VC-m-Xv/VC-m-X Adaptation Source Function Sm-Xv/Sm-X_A_So" with m = 2.

7.3.2 VC-2-Xv/VC-2-X Adaptation Sink Function S2-Xv/S2-X_A_Sk

Refer to ITU-T Recommendation G.783 [4], clause 13.5.1.1.2 "VC-m-Xv/VC-m-X Adaptation Sink Function Sm-Xv/Sm-X_A_Sk" with m = 2.

7.3.3 VC-2-Xv Layer Trail Termination Source Function S2-Xv_TT_So

Refer to ITU-T Recommendation G.783 [4], clause 13.5.1.1.3 "VC-m-Xv/VC-m-X Adaptation Source Function Sm-Xv/Sm-X_A_So" with m = 2.

7.3.4 VC-2-Xv Layer Trail Termination Sink Function S2-Xv_TT_Sk

Refer to ITU-T Recommendation G.783 [4], clause 13.5.1.1.4 "VC-m-Xv/VC-m-X Adaptation Sink Function Sm-Xv/Sm-X_A_Sk" with m = 2.

7.4 VC-2-x Layer Adaptation Functions

7.4.1 VC-2-X to HDLC Adaptation Source Function S2-X/HDLC_A_So

For further study.

7.4.2 VC-2-X to HDLC Adaptation Sink Function S2-X/HDLC_A_Sk

For further study.

7.4.3 VC-2-X to Avp Adaptation Source Function S2-X/Avp_A_So

For further study.

7.4.4 VC-2-X to Avp Adaptation Sink Function S2-X/Avp_A_Sk

For further study.

7.4.5 VC-2-X to TSS4 Adaptation Source Function S2-X/TSS4_A_So

Refer to ETS 300 417-4-1 [3], clause 6.3.1 "VC-2 Layer to TSS4 Adaptation Source S2/TSS4_A_So" with:

- S2 => S2-Xc;
- VC-2 => VC-2-Xc.

7.4.6 VC-2-X to TSS4 Adaptation Sink Function S2-X/TSS4_A_Sk

Refer to ETS 300 417-4-1 [3], clause 6.3.2 "VC-2 Layer to TSS4 Adaptation Sink S3/TSS4_A_Sk" with:

- S2 => S2-Xc;
- VC-2 => VC-2-Xc.

7.5 VC-2-X Layer Trail Protection Functions

7.5.1 VC-2-X Trail Protection Connection Functions S2-XP_C

7.5.1.1 VC-2-X Layer 1+1 uni-directional Protection Connection Function S2-XP1+1u_C

Refer to ETS 300 417-4-1 [3], clause 6.5.1.1 "VC-2 Layer 1+1 uni-directional Protection Connection Function S2P1+1u_C" with:

- S2 => S2-Xc;
- VC-2 => VC-2-Xc.

7.5.1.2 VC-2-X Layer 1+1 bi-directional Protection Connection Function S2-XP1+1b_C

Refer to ETS 300 417-4-1 [3], clause 6.5.1.2 "VC-2 Layer 1+1 bi-directional Protection Connection Function S2P1+1b_C" with:

- S2 => S2-Xc;
- VC-2 => VC-2-Xc.

7.5.2 VC-2 Layer Trail Protection Trail Termination Functions

7.5.2.1 VC-2-X Protection Trail Termination Source S2-XP_TT_So

Refer to ETS 300 417-4-1 [3], clause 6.5.2.1 "VC-2 Protection Trail Termination Source S2P_TT_So" with:

- S2 => S2-Xc;
- VC-2 => VC-2-Xc.

7.5.2.2 VC-2-X Protection Trail Termination Sink S2-XP_TT_Sk

Refer to ETS 300 417-4-1 [3], clause 6.5.2.2 "VC-2 Protection Trail Termination Sink S2P_TT_Sk" with:

- S2 => S2-Xc;
- VC-2 => VC-2-Xc.

7.5.3 VC-2 Layer Linear Trail Protection Adaptation Functions

7.5.3.1 VC-2-X trail to VC-2-X trail Protection Layer Adaptation Source S2-X/S2-XP_A_So

Refer to ETS 300 417-4-1 [3], clause 6.5.3.1 "VC-2 trail to VC-2 trail Protection Layer Adaptation Source S2/S2P_A_So" with:

- S2 => S2-Xc;
- VC-2 => VC-2-Xc.

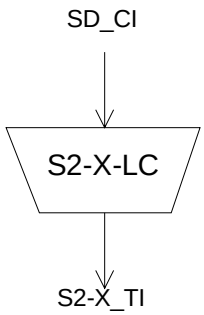
7.5.3.2 VC-2-X trail to VC-2-X trail Protection Layer Adaptation Sink S2-X/S2-XP_A_Sk

Refer to ETS 300 417-4-1 [3], clause 6.5.3.2 "VC-2 trail to VC-2 trail Protection Layer Adaptation Sink S2/S2P_A_Sk" with:

- S2 => S2-Xc;
- VC-2 => VC-2-Xc.

7.6 VC-2-X layer clock adaptation source (S2-X-LC_A_So)

Symbol and interfaces:



Input(s)	Output(s)
SD_CI_CK	S2-X_TI_CK S2-X_TI_FS S2-X_TI_MFS

Figure 25: S2-X-LC_A_So symbol and in/ output signals

Processes:

This function performs the VC-2-X clock and frame start signal generation locked to the network element clock signal SD_CI_CK, to time the adaptation source and connection functions in this layer.

Clock generation: The function shall generate the clock (bit) reference signal S2-X_TI_CK for the VC-2-X signal. The S2-X_TI_CK frequency shall be X • 6 848 kHz locked to the input signal SD_CI_CK.

Jitter limiter: For Further study.

Frame Start signal generation: The function shall generate the frame start reference signal S2-X_TI_FS for the VC-2-X signal. The S2-X_TI_FS signal shall be active once per X • 3424 clock cycle and the multiframe reference S2-X_TI_MFS shall be active once every 1 024 frames.

Defects: None.

Consequent Actions: None.

Defect Correlations: None.

Performance Monitoring: None.

