ETSI TS 137 324 V16.1.0 (2020-09)

TECHNICAL SPECIFICATION

LTE; 5G;
**Evolved Universal Terrestrial Radio Access (E-UTRA) and NR;
Service Data Adaptation Protocol (SDAP) specification
(3GPP TS 37.324 version 16.1.0 Release 16)**

Reference
RTS/TSGR-0237324vg10

Keywords
5G,LTE

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Contents

Foreword

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z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document specifies the Service Data Adaptation Protocol (SDAP) for a UE with connection to the 5G-CN or for a UE in NR SL communication.

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, edition number, version number, etc.) or non-specific.

- For a specific reference, subsequent revisions do not apply.

- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 38.300: "NG Radio Access Network; Overall description".

[3] 3GPP TS 38.331: "NR Radio Resource Control (RRC); Protocol Specification".

[4] 3GPP TS 23.501: "System Architecture for the 5G System".

[5] 3GPP TS 23.287: "Architecture enhancements for 5G System (5GS) to support Vehicle-to-Everything (V2X) services".

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in TR 21.905 [1] and the following apply. A term defined in the present document takes precedence over the definition of the same term, if any, in TR 21.905 [1].

PC5 QoS flow to SL-DRB mapping rule: a mapping rule determining on which SL-DRB packets of a PC5 QoS flow shall be carried.

QoS flow to DRB mapping rule: a mapping rule determining on which DRB packets of a QoS flow shall be carried.

Reflective QoS flow to DRB mapping: a QoS flow to DRB mapping scheme where a UE monitors the QoS flow to DRB mapping rule in the DL, and applies it to in the UL.

NR Sidelink communication: AS functionality enabling at least V2X communication as defined in TS 23.287 [5], between two or more nearby UEs, using NR technology but not traversing any network node.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in TR 21.905 [1] and the following apply. An abbreviation defined in the present document takes precedence over the definition of the same abbreviation, if any, in TR 21.905 [1].

PFI	PC5 QoS Flow ID
QFI	QoS Flow ID
RDI	Reflective QoS flow to DRB mapping Indication
RQI	Reflective QoS Indication

SDAP	Service Data Adaptation Protocol
SL	Sidelink
SL-DRB	Sidelink Data Radio Bearer

4 General

4.1 Introduction

The objective is to describe the SDAP architecture and the SDAP entity from a functional point of view. The specified functionality only applies to UE with connection to the 5G-CN and UE in NR SL communication.

4.2 SDAP architecture

4.2.1 SDAP structure

Figure 4.2.1-1 illustrates one possible structure for the SDAP sublayer; it should not restrict implementation. The figure is based on the radio interface protocol architecture defined in TS 38.300 [2].
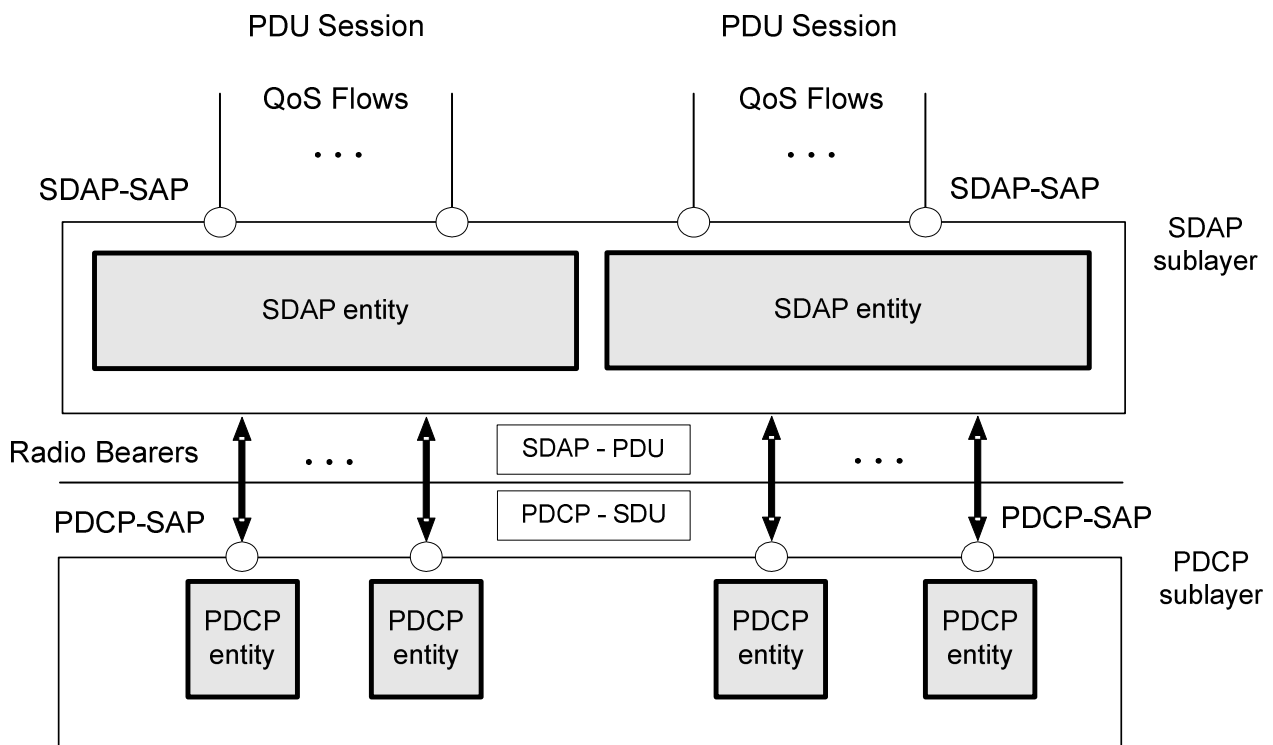
Figure 4.2.1-1: SDAP sublayer, structure view

