

**Draft Recommendation for
Space Data System Standards**

**AOS SPACE DATA
LINK PROTOCOL**

DRAFT RECOMMENDED STANDARD

CCSDS 732.0-P-4.2

PINK SHEETS
September 2024

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DOCUMENT CONTROL

Document	Title	Date	Status
CCSDS 732.0-B-1	AOS Space Data Link Protocol, Issue 1	September 2003	Original issue, superseded
CCSDS 732.0-B-2	AOS Space Data Link Protocol, Recommended Standard, Issue 2	July 2006	Issue 2, superseded
CCSDS 732.0-B-3	AOS Space Data Link Protocol, Recommended Standard, Issue 3	September 2015	Issue 3, superseded
CCSDS 732.0-B-4	AOS Space Data Link Protocol, Recommended Standard, Issue 4	October 2021	Current issue
CCSDS 732.0-P-4.1	AOS Space Data Link Protocol, Draft Recommended Standard, Issue 4.1	October 2023	Prior draft update: <ul style="list-style-type: none"> – adds clarifying text to Frame Header Error Control specification; – modifies Multiplexing Protocol Data Unit header to increase the size of the First Header Pointer.
CCSDS 732.0-P-4.2	AOS Space Data Link Protocol, Issue 4.2	September 2024	Current draft update: <ul style="list-style-type: none"> – replaces Reserved Spare field with Spacecraft ID Extension field in the Transfer Frame Primary Header, enabling expansion of the 8-bit Spacecraft ID to 10 bits.