8 Concatenated VC-12 path layer functions

8.1 Atomic functions overview

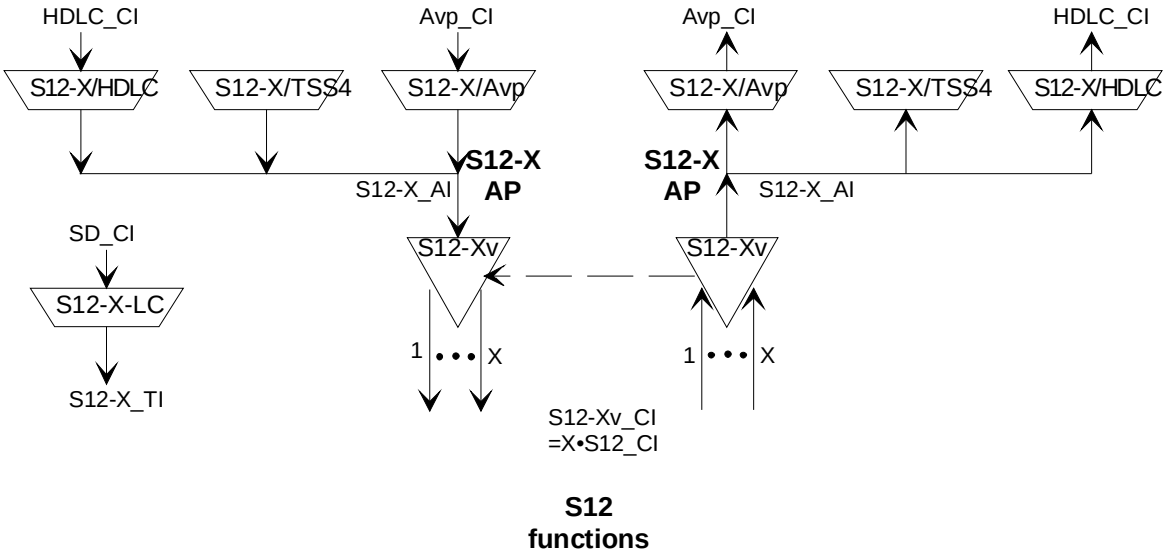


Figure 26: Concatenated VC-12 path layer atomic functions

Figure 26 shows the set of atomic functions for the concatenated VC-12 path layer. Figure 27 shows the additional functions for the concatenated VC-12 layer trail protection.

Figures 26 and 27 show that more than one adaptation function exists in the S12-X layer that can be connected to one S12-X access point. For such cases, a subset of these adaptation source functions is allowed to be activated together, but only one adaptation source function may have access to a specific timeslot. Access to the same timeslot by other adaptation source functions shall be denied. In contradiction with the source direction, adaptation sink functions may be activated all together. This may cause faults to be detected and reported. To prevent this an adaptation sink function can be deactivated.

NOTE: If one adaptation function only is connected to the AP, it will be activated. If one or more other functions are connected to the same AP accessing the same timeslot, one out of the set of functions will be active.

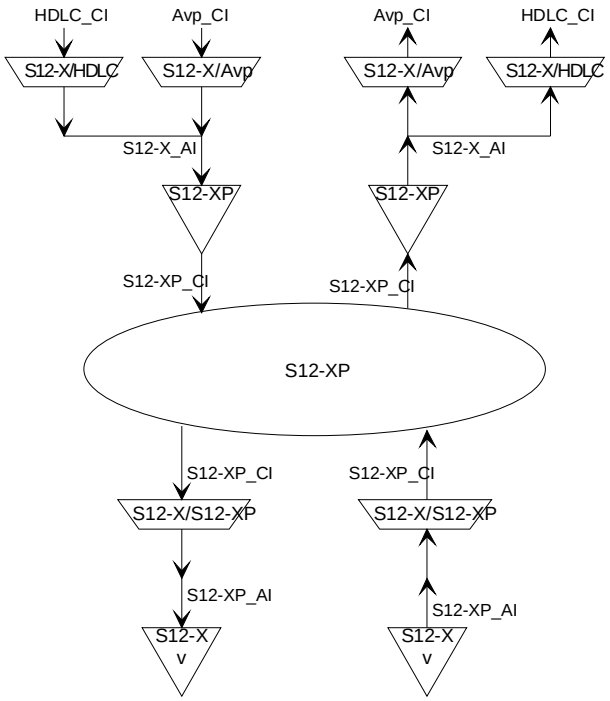


Figure 27: Concatenated VC-12 Layer Trail Protection atomic functions

8.2 Layer information

8.2.1 VC-12-X layer access point

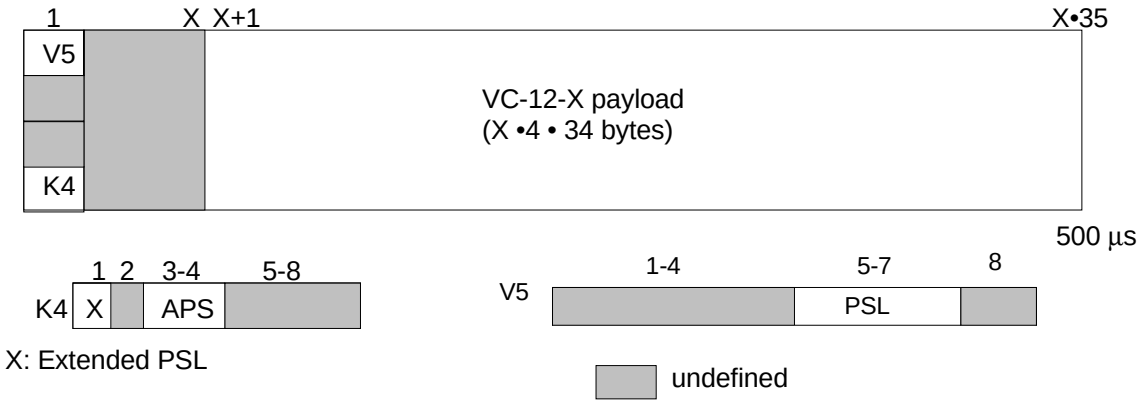


Figure 28: S12-X_AI_D

The VC-12-X AI (S12-X_AI_D) at this point is octet structured with an 500 µs frame. It represents adapted client layer information comprising X • 424 bytes of client layer information, the signal label in bits 5-7 of the V5 byte as defined in ETS 300 147 [5]. For the case the signal has passed the trail protection sublayer, S12_AI has defined APS bits (3 to 4) in byte K4.

NOTE 1: The APS signal has not been defined; a multiframed APS signal might be required.

NOTE 2: Bits 3 to 4 of byte K4 will be undefined when the signal S12-X_AI has not been processed in a trail protection connection function S12-XP_C.

A VC-12-X comprises one of the following payloads:

- an ATM X • 2 176 kbit/s cell stream signal;
- an PPP X • 2 176 kbit/s cell stream signal;
- a Test Signal Structure (TSS4).