The SDAP sublayer is configured by RRC (TS 38.331 [3]). The SDAP sublayer maps QoS flows to DRBs. One or more QoS flows may be mapped onto one DRB. One QoS flow is mapped onto only one DRB at a time in the UL.

In NR SL communication, the SDAP sublayer maps PC5 QoS flows to SL-DRBs. One or more PC5 QoS flows may be mapped onto one SL-DRB. One PC5 QoS flow is mapped onto only one SL-DRB at a time in the SL for transmission.

4.2.2 SDAP entities

The SDAP entities are located in the SDAP sublayer. Several SDAP entities may be defined for a UE. There is an SDAP entity configured for each individual PDU session. For SL, SDAP entity is configured per Destination Layer-2 ID and cast type in the UE.

An SDAP entity receives/delivers SDAP SDUs from/to upper layers and submits/receives SDAP data PDUs to/from its peer SDAP entity via lower layers.

- At the transmitting side, when an SDAP entity receives an SDAP SDU from upper layers, it constructs the corresponding SDAP data PDU and submits it to lower layers;

- At the receiving side, when an SDAP entity receives an SDAP data PDU from lower layers, it retrieves the corresponding SDAP SDU and delivers it to upper layers.

Figure 4.2.2-1 illustrates the functional view of the SDAP entity for the SDAP sublayer; it should not restrict implementation. The figure is based on the radio interface protocol architecture defined in TS 38.300 [2].
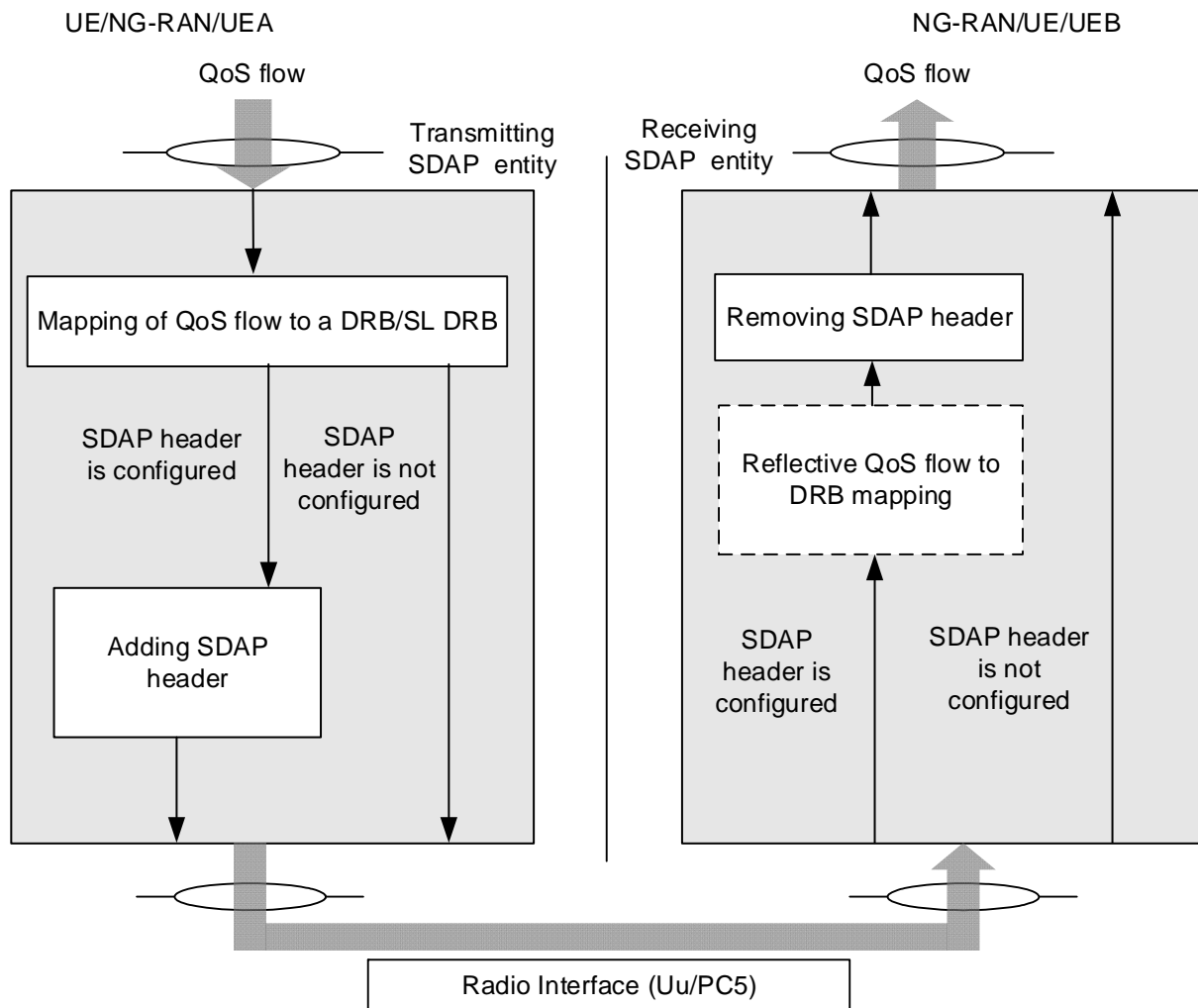

Figure 4.2.2-1: SDAP layer, functional view

Reflective QoS flow to DRB mapping is performed at UE, as specified in the clause 5.3.2, if DL SDAP header is configured.