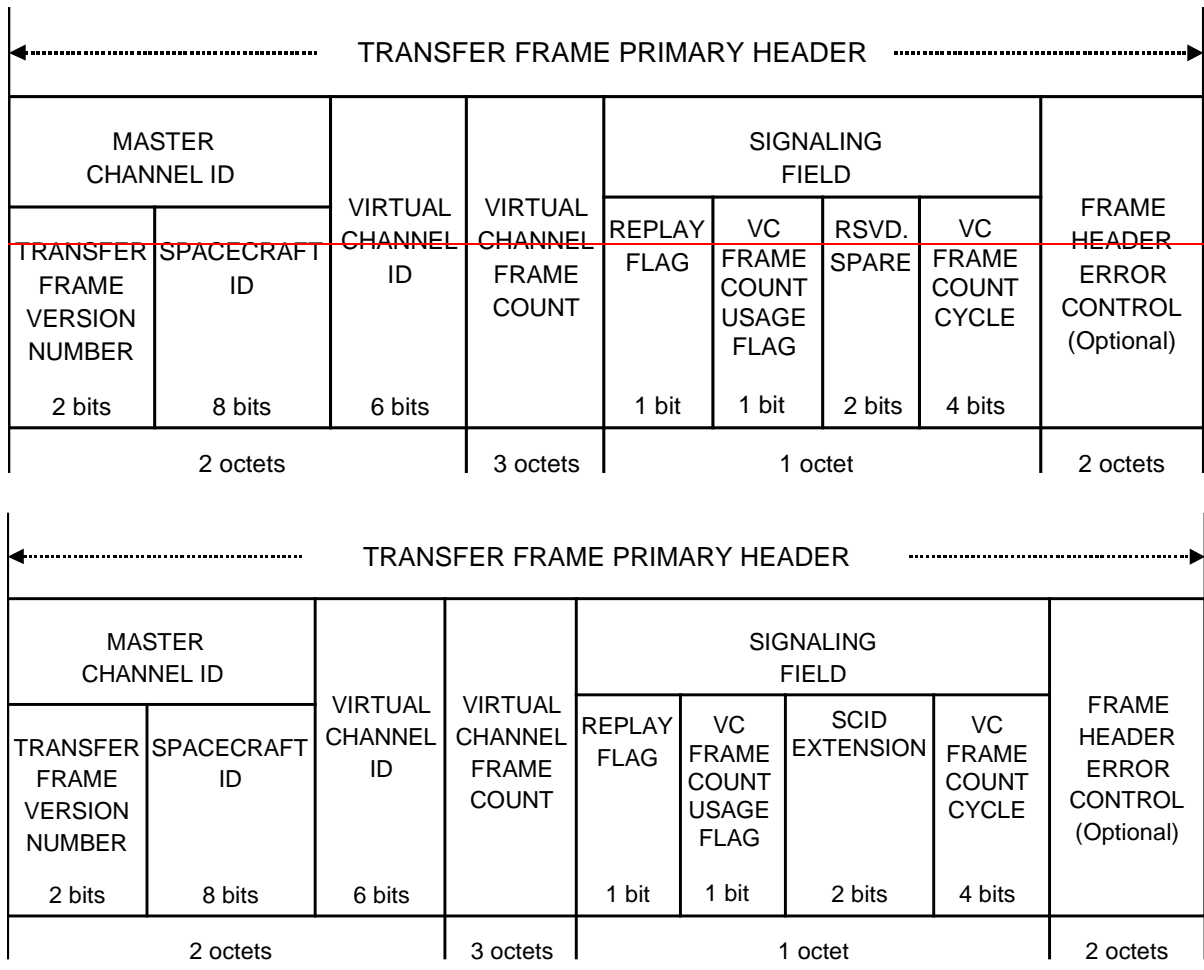


Figure 4-2: Transfer Frame Primary Header

4.1.2.2 Master Channel Identifier

4.1.2.2.1 General

4.1.2.2.1.1 Bits 0–9 of the Transfer Frame Primary Header shall contain the Master Channel Identifier (MCID).

4.1.2.2.1.2 The Master Channel Identifier shall consist of:

- a) Transfer Frame Version Number (2 bits, mandatory);
- b) Spacecraft Identifier (8 bits, mandatory).

4.1.2.2.2 Transfer Frame Version Number

4.1.2.2.2.1 Bits 0–1 of the Transfer Frame Primary Header shall contain the (Binary Encoded) Transfer Frame Version Number.

4.1.2.2.2.2 This 2-bit field shall identify the data unit as a Transfer Frame defined by this Recommended Standard; it shall be set to ‘01’.

NOTE – This Recommended Standard defines the AOS Version 2 Transfer Frame, whose binary encoded Version Number is ‘01’.

4.1.2.2.3 Spacecraft Identifier

~~Bits 2–9 of the Transfer Frame Primary Header shall contain the Spacecraft Identifier (SCID).~~

4.1.2.2.3.1 The length of the Spacecraft Identifier (SCID) depends upon the value of the 2-bit SCID Extension field (defined in 4.1.2.5.4). The SCID can be either 8 or 10 bits in length.

4.1.2.2.3.2 If the SCID Extension field is set to ‘00’ then bits 2-9 of the Transfer Frame Primary Header contain the Spacecraft Identifier, defining the 8-bit SCID.

4.1.2.2.3.3 If the SCID Extension field is not set to ‘00’ then these two bits are to be interpreted as two additional high-order bits added at the beginning (i.e., the most left justified when drawing a figure) of the 8-bit SCID, defining the 10-bit SCID.

NOTE – The Space Assigned Numbers Authority (SANA) assigns Spacecraft Identifiers according to the procedures in reference [7].

4.1.2.3 Virtual Channel Identifier

4.1.2.3.1 Bits 10–15 of the Transfer Frame Primary Header shall contain the Virtual Channel Identifier (VCID).

4.1.2.3.2 The Virtual Channel Identifier shall be used to identify the Virtual Channel.

NOTES

- 1 If only one Virtual Channel is used, these bits are set permanently to value ‘all zeros’. A Virtual Channel used for transmission of Only Idle Data (OID) Transfer Frames (i.e., frames whose Data Fields contain only idle data—see 4.1.4) is indicated by setting these bits to the reserved value of ‘all ones’.
- 2 There are no restrictions on the selection of Virtual Channel Identifiers except the rules described above. In particular, Virtual Channels are not required to be numbered consecutively.
- 3 A Transfer Frame on the ‘Idle’ Virtual Channel may not contain any valid user data within its Transfer Frame Data Field, but it must contain the Insert Zone if the Insert Service is supported.