8.2.2 VC-12-X layer connection point

A VC-12 concatenated trail is transported via virtual concatenated VC-12 (VC-12-Xv) connections.

For a virtual concatenated VC-12-Xv connection all values for X ≥ 1 are allowed.

8.2.3 VC-12-Xv layer connection point

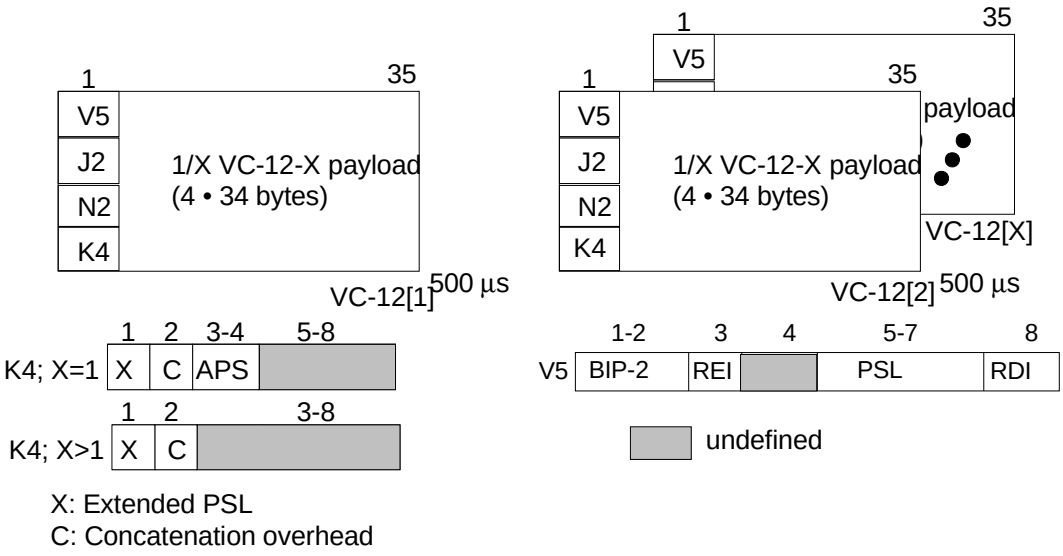


Figure 29: S12-Xv_CI_D

The CI of a VC-12-Xv (S12-Xv_CI_D) consists of X times S12_CI as defined in ETS 300 417-1-1 [1]. The H4 byte is generated as defined in ETS 300 147 [5].

The mapping of S12-X_AI to S12-Xv_CI is performed as shown in figure 30.

NOTE: K4, bits 3-4 (APS) of VC-12[2...X] are undefined.

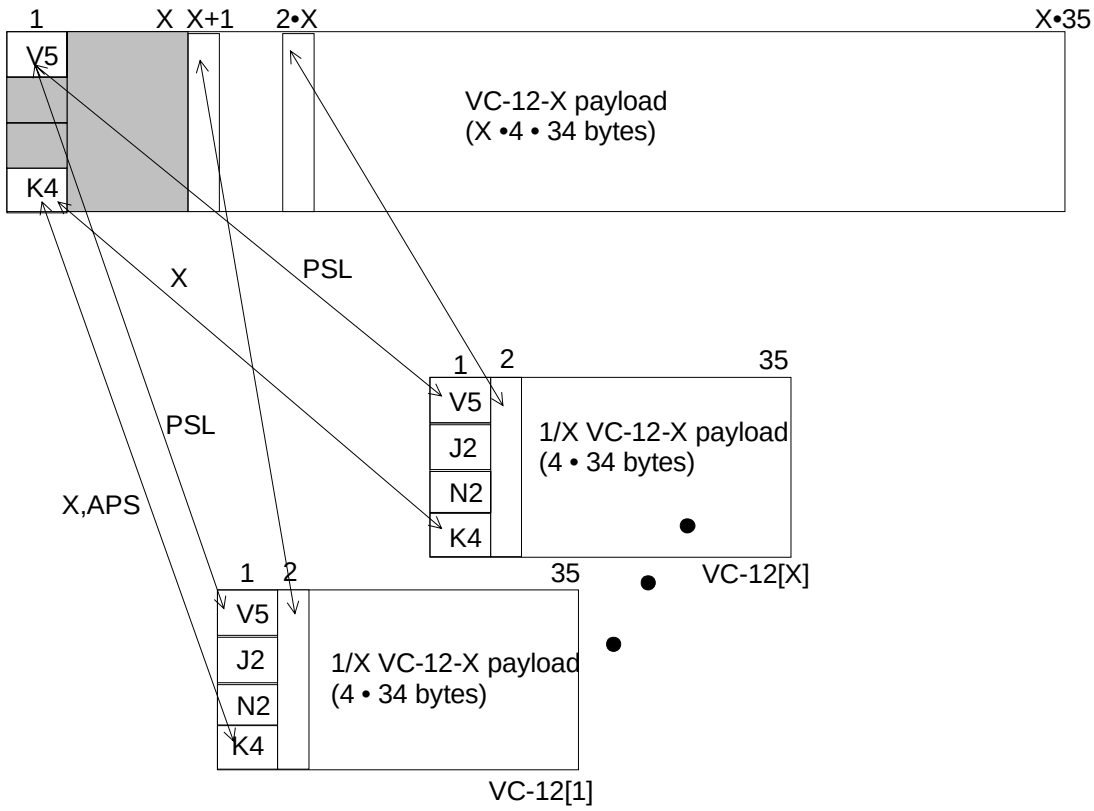


Figure 30: S12-X_AI_D to S12-Xv_CI_D mapping

8.2.4 VC-12-XP layer access point

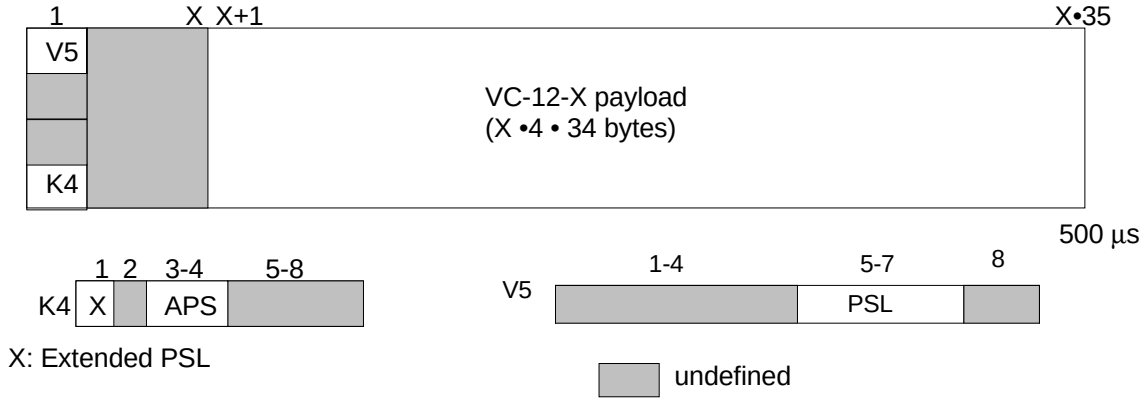


Figure 31: S12-XP_AI_D

The S12-XP AI is identical to the S12-X AI with defined APS information if the protection scheme uses it.