For NR SL communication, reflective PC5 QoS flow to SL-DRB mapping is not supported.

4.3   Services

4.3.1   Services provided to upper layers

The SDAP sublayer provides its service to the user plane upper layers. The following services are provided by SDAP to upper layers:

- transfer of user plane data.

4.3.2   Services expected from lower layers

An SDAP entity expects the following services from lower layers:

-    user plane data transfer service;

-    in-order delivery except when out of order delivery is configured by RRC (TS 38.331 [3]).

4.4   Functions

The SDAP sublayer supports the following functions:

-    transfer of user plane data;

-    mapping between a QoS flow and a DRB for both DL and UL;

-    mapping between a PC5 QoS flow and a SL-DRB for NR SL communication;

-    marking QoS flow ID in both DL and UL packets;

-    marking PC5 QoS flow ID in unicast of NR SL communication packets;

-    reflective QoS flow to DRB mapping for the UL SDAP data PDUs.

5   SDAP procedures

5.1   SDAP entity handling

5.1.1   SDAP entity establishment

When RRC (TS 38.331 [3]) requests an SDAP entity establishment, the UE shall:

-    establish an SDAP entity;

-    follow the procedures in clause 5.2.1 and 5.2.2.

When RRC (TS 38.331 [3]) requests establishment of an SDAP entity for unicast, groupcast or broadcast of NR SL communication, the UE shall:

-    establish an SDAP entity;

-    follow the procedures in clauses 5.2.3 and 5.2.4.

5.1.2   SDAP entity release

When RRC (TS 38.331 [3]) requests an SDAP entity release, the UE shall:

-    release the SDAP entity.

