# E1 Relationship of Proximity-1 (Version-3) to USLP (Version-4) Transfer Frames (Normative Annex)

## Transfer Frame primary Header

The mapping between Version-3 transfer frame header fields to Version-4 transfer frame primary header fields is summarized in table E-1 below.

**Table E-1 Relationship of Transfer Frame Header fields between Version 3 and Version 4 Frames**

|  |  |  |  |
| --- | --- | --- | --- |
| **Version 3 Frame (Proximity-1)** | | **Version 4 Frame (USLP)** | |
| **Field Name** | **Location in Frame** | **Field Name** | **Location in Frame** |
| Transfer Frame Version Number | Bits 0-1 | Transfer Frame Version Number | Bits 0-3 |
| Quality of Service (QoS) Indicator | Bit 2 | Bypass Flag | Bit 48 |
| PDU Type ID | Bit 3 | Command Control Flag | Bit 49 |
| Data Field Construction ID (DFC ID) | Bits 4-5 | TFDZ Construction Rules in TFDF Header | See table E-2 |
| Spacecraft Identifier (SCID) | Bits 6-15 | Spacecraft Identifier (SCID) | Bits 4-19 |
| Physical Channel Identifier (PCID) | Bit 16 | Virtual Channel Identifier (VCID) | Use only Bit 21 |
| N/A | N/A | Virtual Channel Identifier (VCID) | Use Bits 22-26 |
| Port ID | Bits 17-19 | MAP ID | Use only Bits 28-30 |
| Source-or-Destination Identifier | Bit 20 | Source-or-Destination Identifier | Bit 20 |
| Frame Length | Bits 21-31 | Frame Length | Bits32-47 |
| Frame Sequence Number | Bits 32-39 | Virtual Channel Frame Count | Bits 56-63 |
| N/A | N/A | End of Frame Primary Header Flag | Bit 31 |
| N/A | N/A | OCF Flag | Bit 52 |
| N/A | N/A | VC Frame Count Length | Bit 53-55 |

### Transfer Frame Version Number (TFVN)

The Version-3 TFVN has been extended by two bits to allow for future versions. The USLP Transfer Frame uses the last remaining value available in the 2 bit Transfer Frame Version Number field i.e., ‘11’ and appends “00” to it to complete the 4 bit Version-4 TFVN (‘*1100*’).

### Quality of Service (QoS) Indicator

The Bypass Flag in bit 48 of the Version-4 Transfer Frame Primary Header is equivalent to the Quality of Service Indicator field in bit 2 of the Version-3 frame.

### PDU Type ID

The Command Control Flag in bit 49 of the Version-4 Transfer Frame Primary Header is equivalent to the PDU Type Indicator in bit 3 of the Version-3 frame.

### Data Field construction ID (DFC ID)

The Transfer Frame Data Zone (TFDZ) Construction Rules in bits 1-3 of the Version-4 Transfer Frame Data Field (TFDF) Header replaces the functionality of both the Data Field Construction ID in bits 4-5 of the Version-3 frame as well as the Segment Header Sequence Flags defined in the first two bits of the Proximity-1 Segment Header within the Version-3 Transfer Frame Data Field. See table E-2 below for how to relate the content of the Version-3 TFDF to the TFDZ of the Version-4 frame.

Table E‑2 : TFDZ Construction Rules

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Version-3 DFC ID** | **Version-3 DFC ID Interpretation** | **Version-3**  **Segment Header Sequence Flags** | **Version-4 TFDZ Construction Rule Equivalent** | **Version-4 TFDZ Construction Rule Interpretation** |
| ‘00’ | Packets (integer number of unsegmented packets) | N/A | ‘111’ | No Segmentation |
| ‘01’ | Segment Data (a complete or segmented packet) | ‘00’  ‘01’  ‘10’  ‘11’ | ‘100’  ‘101’  ‘110’  ‘111’ | Starting Segment  Continuing Segment  Last Segment  No Segmentation |
| ‘10’ | Reserved for future CCSDS definition | N/A | N/A | N/A |
| ‘11’ | User Defined Data | N/A | ‘011’ | Octet Stream |

### Spacecraft ID

The Spacecraft ID in bits 4-19 of the Version-4 Transfer Frame Primary Header replaces the Spacecraft ID in bits 6-15 of the Version-3 transfer frame.

NOTE - The Spacecraft ID field in the Version-4 frame is specified as a 16 bit field to accommodate the increase in SCID requests for future missions.

### Physical Channel ID

The most significant bit of the Virtual Channel ID field (bit 21) of the Version-4 Transfer Frame Primary Header is used for the Physical channel ID in the Version-3 frame header.

The VCID in the Version-4 Transfer frame is a 6 bit field but only the first bit of this field shall be utilized for the Physical Channel ID.

NOTE – The use of a separate VCID for Expedited Frames eliminates the need to have 2 separate Virtual Channel Frame Counters for the PCID.

### Port Identifier (Port id)

The MAP ID in bits 28-30 of the Version-4 Transfer Frame Primary Header replaces the Port ID in bits 17-19 of the Version-3 frame.

### SOURCE/DESTINATION ID

The source/destination ID in bit 20 of the Version-4 Transfer Frame Primary Header is equivalent to the Source/Destination ID in bit 20 of the Version-3 frame.

