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Technical Specification

Universal Mobile Telecommunications System (UMTS); UTRAN Iur Interface User Plane Protocols for Common Transport Channel Data Streams (3GPP TS 25.425 version 3.5.0 Release 1999)



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1 Scope

The present document shall provide a description of the UTRAN RNS-RNS (Iur) interface user plane protocols for Common Transport Channel data streams as agreed within the TSG-RAN working group 3.

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] ITU-T Recommendation I.361 (11/1995): "B-ISDN ATM Layer Specification".
 - [2] ITU-T Recommendation I.363.2 (09/1997): "B-ISDN ATM Adaptation Layer specification: Type 2 AAL".
 - [3] ITU-T Recommendation I.366.1 (06/1998): "Segmentation and Reassembly Service Specific Convergence Sublayer for the AAL type 2".
 - [4] 3GPP TS 25.427: "UTRAN Iub/Iur Interface User Plane Protocols for DCH Data Streams".
 - [5] 3GPP TS 25.401: "UTRAN overall description".
 - [6] 3GPP TR 25.990: "Vocabulary".
 - [7] 3GPP TS 25.321: "Medium Access Control (MAC) protocol specification".
-

3 Definitions, symbols and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions in [5] and the following apply:

Common Transport Channel: it is defined as a transport channel that is shared by several users i.e. DSCH, USCH [TDD], CPCH [FDD], RACH, FACH

Transport Connection: service provided by the transport layer and used by Frame Protocol for the delivery of FP PDU

3.2 Symbols

No special symbols are defined in the present document.

3.3 Abbreviations

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

| | |
|--------|---------------------------------------|
| AAL2 | ATM Adaptation Layer type 2 |
| ATM | Asynchronous Transfer Mode |
| CFN | Connection Frame Number |
| CmCH | Common Transport Channel |
| CPCH | Common Packet Channel |
| C-RNC | Controlling Radio Network Controller |
| CRC | Cyclic Redundancy Checksum |
| DCH | Dedicated Transport Channel |
| DL | Downlink |
| D-RNTI | Drift RNTI |
| DSCH | Downlink Shared Channel |
| FACH | Forward Access Channel |
| FP | Frame Protocol |
| FT | Frame Type |
| RACH | Random Access Channel |
| RNC | Radio Network Controller |
| RNTI | Radio Network Temporary Identity |
| SRNC | Serving Radio Network Controller |
| S-RNTI | Serving RNTI |
| SSCS | Service Specific Convergence Sublayer |
| TB | Transport Block |
| TBS | Transport Block Set |
| TFI | Transport Format Indicator |
| ToA | Time of Arrival |
| TTI | Transmission Time Interval |
| UE | User Equipment |
| UL | Uplink |
| U-RNTI | UTRAN RNTI |
| USCH | Uplink Shared Channel |

4 General Aspects

4.1 Common Transport Channel Data Streams User Plane Protocol Services

This subclause describes the services that the User Plane Protocols provide such as data transfer, flow control.

4.1.1 RACH/CPCH[FDD] Data Streams User Plane Protocol Services

RACH/CPCH[FDD] frame protocol provides the following services:

- Transport of MAC-c/sh SDUs from the DRNC to the SRNC for RACH/CPCH[FDD] common transport channels.

4.1.2 FACH Data Streams User Plane Protocol Services

FACH frame protocol provides the following services:

- Transport of MAC-c/sh SDUs from the SRNC to the DRNC for FACH common transport channel.
- Flow Control between MAC-d and MAC-c/sh.

4.1.3 [TDD USCH]/DSCH Data Streams User Plane Protocol Services

[TDD USCH]/DSCH frame protocol provides the following services:

- Transport of MAC-c/sh SDUs between the SRNC and the DRNC for [TDD USCH] and DSCH common transport channels.
- Flow Control between MAC-d and MAC-c/sh.

4.2 Services expected from the Data Transport Network layer

The following services are expected from the transport layer:

- Delivery of Frame Protocol PDUs.

In sequence delivery is not required. However, frequent out-of-sequence delivery may impact the performance and should be avoided.

4.3 Protocol Version

This revision of the specification specifies version 1 of the protocols.