When RRC (TS 38.331 [3]) requests release of an SDAP entity for unicast, groupcast or broadcast of NR SL communication, the UE shall:

-    release the SDAP entity.

5.2 Data transfer

5.2.1 Uplink

At the reception of an SDAP SDU from upper layer for a QoS flow, the transmitting SDAP entity shall:

- if there is no stored QoS flow to DRB mapping rule for the QoS flow as specified in the clause 5.3:

  - map the SDAP SDU to the default DRB;

- else:

  - map the SDAP SDU to the DRB according to the stored QoS flow to DRB mapping rule;

- if the DRB to which the SDAP SDU is mapped is configured by RRC (TS 38.331 [3]) with the presence of SDAP header,

  - construct the UL SDAP data PDU as specified in the clause 6.2.2.3;

- else:

  - construct the UL SDAP data PDU as specified in the clause 6.2.2.1;

- submit the constructed UL SDAP data PDU to the lower layers.

NOTE 1: UE behaviour is not defined if there is neither a default DRB nor a stored QoS flow to DRB mapping rule for the QoS flow.

NOTE 2: Default DRB is always configured with UL SDAP header (TS 38.331 [3]).

5.2.2 Downlink

At the reception of an SDAP data PDU from lower layers for a QoS flow, the receiving SDAP entity shall:

- if the DRB from which this SDAP data PDU is received is configured by RRC (TS 38.331 [3]) with the presence of SDAP header:

  - perform reflective QoS flow to DRB mapping as specified in the clause 5.3.2;

  - perform RQI handling as specified in the clause 5.4;

  - retrieve the SDAP SDU from the DL SDAP data PDU as specified in the clause 6.2.2.2.

- else:

  - retrieve the SDAP SDU from the DL SDAP data PDU as specified in the clause 6.2.2.1;

- deliver the retrieved SDAP SDU to the upper layer.

5.2.3 SL transmission

At the reception of an SDAP SDU from upper layer for a PC5 QoS flow, the transmitting SDAP entity shall:

- if there is no stored PC5 QoS flow to SL-DRB mapping rule for the PC5 QoS flow as specified in the clause 5.5:

  - map the SDAP SDU to the default SL-DRB;

- else:

  - map the SDAP SDU to the SL-DRB according to the stored PC5 QoS flow to SL-DRB mapping rule;

- if the SL-DRB to which the SDAP SDU is mapped is configured by RRC (TS 38.331 [3]) with the presence of SDAP header:

  - construct the SL SDAP data PDU as specified in the clause 6.2.2.4;

- else:

    - construct the SL SDAP data PDU as specified in the clause 6.2.2.1;

- submit the constructed SL SDAP data PDU to the lower layers.

5.2.4   SL reception

At the reception of an SDAP data PDU from lower layers for a PC5 QoS flow, the receiving SDAP entity shall:

- if the SL-DRB from which this SDAP data PDU is received is configured by RRC (TS 38.331 [3]) with the presence of SDAP header:

    - retrieve the SDAP SDU from the SL SDAP data PDU as specified in the clause 6.2.2.4;

- else:

    - retrieve the SDAP SDU from the SL SDAP data PDU as specified in the clause 6.2.2.1;

- deliver the retrieved SDAP SDU to the upper layer.

5.3   QoS flow to DRB mapping

5.3.1   Configuration

When RRC (TS 38.331 [3]) configures an UL QoS flow to DRB mapping rule for a QoS flow, the SDAP entity shall:

- if the SDAP entity has already been established and there is no stored QoS flow to DRB mapping rule for the QoS flow and a default DRB is configured:

    - construct an end-marker control PDU, as specified in the clause 6.2.3, for the QoS flow;

    - map the end-marker control PDU to the default DRB;

    - submit the end-marker control PDU to the lower layers.

- if the stored UL QoS flow to DRB mapping rule is different from the configured QoS flow to DRB mapping rule for the QoS flow and the DRB according to the stored QoS flow to DRB mapping rule is configured by RRC (TS 38.331 [3]) with the presence of UL SDAP header:

    - construct an end-marker control PDU, as specified in the clause 6.2.3, for the QoS flow;

    - map the end-marker control PDU to the DRB according to the stored QoS flow to DRB mapping rule;

    - submit the end-marker control PDU to the lower layers.