8.2.5 VC-12XP layer connection point

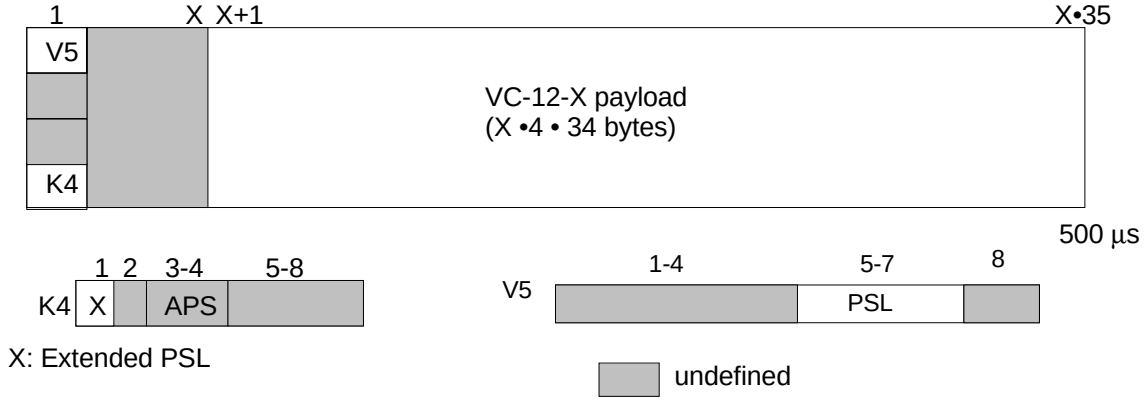


Figure 32: S12-XP_CI_D

The S12-XP CI is identical to the S12-X AI, with undefined APS information.

8.3 VC-12-Xv Layer Trail Termination Functions S12-Xc_TT

Refer to ITU-T Recommendation G.783 [4], clause 13.5.1.1 "VC-m-Xv Layer Trail Termination Function Sm-Xv_TT" with m = 12.

8.3.1 VC-12-Xv/VC-12-X Adaptation Source Function S12-Xv/S12-X_A_So

Refer to ITU-T Recommendation G.783 [4], clause 13.5.1.1.1 "VC-m-Xv/VC-m-X Adaptation Source Function Sm-Xv/Sm-X_A_So" with m = 12.

8.3.2 VC-12-Xv/VC-12-X Adaptation Sink Function S12-Xv/S12-X_A_Sk

Refer to ITU-T Recommendation G.783 [4], clause 13.5.1.1.2 "VC-m-Xv/VC-m-X Adaptation Sink Function Sm-Xv/Sm-X_A_Sk" with m = 12.

8.3.3 VC-12-Xv Layer Trail Termination Source Function S12-Xv_TT_So

Refer to ITU-T Recommendation G.783 [4], clause 13.5.1.1.3 "VC-m-Xv/VC-m-X Adaptation Source Function Sm-Xv/Sm-X_A_So" with m = 12.

8.3.4 VC-12-Xv Layer Trail Termination Sink Function S12-Xv_TT_Sk

Refer to ITU-T Recommendation G.783 [4], clause 13.5.1.1.4 "VC-m-Xv/VC-m-X Adaptation Sink Function Sm-Xv/Sm-X_A_Sk" with m = 12.

8.4 VC-12-x Layer Adaptation Functions

8.4.1 VC-12-X to HDLC Adaptation Source Function S12-X/HDLC_A_So

For further study.

8.4.2 VC-12-X to HDLC Adaptation Sink Function S12-X/HDLC_A_Sk

For further study.

8.4.3 VC-12-X to Avp Adaptation Source Function S12-X/Avp_A_So

For further study.

8.4.4 VC-12-X to Avp Adaptation Sink Function S12-X/Avp_A_Sk

For further study.

8.4.5 VC-12-X to TSS4 Adaptation Source Function S12-X/TSS4_A_So

Refer to ETS 300 417-4-1 [3], clause 7.3.7 "VC-12 Layer to TSS4 Adaptation Source S12/TSS4_A_So" with:

- S12 => S12-Xc;
- VC-12 => VC-12-Xc.

8.4.6 VC-12-X to TSS4 Adaptation Sink Function S12-X/TSS4_A_Sk

Refer to ETS 300 417-4-1 [3], clause 7.3.8 "VC-12 Layer to TSS4 Adaptation Sink S3/TSS4_A_Sk" with:

- S12 => S12-Xc;
- VC-12 => VC-12-Xc.

8.5 VC-12-X Layer Trail Protection Functions

8.5.1 VC-12-X Trail Protection Connection Functions S12-XP_C

8.5.1.1 VC-12-X Layer 1+1 uni-directional Protection Connection Function S12-XP1+1u_C

Refer to ETS 300 417-4-1 [3], clause 7.5.1.1 "VC-12 Layer 1+1 uni-directional Protection Connection Function S12P1+1u_C" with:

- S12 => S12-Xc;
- VC-12 => VC-12-Xc.

8.5.1.2 VC-12-X Layer 1+1 bi-directional Protection Connection Function S12-XP1+1b_C

Refer to ETS 300 417-4-1 [3], clause 7.5.1.2 "VC-12 Layer 1+1 bi-directional Protection Connection Function S12P1+1b_C" with:

- S12 => S12-Xc;
- VC-12 => VC-12-Xc.

8.5.2 VC-12 Layer Trail Protection Trail Termination Functions

8.5.2.1 VC-12-X Protection Trail Termination Source S12-XP_TT_So

Refer to ETS 300 417-4-1 [3], clause 7.5.2.1 "VC-12 Protection Trail Termination Source S12P_TT_So" with:

- S12 => S12-Xc;
- VC-12 => VC-12-Xc.