5 Common Transport Channel Data Streams User Plane Procedures

This clause specifies the user plane procedures for Common Transport Channels data streams. Typical related scenarios at Iur interface should be described.

For the user plane of the radio network layer there are four Common Transport Channel frame handling protocols:

1. Random Access Channel/Common Packet Channel [FDD] Frame Protocol (RACH/CPCH[FDD] FP) for transport of Iur data streams carried on RACH/CPCH[FDD] on the Uu-interface.
2. Forward Access Channel Frame Protocol (FACH FP) for transport of Iur data streams carried on FACH on the Uu-interface.
3. Downlink Shared Channel Frame Protocol (DSCH FP) for transport of Iur data streams carried on DSCH on the Uu-interface.
4. Uplink Shared Channel Frame Protocol ([TDD USCH] FP) for transport of Iur data streams carried on USCH on the Uu-interface.

5.1 Data Transfer

5.1.1 RACH/CPCH[FDD] Data Transfer

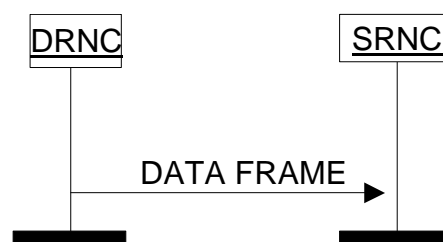


Figure 1: RACH/CPCH[FDD] Data Transfer procedure

Data received on the RACH/CPCH[FDD] transport channel is transmitted from the DRNC to the SRNC using RACH/CPCH[FDD] DATA FRAMES. The data is protected by a mandatory payload CRC. Multiple MAC-c/sh SDUs of same length may be transmitted in the same RACH/CPCH[FDD] DATA FRAME.

5.1.2 FACH Data Transfer

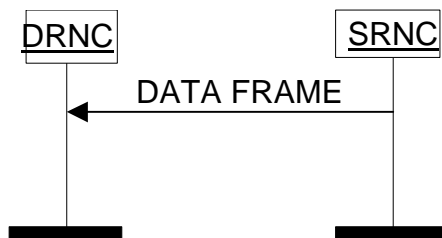


Figure 2: FACH Data Transfer procedure

Data to be transmitted on the FACH transport channel is transmitted from the SRNC to the DRNC using FACH DATA FRAMES. Multiple MAC-c/sh SDUs of same length and same priority level (CmCH-PI) may be transmitted in the same FACH DATA FRAME. Within one priority level and size the MAC-c/sh SDUs shall be transmitted by the DRNS on the Uu interface in the same order as they were received from the SRNC.

The *UE-ID Type Indicator* IE indicates which UE-ID type MAC-c/sh shall include in the MAC header.

5.1.3 USCH Data Transfer [TDD]

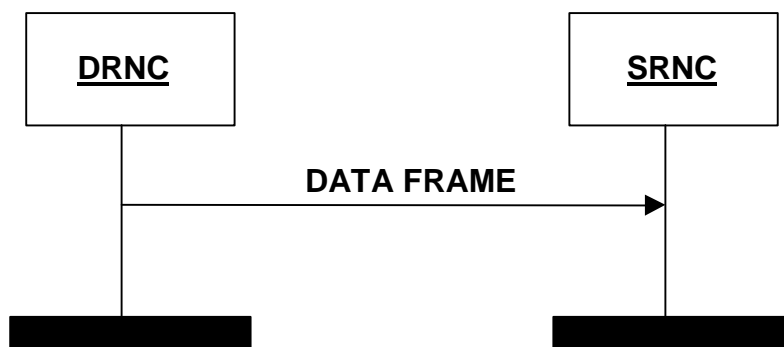


Figure 3: USCH Data Transfer procedure

Whenever there is USCH data in the DRNC, transfer is done immediately to the SRNC via the USCH Data Port using USCH DATA FRAMES.

Data received on the USCH transport channel is transmitted from the DRNC to the SRNC using USCH DATA FRAMES. The data is protected by a mandatory payload CRC. Multiple MAC-c/sh SDUs of same length may be transmitted in the same USCH DATA FRAME.