- store the configured UL QoS flow to DRB mapping rule for the QoS flow.

When RRC (TS 38.331 [3]) releases an UL QoS flow to DRB mapping rule for a QoS flow, the SDAP entity shall:

- remove the UL QoS flow to DRB mapping rule for the QoS flow.

5.3.2   Reflective mapping

For each received DL SDAP data PDU with RDI set to 1, the SDAP entity shall:

- process the QFI field in the SDAP header and determine the QoS flow;

- if there is no stored QoS flow to DRB mapping rule for the QoS flow and a default DRB is configured:

    - construct an end-marker control PDU, as specified in the clause 6.2.3, for the QoS flow;

    - map the end-marker control PDU to the default DRB;

- submit the end-marker control PDU to the lower layers;

- if the stored QoS flow to DRB mapping rule for the QoS flow is different from the QoS flow to DRB mapping of the DL SDAP data PDU and the DRB according to the stored QoS flow to DRB mapping rule is configured by RRC (TS 38.331 [3]) with the presence of UL SDAP header:

  - construct an end-marker control PDU, as specified in the clause 6.2.3, for the QoS flow;

  - map the end-marker control PDU to the DRB according to the stored QoS flow to DRB mapping rule;

  - submit the end-marker control PDU to the lower layers;

- store the QoS flow to DRB mapping of the DL SDAP data PDU as the QoS flow to DRB mapping rule for the UL.

5.3.3   DRB release

When RRC (TS 38.331 [3]) indicates that a DRB is released, the SDAP entity shall:

- remove all QoS flow to DRB mappings associated with the released DRB based on the clauses 5.3.1 and 5.3.2.

5.4   RQI handling

For each received DL SDAP data PDU with RQI set to 1, the SDAP entity shall:

- inform the NAS layer of the RQI and QFI.

5.5   PC5 QoS flow to SL-DRB mapping

5.5.1   Configuration

When RRC (TS 38.331 [3]) configures a PC5 QoS flow to SL-DRB mapping rule for a PC5 QoS flow, the SDAP entity shall:

- for unicast of NR SL communication, if the SDAP entity has already been established and there is no stored SL-DRB mapping rule for the PC5 QoS flow and a default SL-DRB is configured:

  - construct an end-marker control PDU, as specified in the clause 6.2.3, for the PC5 QoS flow;

  - map the end-marker control PDU to the default SL-DRB;

  - submit the end-marker control PDU to the lower layers;

- for unicast of NR SL communication, if the stored PC5 QoS flow to SL-DRB mapping rule is different from the configured PC5 QoS flow to SL-DRB mapping rule for the PC5 QoS flow and the SL-DRB according to the stored PC5 QoS flow to SL-DRB mapping rule is configured by RRC (TS 38.331 [3]) with the presence of SL SDAP header:

  - construct an end-marker control PDU, as specified in the clause 6.2.3, for the PC5 QoS flow;

  - map the end-marker control PDU to the SL-DRB according to the stored PC5 QoS flow to SL-DRB mapping rule;

  - submit the end-marker control PDU to the lower layers;

- store the configured PC5 QoS flow to SL-DRB mapping rule for the PC5 QoS flow.

When RRC (TS 38.331 [3]) releases a PC5 QoS flow to SL-DRB mapping rule for a PC5 QoS flow, the SDAP entity shall:

- remove the PC5 QoS flow to SL-DRB mapping rule for the PC5 QoS flow.

5.5.2   SL-DRB release

When RRC (TS 38.331 [3]) indicates that an SL-DRB is released, the SDAP entity shall:

- remove all PC5 QoS flow to SL-DRB mappings associated with the released SL-DRB based on the clause 5.5.1.

6   Protocol data units, formats, and parameters

6.1   Protocol data units

6.1.1   Data PDU

The SDAP Data PDU is used to convey one or more of followings:

- SDAP header;

- user plane data.

6.1.2   Control PDU

a) End-Marker Control PDU

End-Marker control PDU is used by the SDAP entity at UE to indicate that it stops the mapping of the SDAP SDU of the QoS flow indicated by the QFI/PFI to the DRB/SL-DRB on which the End-Marker PDU is transmitted.