8.5.2.2 VC-12-X Protection Trail Termination Sink S12-XP_TT_Sk

Refer to ETS 300 417-4-1 [3], clause 7.5.2.2 "VC-12 Protection Trail Termination Sink S12P_TT_Sk" with:

- S12 => S12-Xc;
- VC-12 => VC-12-Xc.

8.5.3 VC-12 Layer Linear Trail Protection Adaptation Functions

8.5.3.1 VC-12-X trail to VC-12-X trail Protection Layer Adaptation Source S12-X/S12-XP_A_So

Refer to ETS 300 417-4-1 [3], clause 7.5.3.1 "VC-12 trail to VC-12 trail Protection Layer Adaptation Source S12/S12P_A_So" with:

- S12 => S12-Xc;
- VC-12 => VC-12-Xc.

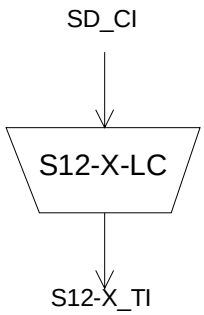
8.5.3.2 VC-12-X trail to VC-12-X trail Protection Layer Adaptation Sink S12-X/S12-XP_A_Sk

Refer to ETS 300 417-4-1 [3], clause 7.5.3.2 "VC-12 trail to VC-12 trail Protection Layer Adaptation Sink S12/S12P_A_Sk" with:

- S12 => S12-Xc;
- VC-12 => VC-12-Xc.

8.6 VC-12-X layer clock adaptation source (S12-X-LC_A_So)

Symbol and interfaces:



Input(s)	Output(s)
SD_CI_CK	S12-X_TI_CK S12-X_TI_FS S12-X_TI_MFS

Figure 33: S12-X-LC_A_So symbol and in/output signals

Processes:

This function performs the VC-12-X clock and frame start signal generation locked to the network element clock signal SD_CI_CK, to time the adaptation source and connection functions in this layer.

Clock generation: The function shall generate the clock (bit) reference signal S12-X_TI_CK for the VC-12-X signal. The S12-X_TI_CK frequency shall be X • 2 240 kHz locked to the input signal SD_CI_CK.

Jitter limiter: For Further study.

Frame Start signal generation: The function shall generate the frame start reference signal S12-X_TI_FS for the VC-12-X signal. The S12-X_TI_FS signal shall be active once per X • 1 120 clock cycle and the multiframe reference S12-X_TI_MFS shall be active once every 1 024 frames.

Defects: None.

Consequent Actions: None.

Defect Correlations: None.

Performance Monitoring: None.

Annex A (informative): Concatenated VC-11 path layer functions

A.1 Atomic functions overview

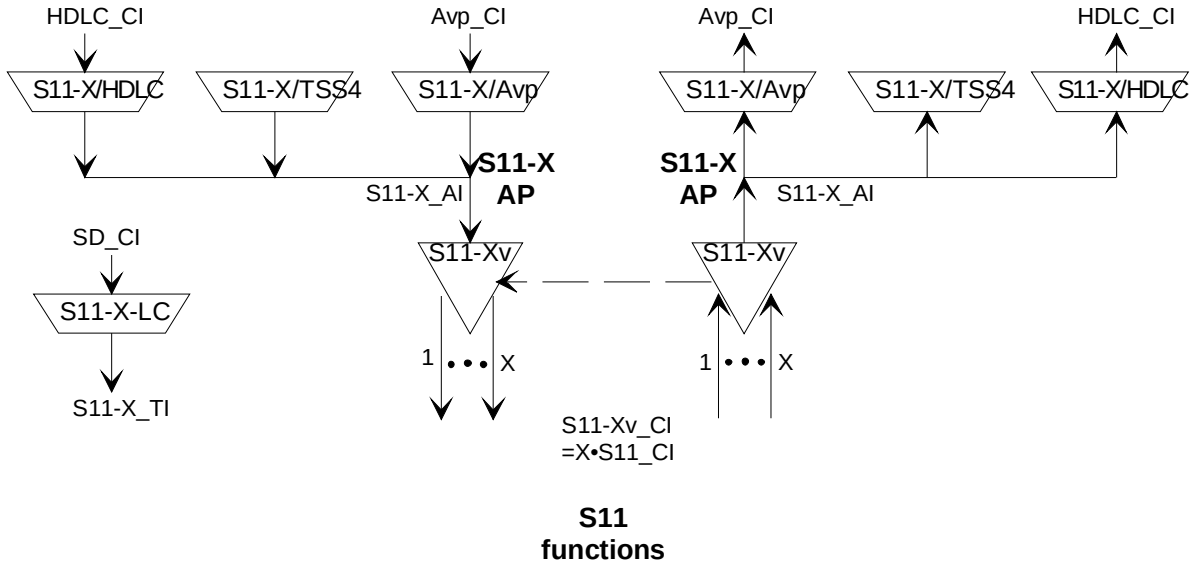


Figure A.1: Concatenated VC-11 path layer atomic functions

Figure A.1 shows the set of atomic functions for the concatenated VC-11 path layer. Figure A.2 shows the additional functions for the concatenated VC-11 layer trail protection.

Figures A.1 and A.2 show that more than one adaptation function exists in the S11-X layer that can be connected to one S11-X access point. For such cases, a subset of these adaptation source functions is allowed to be activated together, but only one adaptation source function may have access to a specific timeslot. Access to the same timeslot by other adaptation source functions shall be denied. In contradiction with the source direction, adaptation sink functions may be activated all together. This may cause faults to be detected and reported. To prevent this an adaptation sink function can be deactivated.

NOTE: If one adaptation function only is connected to the AP, it will be activated. If one or more other functions are connected to the same AP accessing the same timeslot, one out of the set of functions will be active.