5.1.4 DSCH Data Transfer

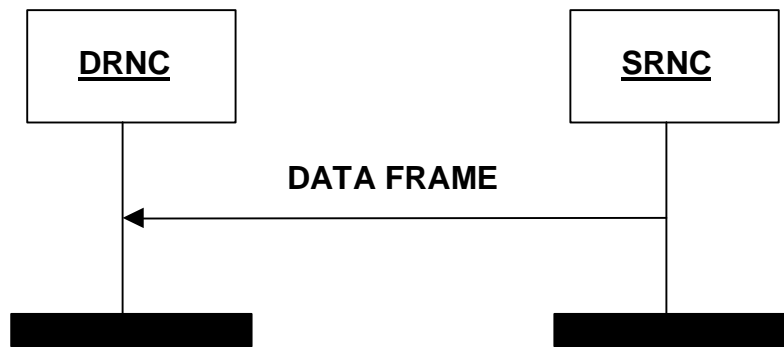


Figure 4: DSCH Data Transfer procedure

When the SRNC has been granted capacity by the DRNC via the DSCH CAPACITY ALLOCATION Control Frame and the SRNC has data waiting to be sent, then the DSCH DATA FRAME is used to transfer the data. When data is waiting to be transferred, and a CAPACITY ALLOCATION Control Frame is received, a DSCH DATAFRAME will be transmitted immediately according to allocation received.

Multiple MAC-c/sh SDUs of same length and same priority level (CmCH-PI) may be transmitted in the same DSCH DATA FRAME.

The DSCH DATAFRAME includes a *User Buffer Size IE* to indicate the amount of data pending for the respective UE for the indicated priority level. Within one priority level and size the MAC-c/sh SDUs shall be transmitted by the DRNS on the Uu interface in the same order as they were received from the SRNC.

5.2 Flow Control

5.2.1 FACH Flow Control

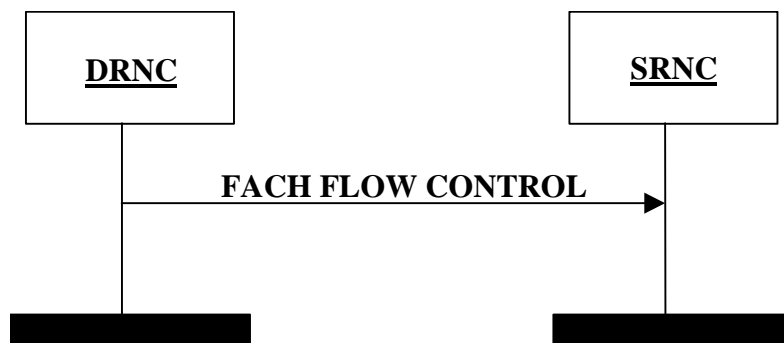


Figure 4A: FACH Flow Control procedure

The FACH Flow Control procedure is used by the DRNC to control the user data flow. It may be generated in response to a FACH Capacity Request procedure or at any other time. The *Credits IE* indicates the number of MAC-c/sh SDUs the SRNC is allowed to transmit for the UE identified by the *SRNTI IE* and the associated priority level indicated by the *Common Transport Channel Priority Indicator IE*.

The *Credits IE* indicates the total amount of credits granted. Any credits previously granted are withdrawn.

If *Credits IE* = 0 (e.g. due to congestion in the DRNC), the SRNC shall immediately stop transmission of MAC-c/sh SDUs.

Credits IE = 'unlimited' indicates that the SRNC may transmit an unlimited number of MAC-c/sh SDUs.

5.2.2 DSCH Capacity Request

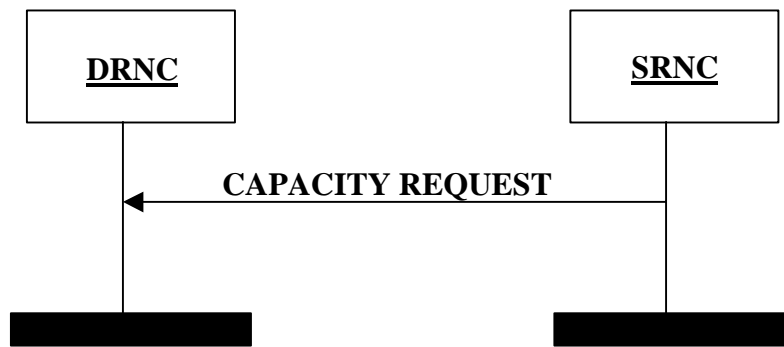


Figure 5: DSCH Capacity Request procedure

The DSCH Capacity Request procedure provides means for the SRNC to request DSCH capacity by indicating the user buffer size in the SRNC for a given priority level.