6.2   Formats

6.2.1   General

A SDAP PDU is a bit string that is byte aligned (i.e. multiple of 8 bits) in length. In the figures in clause 6.2, bit strings are represented by tables in which the first and most significant bit is the left most bit of the first line of the table, the last and least significant bit is the rightmost bit of the last line of the table, and more generally the bit string is to be read from left to right and then in the reading order of the lines.

SDAP SDUs are bit strings that are byte aligned (i.e. multiple of 8 bits) in length. An SDAP SDU is included into a SDAP PDU from the first bit onward.

For groupcast and broadcast of NR SL communication, only SDAP data PDU without SDAP header is supported.

6.2.2   Data PDU

6.2.2.1   Data PDU without SDAP header

An SDAP PDU consists only of a data field and does not consist of any SDAP header, as described in Figure 6.2.2.1-1.
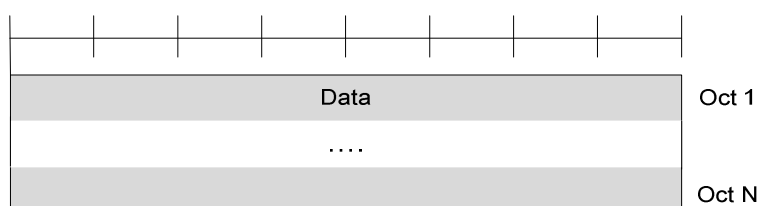

Figure 6.2.2.1-1: SDAP Data PDU format without SDAP header

6.2.2.2 DL Data PDU with SDAP header

Figure 6.2.2.2 – 1 shows the format of SDAP Data PDU of DL with SDAP header being configured.
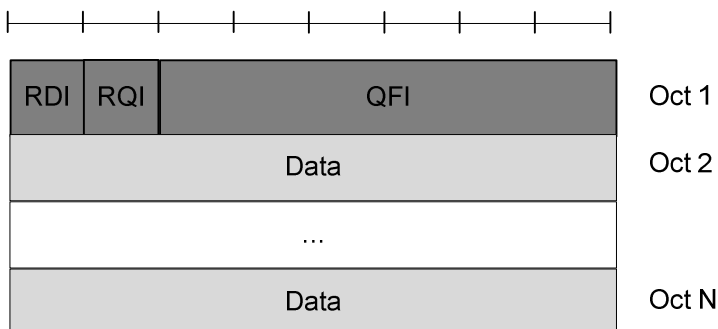

Figure 6.2.2.2-1: DL SDAP Data PDU format with SDAP header

6.2.2.3 UL Data PDU with SDAP header

Figure 6.2.2.3 – 1 shows the format of SDAP Data PDU of UL with SDAP header being configured.
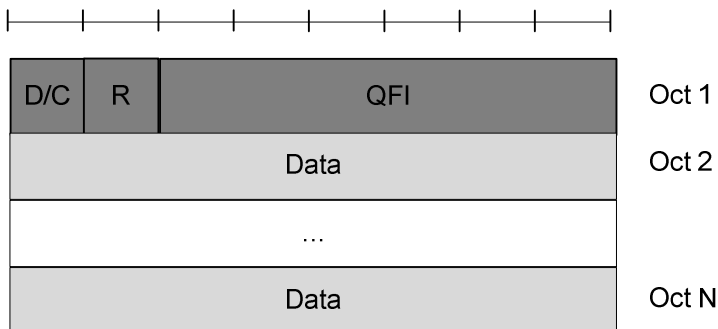
Figure 6.2.2.3-1: UL SDAP Data PDU format with SDAP header

6.2.2.4 SL Data PDU with SDAP header for unicast of NR SL communication

Figure 6.2.2.4–1 shows the format of SDAP Data PDU for unicast of NR SL communication with SDAP header being configured.

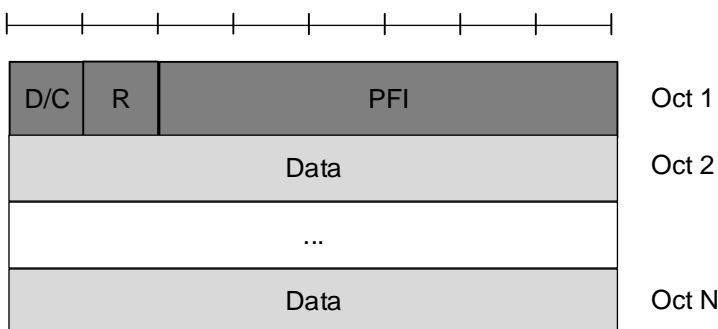**Figure 6.2.2.4-1: SL SDAP Data PDU format with SDAP header for unicast of NR SL communication**