### FRAME LENGTH

The frame length field in the Version-4 Transfer Frame Primary Header is 16 bits in length and is located in bits 32 - 47. The frame length field in the Version-3 frame is 11 bits in length and located in bits 21-31. The Version-4 frame can support frame lengths up to 65536 octets.

### VIRTUAL CHANNEL FRAME COUNT LENGTH

For Proximity-1 operations, the value of the Virtual Channel Frame Count Length Field in the Version-4 Transfer Frame Primary Header shall be set to ‘001’ i.e., one octet.

### FRAME SEQUENCE Number

The Virtual Channel Frame Count in bits 56-63 of the Version-4 Transfer frame Primary Header replaces the frame sequence counter in bits 32-39 of the Version-3 frame.

### TRUNCATED TRANSFER FRAME PRIMARY HEADER

The Truncated primary header option is provided for short hardware commands. Since the frame is truncated and has no length field the frames length is controlled by a managed parameter and is set for the mission. The truncated frame is created and signaled by setting the End of Frame Primary Header Flag (bit 31) to a “1”. Because the transfer frame primary header is truncated and the length field is not present, the frame size is fixed based upon the value contained in the Truncated Transfer Frame Length managed parameter.

## INSERT ZONE

The insert Zone is specified for use with fixed length frames that are aligned with fixed length codeblocks. Thus the use of the Insert Zone in proximity operations is not allowed.

## Transfer frame data field (tfdf)

The TFDF Header for proximity operations utilizes a subset of the fields defined in USLP. Because Proximity-1 is defined to use variable length frames exclusively, the USLP Pointer Field shall not be present in the TFDF Header. Thus the TFDF Header reduces to a header composed of 2 fields immediately followed by the Transfer Frame Data Zone (TFDZ).



Figure E-2: Transfer Frame Data Field Header for proximity operations

(note to Tom Gannett: Indicate in Figure E-2 that Pointer Field is N/A)

### TFDF header

For proximity operations, the TFDF Header utilizes the first two fields of the TFDF defined in USLP:

1. The TFDZ Construction Rules is a three bit field;
2. The USLP Protocol ID field (UPID) is a five bit field;

#### TFDZ Construction Rules

The TFDZ Construction Rules for proximity operations utilizes a subset of the 8 rules defined in USLP. Three of these rules are defined exclusively for fixed length frames and thus are not applicable for Proximity-1 operations. Segmentation for Proximity operations is accomplished by using the TFDZ Construction Rules. Therefore the Segment Header as defined in Proximity-1 as the first octet of the Transfer Frame Data field is not used. The TFDZ Construction Rules that apply to Proximity-1 operations are described in table E-2 above.

#### USLP Protocol ID (UPID)

The USLP Protocol Identifier applicable to Proximity-1 operations shall be interpreted as follows:[[1]](#footnote-1)

1. The value ‘00000’ in the UPID field signals that Space Packets or Encapsulation packets are contained within the TFDZ.
2. The value ‘00010’ in the UPID field signals that COP-P directives are contained within the TFDZ.
3. The value ‘00011’ in the UPID field signals that SDLS directives are contained with the TFDZ.
4. The value ‘00100’ in the UPID field signals that user-defined stream data are contained within the TFDZ.
5. The value ‘00101’ in the UPID field signals that mission specific information-1 is contained within the TFDZ.
6. The value ‘00110’ in the UPID field signals that mission specific information-2 is contained within the TFDZ.
7. The value ‘11111’ in the Protocol ID field signals that the entire TFDZ contains idle data (a project-specified ‘idle’ pattern).

NOTE: There is no UPID value for a PLCW.

## SECURITY HEADER AND TRAILER

SDLS is applicable for use over the Proximity-1 Space Data Link Protocol when the Version-4 transfer frame is used.

The presence of the Security Header and Security Trailer is controlled by the USLP Virtual Channel managed parameters with SDLS. It is anticipated that these managed parameters will be fixed for a mission. Because USLP defines the Virtual Channel ID field, and because the most significant bit of the VCID field for Proximity-1 operations is defined as the Physical Channel ID equivalent (See 1.2.6), there are only 32 VCIDs defined for Proximity-1 operations over USLP.

NOTE - The VCID associated with a specific spacecraft can be set for the mission and different spacecraft could be assigned different VCIDs so that they could utilize independent Security Associations as defined in SDLS.

## OCF

The OCF Flag in bit 52 of the Version-4 Transfer Frame Primary Header signals the presence or absence of the OCF field in the frame. The use of the OCF is optional. The OCF can be used to transfer either a PLCW or a SDLS Frame Security Report (FSR).

For Proximity-1 operations using the Version-4 frame there are two distinct methods for transferring a PLCW or FSR either 1) as a Protocol Control Command i.e., in Proximity-1 terms, as a SPDU sent in a separate P-frame or 2) as user data within the OCF.

NOTE - The PLCW or FSR can be sent in the OCF field of a transfer frame that does not contain a TFDF.

## FECF

The 4 octet FECF is mandatory for Proximity-1 operations. The USLP frame defines the FECF in the frame and thus the frame length includes these 4 octets.

1. When this Recommended Standard is finalized, the USLP Protocol IDs will registered and maintained within SANA. [↑](#footnote-ref-1)