The SRNC is allowed to reissue the DSCH Capacity Request procedure if no CAPACITY ALLOCATION has been received within an appropriate time threshold.

5.2.3 DSCH Capacity Allocation

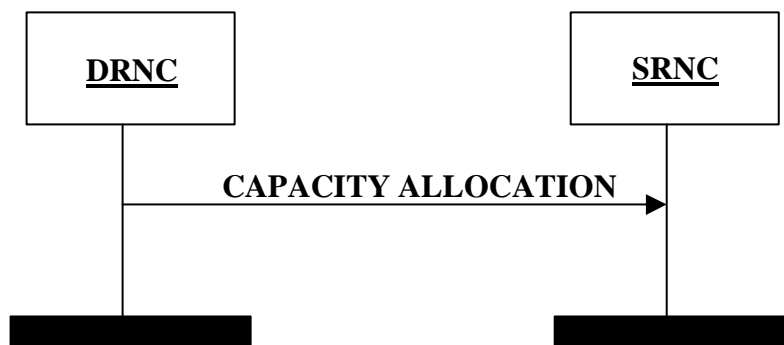


Figure 6: DSCH Capacity Allocation procedure

The DSCH Capacity Allocation procedure is generated within the DRNC. It may be generated either in response to the DSCH Capacity Request procedure or at any other time.

The DRNC may use this message to modify the capacity at any time, irrespective of the reported user buffer status.

The DSCH CAPACITY ALLOCATION frame is used by the DRNC to control the user data flow. *Credits* IE indicates the number of MAC-c/sh SDUs that the SRNC is allowed to transmit for the UE and the associated priority level indicated by the *Common Transport Channel Priority Indicator* IE.

The *Maximum MAC-c/sh SDU Length*, *Credits*, *Interval* and *Repetition Period* IEs indicate the total amount of capacity granted. Any capacity previously granted is replaced.

If *Credits* IE = 0 (e.g. due to congestion in the DRNC), the SRNC shall immediately stop transmission of MAC-c/sh SDUs. If *Credits* IE = 255, the SRNC can transmit MAC-c/sh SDUs with unlimited capacity.

The IEs used in the DSCH CAPACITY ALLOCATION Control Frame are the *Common Transport Channel Priority Indicator*, *Credits*, *Maximum MAC-c/sh SDU Length*, *Interval* and the *Repetition Period*.

If the *Repetition Period* IE = 'unlimited repetition period' it indicates that the SRNC may transmit the specified number of MAC-c/sh SDUs for an unlimited period according to the bounds of *Maximum MAC-c/sh SDU Length*, *Credits* and *Interval* IEs.

5.2.4 FACH Capacity Request

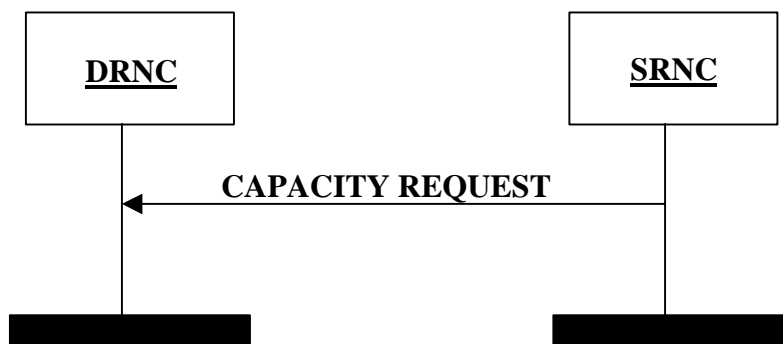


Figure 6A: FACH Capacity Request procedure

The FACH Capacity Request procedure provides the means for the SRNC to notify the DRNC about the user buffer size for a given priority level. It may be sent if no FACH FLOW CONTROL frame has been received within an appropriate time threshold, or to signal an event such as data arrival or user buffer discard.