4.1.2.4 Virtual Channel Frame Count

4.1.2.4.1 Bits 16–39 of the Transfer Frame Primary Header shall contain the Virtual Channel Frame Count.

4.1.2.4.2 This 24-bit field shall contain a sequential binary count (modulo-16,777,216) of each Transfer Frame transmitted within a specific Virtual Channel.

4.1.2.4.3 A resetting of the Virtual Channel Frame Count before reaching 16,777,215 shall not take place unless it is unavoidable.

NOTE – The purpose of this field is to provide individual accountability for each Virtual Channel, primarily to enable systematic Packet extraction from the Transfer Frame Data Field. If the Virtual Channel Frame Count is reset because of an unavoidable re-initialization, the completeness of a sequence of Transfer Frames in the related Virtual Channel cannot be determined.

4.1.2.5 Signaling Field

4.1.2.5.1 General

4.1.2.5.1.1 Bits 40–47 of the Transfer Frame Primary Header shall contain the Signaling Field.

4.1.2.5.1.2 The Signaling Field shall be used to alert the receiver of the Transfer Frames with respect to functions that: (a) may change more rapidly than can be handled by management, or; (b) provide a significant cross-check against manual or automated setups for fault detection and isolation purposes.

4.1.2.5.1.3 This 8-bit field shall be subdivided into four sub-fields as follows:

- a) Replay Flag (1 bit, mandatory);
- b) Virtual Channel (VC) Frame Count Cycle Use Flag (1 bit, mandatory);
- c) ~~Reserved Spares~~ SCID Extension (2 bits, mandatory);
- d) Virtual Channel Frame Count Cycle (4 bits, mandatory).

4.1.2.5.2 Replay Flag

4.1.2.5.2.1 Bit 40 of the Transfer Frame Primary Header shall contain the Replay Flag.

4.1.2.5.2.2 Recognizing the need to store Transfer Frames during periods when the space link is unavailable, and to retrieve them for subsequent replay when the link is restored, this flag shall alert the receiver of the Transfer Frames with respect to its ‘realtime’ or ‘replay’

status. Its main purpose is to discriminate between realtime and replay Transfer Frames when they both may use the same Virtual Channel.

4.1.2.5.2.3 The Replay Flag is interpreted as follows:

- a) '0' = Realtime Transfer Frame;
- b) '1' = Replay Transfer Frame.

NOTES

- 1 Owing to the wide spectrum of onboard storage and retrieval technology options, the exact interpretation of this Flag is necessarily the subject of negotiation between projects and cross-support organizations. For instance, it may be interpreted to indicate that the value of the Virtual Channel Frame Count field on the replayed VC decreases, rather than increases, as a function of reverse playback.
- 2 If Transfer Frames are stored after encoding by the Channel Coding Sublayer, they must be re-encoded if the status of the Replay Flag is altered after retrieval.

4.1.2.5.3 Virtual Channel (VC) Frame Count Cycle Use Flag

4.1.2.5.3.1 Bit 41 of the Transfer Frame Primary Header shall contain the VC Frame Count Cycle Use Flag.

4.1.2.5.3.2 This one-bit field shall indicate whether the VC Frame Count Cycle field is used; its value shall be interpreted as follows:

- a) '0' = VC Frame Count Cycle field is not used and shall be ignored by the receiver;
- b) '1' = VC Frame Count Cycle field is used and shall be interpreted by the receiver.

4.1.2.5.4 ~~Reserved Spare~~ SCID Extension

4.1.2.5.4.1 Bits 42-43 of the Transfer Frame Primary Header shall contain the ~~reserved spare~~ SCID Extension.

NOTE – The SCID Extension provides a mechanism to extend the SCID from 8 bits to 10 bits, thereby increasing the number of spacecraft addressable by this protocol.

4.1.2.5.4.2 ~~This 2-bit field is reserved for future definition by CCSDS and shall be set to '00'. The interpretation of this field is defined in 4.1.2.2.3.~~