6.2.3 End-Marker Control PDU

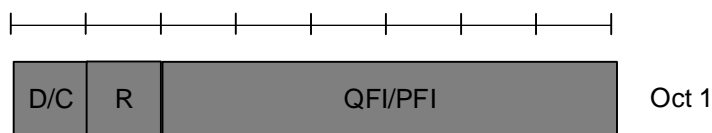Figure 6.2.3-1 shows the format of End-Marker Control PDU.

Figure 6.2.3-1: End-Marker Control PDU

6.3   Parameters

6.3.1   General

If not otherwise mentioned in the definition of each field, then the bits in the parameters shall be interpreted as follows: the left most bit is the first and most significant bit and the right most bit is the last and least significant bit.

Unless otherwise mentioned, integers are encoded in standard binary encoding for unsigned integers. In all cases the bits appear ordered from MSB to LSB when read in the PDU.

6.3.2   Data

Length: Variable

This field includes the SDAP SDU.

6.3.3   D/C

Length: 1 bit,

The D/C bit indicates whether the SDAP PDU is an SDAP Data PDU or an SDAP Control PDU.

Table 6.3.3-1: D/C field

Bit	Description
0	Control PDU
1	Data PDU

6.3.4   QFI

Length: 6 bits

The QFI field indicates the ID of the QoS flow (TS 23.501 [4]) to which the SDAP PDU belongs.

6.3.5   R

Length: 1 bit

Reserved. In this version of the specification reserved bits shall be set to 0. Reserved bits shall be ignored by the receiver.

6.3.6   RQI

Length: 1 bit,

The RQI bit indicates whether NAS should be informed of the updated of SDF to QoS flow mapping rules (TS 23.501 [4]).

Table 6.3.6-1: RQI field

Bit	Description
0	No action
1	To inform NAS that RQI bit is set to 1.

6.3.7   RDI

Length: 1 bit,

The RDI bit indicates whether QoS flow to DRB mapping rule should be updated.

Table 6.3.7-1: RDI field

Bit	Description
0	No action
1	To store QoS flow to DRB mapping rule.

6.3.8   PFI

Length: 6 bits

The PFI field indicates the ID of the PC5 QoS flow (TS 23.287[5]) to which the SDAP PDU belongs.

Annex A (informative): Change history

Change history							
Date	**Meeting**	**TDoc**	**CR**	**Rev**	**Cat**	**Subject/Comment**	**New version**
06/2017	RAN2 NR AH		-	-	-	First version	0.1.0
08/2017	RAN2#99		-	-	-	To capture agreements made in RAN2#99	0.2.0
09/2017	RAN#77		-	-	-	Presented to RAN#77 for information	1.0.0
10/2017	RAN2#99bis					To capture agreements made in RAN2#99bis	1.1.0
11/2017	RAN2#100					To remove editor's notes.	1.2.0
01/2018	RAN2 NR AH					To capture agreements made in RAN2 NR AH	1.3.0
04/2018	RAN2#101bis					To capture agreements made in RAN2#101	1.4.0
	RAN2#101bis					To capture agreements made in RAN2#101bis	1.5.0
05/2018	RAN2#102					To capture agreements made in RAN2#102	1.6.0
06/2018	RP-80	RP-181256				Provided to RAN #80 for approval	2.0.1
	RP-80	RP-181266				Provided to RAN #80 for approval (update as RP-181256 was misused for another Tdoc)	2.0.2
						Upgraded to Rel-15 after the plenary approval	15.0.0
09/2018	RP-81	RP-181940	0006	1	F	Miscellaneous corrections for SDAP	15.1.0
	RP-81	RP-181939	0007	-	D	Miscellaneous corrections to SDAP	15.1.0
	RP-81	RP-181942	0008	1	F	Correction on flow remapping from default DRB	15.1.0
03/2020	RP-87	RP-200346	0014	1	B	Introduction of 5G_V2X_NRSL to 37.324	16.0.0
07/2020	RP-88	RP-201176	0016	1	F	Capture latest agreements on SDAP	16.1.0

History

Document history		
V16.1.0	September 2020	Publication