6 Frame Structure and Coding

6.1 General

The general structure of a Common Transport Channel frame consists of a header and a payload. This structure is depicted in the figure 7.

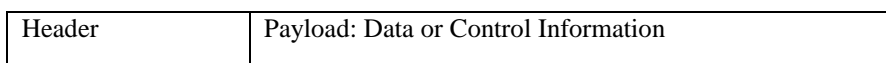


Figure 7: General Frame Structure

The header shall contain the frame type field and information related to the frame type.

There are two types of frames (indicated by the Frame Type field).

1. Data frame.
2. Control frame.

In the present document the structure of frames will be specified by using pictures similar to the following figure 8.

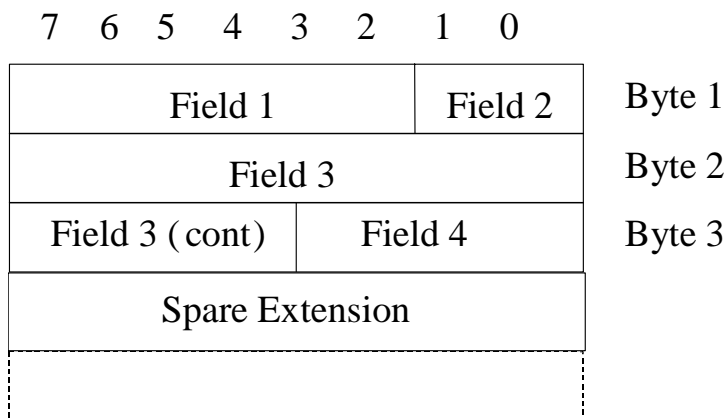


Figure 8: Example frame structure

Unless otherwise indicated, fields which consist of multiple bits within a byte will have the more significant bit located at the higher bit position (indicated above frame in figure 8). In addition, if a field spans several bytes, more significant bits will be located in lower numbered bytes (right of frame in figure 8).

On the Iur interface, the frame will be transmitted starting from the lowest numbered byte. Within each byte, the bits are sent according decreasing bit position (bit position 7 first).

The Spare Extension indicates the location where new IEs can in the future be added in a backward compatible way.

The Spare Extension shall not be used by the transmitter and shall be ignored by the receiver.

Spare bits shall be set to 0 by the transmitter and shall be ignored by the receiver.

The parameters are specified giving the value range and the step (if not 1). The coding is done as follows (unless otherwise specified):

- Lowest value (in the range) coded as a sequence of 0's;
- Highest value in the range coded as a sequence of 1's.

6.2 Data Frame structure

6.2.1 RACH/CPCH[FDD] Channels

RACH/CPCH[FDD] Iur data stream corresponds to the data stream of one specific UE. The used transport bearer for the transport of FACH/RACH or FACH/CPCH[FDD] is bi-directional.

The RACH/CPCH[FDD]/FACH FP does not facilitate multiplexing of data streams from different UEs onto the same data frame, but does allow multiple UEs to share the same transport bearer.

The RACH DATA FRAME structure is defined as common for FDD and TDD with conditional fields, and CPCH[FDD] DATA FRAME structure is defined as common for FDD only.