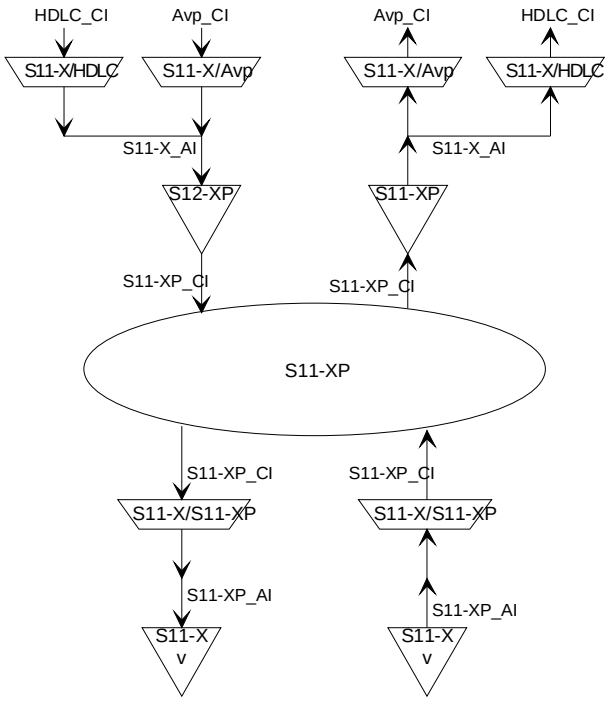


Figure A.2: Concatenated VC-11 Layer Trail Protection atomic functions

A.2 Layer information

A.2.1 VC-11-X layer access point

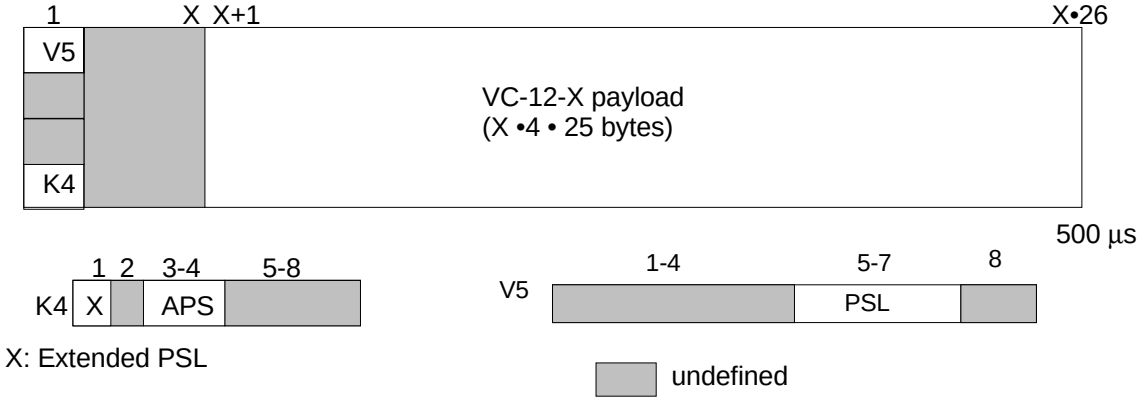


Figure A.3: S11-X_AI_D

The VC-11-X AI (S11-X_AI_D) at this point is octet structured with an 500 µs frame. It represents adapted client layer information comprising X • 424 bytes of client layer information, the signal label in bits 5-7 of the V5 byte as defined in ETS 300 147 [5]. For the case the signal has passed the trail protection sublayer, S11_AI has defined APS bits (3 to 4) in byte K4.

NOTE 1: The APS signal has not been defined; a multiframed APS signal might be required.

NOTE 2: Bits 3 to 4 of byte K4 will be undefined when the signal S11-X_AI has not been processed in a trail protection connection function S11-XP_C.

A VC-11-X comprises one of the following payloads:

- an ATM X • 1 600 kbit/s cell stream signal;
- an PPP X • 1 600 kbit/s cell stream signal;
- a Test Signal Structure (TSS4).

A.2.2 VC-11-X layer connection point

A VC-11 concatenated trail is transported via virtual concatenated VC-11 (VC-11-Xv) connections.

For a virtual concatenated VC-11-Xv connection all values for X ≥ 1 are allowed.

A.2.3 VC-11-Xv layer connection point

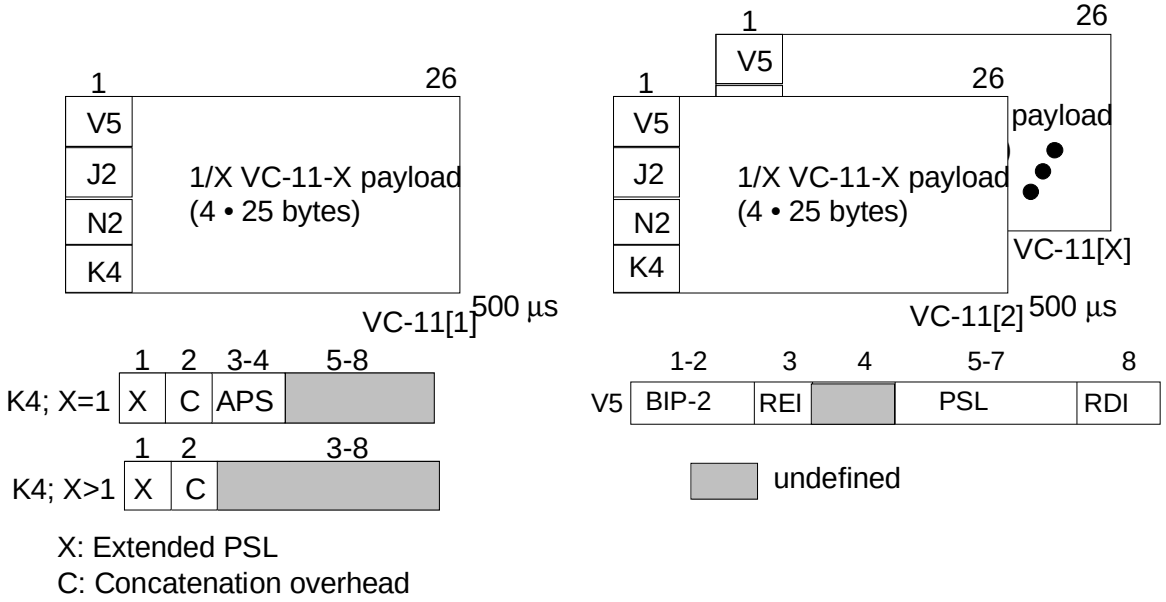


Figure A.4: S11-Xv_CI_D

The CI of a VC-11-Xv (S11-Xv_CI_D) consists of X times S11_CI as defined in ETS 300 417-1-1 [1]. The H4 byte is generated as defined in ETS 300 147 [5].

The mapping of S11-X_AI to S11-Xv_CI is performed as shown in figure A.5.

NOTE: K4, bits 3-4 (APS) of VC-11[2...X] are undefined.

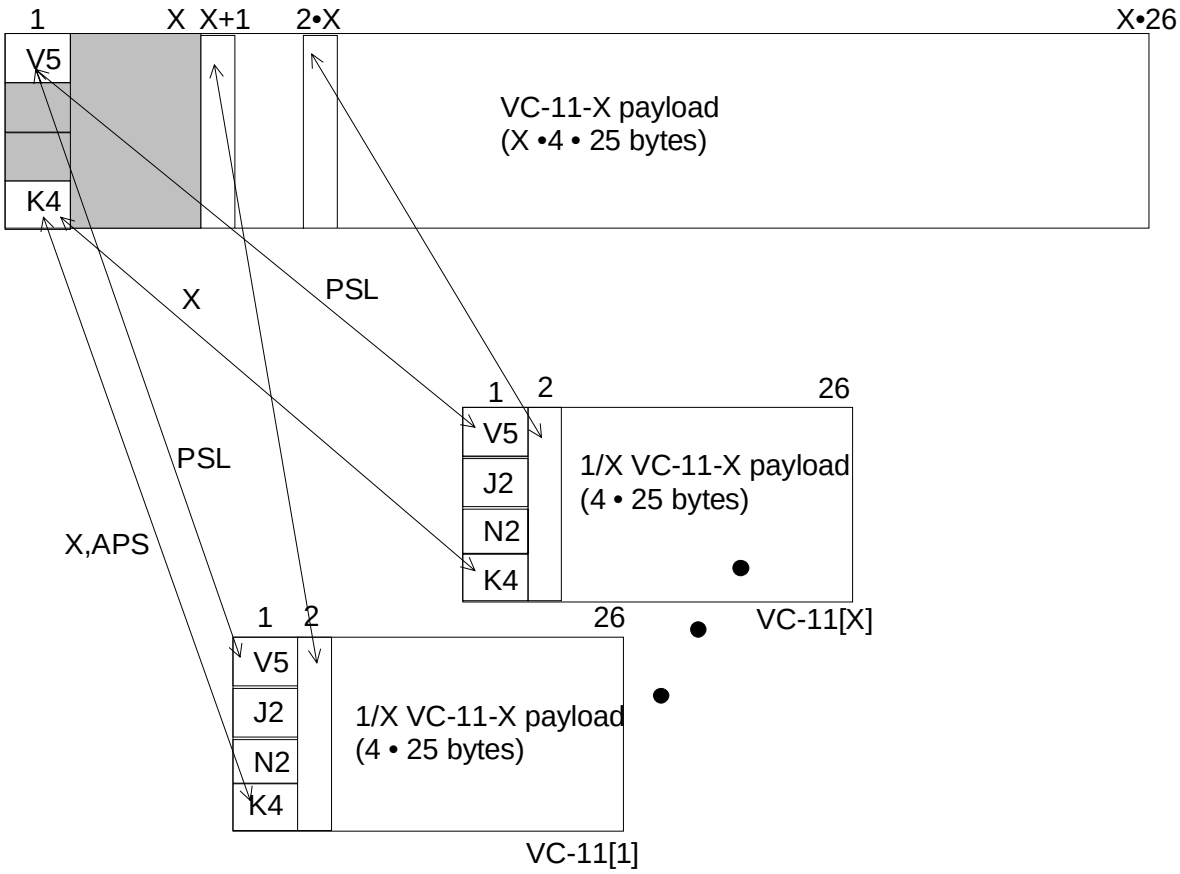


Figure A.5: S11-X_AI_D to S11-Xv_CI_D mapping

A.2.4 VC-11-XP layer access point

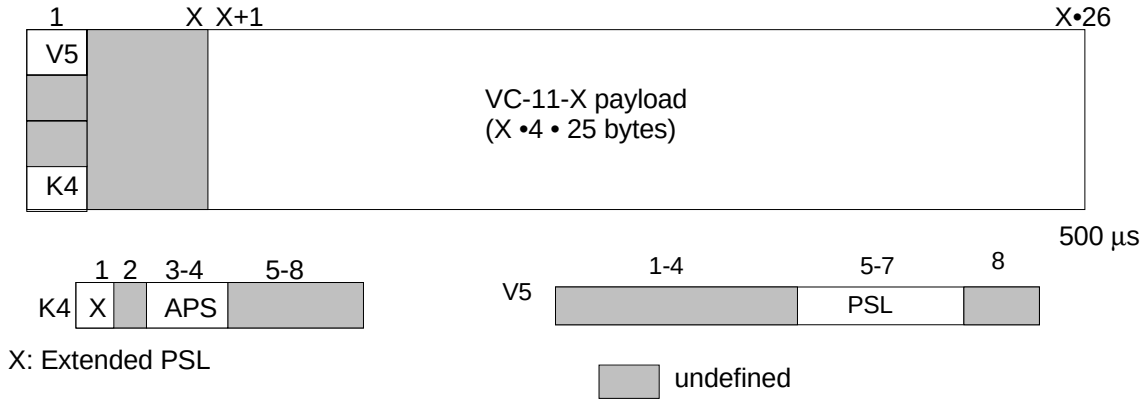


Figure A.6: S11-XP_AI_D

The S11-XP AI is identical to the S11-X AI with defined APS information if the protection scheme uses it.

A.2.5 VC-11XP layer connection point

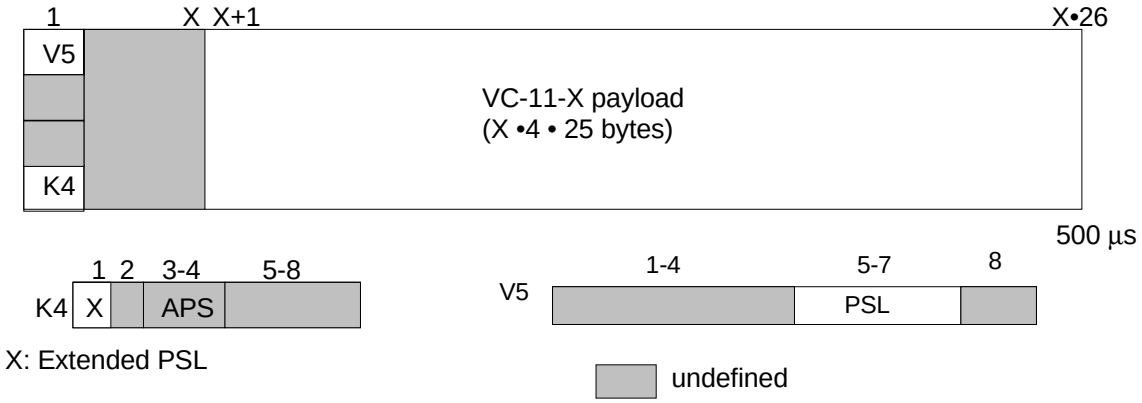


Figure A.7: S11-XP_CI_D

The S11-XP CI is identical to the S11-X AI, with undefined APS information.

A.3 VC-11-Xv Layer Trail Termination Functions S11-Xc_TT

Refer to ITU-T Recommendation G.783 [4], clause 13.5.1.1 "VC-m-Xv Layer Trail Termination Function Sm-Xv_TT" with m = 11.

A.3.1 VC-11-Xv/VC-11-X Adaptation Source Function S11-Xv/S11-X_A_So

Refer to ITU-T Recommendation G.783 [4], clause 13.5.1.1.1 "VC-m-Xv/VC-m-X Adaptation Source Function Sm-Xv/Sm-X_A_So" with m = 11.

A.3.2 VC-11-Xv/VC-11-X Adaptation Sink Function S11-Xv/S11-X_A_Sk

Refer to ITU-T Recommendation G.783 [4], clause 13.5.1.1.2 "VC-m-Xv/VC-m-X Adaptation Sink Function Sm-Xv/Sm-X_A_Sk" with m = 11.

A.3.3 VC-11-Xv Layer Trail Termination Source Function S11-Xv_TT_So

Refer to ITU-T Recommendation G.783 [4], clause 13.5.1.1.3 "VC-m-Xv/VC-m-X Adaptation Source Function Sm-Xv/Sm-X_A_So" with m = 11.

A.3.4 VC-11-Xv Layer Trail Termination Sink Function S11-Xv_TT_Sk

Refer to ITU-T Recommendation G.783 [4], clause 13.5.1.1.4 "VC-m-Xv/VC-m-X Adaptation Sink Function Sm-Xv/Sm-X_A_Sk" with m = 11.

A.4 VC-11-x Layer Adaptation Functions

A.4.1 VC-11-X to HDLC Adaptation Source Function S11-X/HDLC_A_So

For further study.

A.4.2 VC-11-X to HDLC Adaptation Sink Function S11-X/HDLC_A_Sk

For further study.

A.4.3 VC-11-X to Avp Adaptation Source Function S11-X/Avp_A_So

For further study.

A.4.4 VC-11-X to Avp Adaptation Sink Function S11-X/Avp_A_Sk

For further study.

A.4.5 VC-11-X to TSS4 Adaptation Source Function S11-X/TSS4_A_So

Refer to ETS 300 417-4-1 [3], clause F.3.3 "VC-11 Layer to TSS4 Adaptation Source S11/TSS4_A_So" with:

- S11 => S11-Xc;
- VC-11 => VC-11-Xc.

A.4.6 VC-11-X to TSS4 Adaptation Sink Function S11-X/TSS4_A_Sk

Refer to ETS 300 417-4-1 [3], clause F.3.4 "VC-11 Layer to TSS4 Adaptation Sink S3/TSS4_A_Sk" with:

- S11 => S11-Xc;
- VC-11 => VC-11-Xc.

A.5 VC-11-X Layer Trail Protection Functions

A.5.1 VC-11-X Trail Protection Connection Functions S11-XP_C

A.5.1.1 VC-11-X Layer 1+1 uni-directional Protection Connection Function S11-XP1+1u_C

Refer to ETS 300 417-4-1 [3], clause F.5.1.1 "VC-11 Layer 1+1 uni-directional Protection Connection Function S11P1+1u_C" with:

- S11 => S11-Xc;
- VC-11 => VC-11-Xc.

A.5.1.2 VC-11-X Layer 1+1 bi-directional Protection Connection Function S11-XP1+1b_C

Refer to ETS 300 417-4-1 [3], clause F.5.1.2 "VC-11 Layer 1+1 bi-directional Protection Connection Function S11P1+1b_C" with:

- S11 => S11-Xc;
- VC-11 => VC-11-Xc.

A.5.2 VC-11 Layer Trail Protection Trail Termination Functions

A.5.2.1 VC-11-X Protection Trail Termination Source S11-XP_TT_So

Refer to ETS 300 417-4-1 [3], clause F.5.2.1 "VC-11 Protection Trail Termination Source S11P_TT_So" with:

- S11 => S11-Xc;
- VC-11 => VC-11-Xc.

A.5.2.2 VC-11-X Protection Trail Termination Sink S11-XP_TT_Sk

Refer to ETS 300 417-4-1 [3], clause F.5.2.2 "VC-11 Protection Trail Termination Sink S11P_TT_Sk" with:

- S11 => S11-Xc;
- VC-11 => VC-11-Xc.

A.5.3 VC-11 Layer Linear Trail Protection Adaptation Functions

A.5.3.1 VC-11-X trail to VC-11-X trail Protection Layer Adaptation Source S11-X/S11-XP_A_So

Refer to ETS 300 417-4-1 [3], clause F.5.3.1 "VC-11 trail to VC-11 trail Protection Layer Adaptation Source S11/S11P_A_So" with:

- S11 => S11-Xc;
- VC-11 => VC-11-Xc.

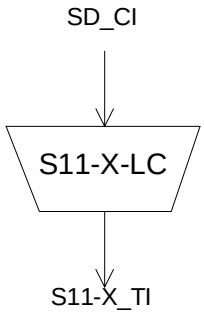
A.5.3.2 VC-11-X trail to VC-11-X trail Protection Layer Adaptation Sink S11-X/S11-XP_A_Sk

Refer to ETS 300 417-4-1 [3], clause F.5.3.2 "VC-11 trail to VC-11 trail Protection Layer Adaptation Sink S11/S11P_A_Sk" with:

- S11 => S11-Xc;
- VC-11 => VC-11-Xc.

A.6 VC-11-X layer clock adaptation source (S11-X-LC_A_So)

Symbol and interfaces:



Input(s)	Output(s)
SD_CI_CK	S11-X_TI_CK S11-X_TI_FS S11-X_TI_MFS

Figure A.8: S11-X-LC_A_So symbol and in/output signals

Processes:

This function performs the VC-11-X clock and frame start signal generation locked to the network element clock signal SD_CI_CK, to time the adaptation source and connection functions in this layer.

Clock generation: The function shall generate the clock (bit) reference signal S11-X_TI_CK for the VC-11-X signal. The S11-X_TI_CK frequency shall be X • 1 664 kHz locked to the input signal SD_CI_CK.

Jitter limiter: For Further study.

Frame Start signal generation: The function shall generate the frame start reference signal S11-X_TI_FS for the VC-11-X signal. The S11-X_TI_FS signal shall be active once per X • 832 clock cycle and the multiframe reference S11-X_TI_MFS shall be active once every 1 024 frames.

Defects: None.

Consequent Actions: None.

Defect Correlations: None.

Performance Monitoring: None.

History

Document history			
V1.1.1	May 2001	One-step Approval Procedure	OAP 20010921: 2001-05-23 to 2001-09-21