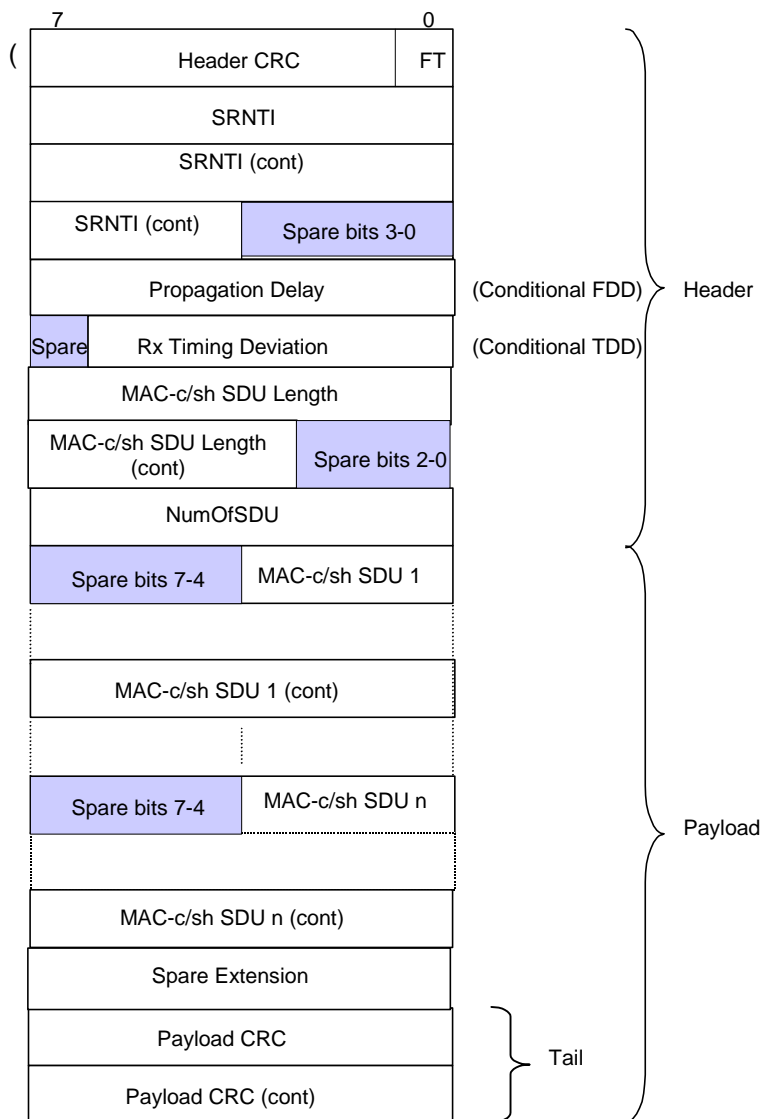


Figure 9: RACH/CPCH[FDD] DATA FRAME structure

Propagation delay is a conditional Information Element which is only present when the Cell supporting the RACH/CPCH[FDD] Transport Channel is a FDD Cell.

Rx Timing Deviation is a conditional Information Element which is only present when the Cell supporting the RACH Transport Channel is a TDD Cell.

6.2.2 FACH Channels

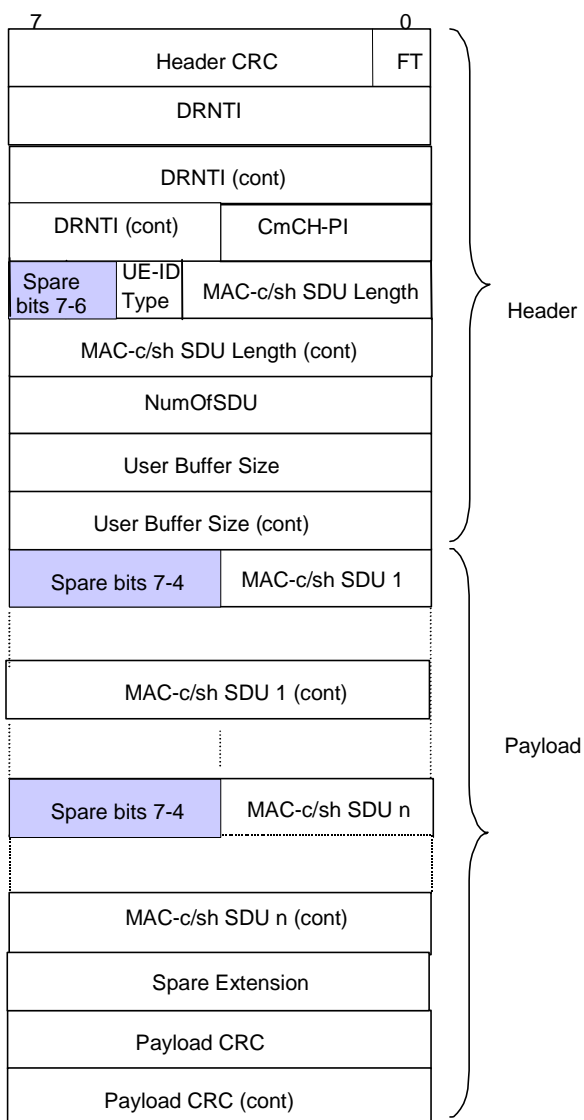


Figure 10: FACH DATA FRAME structure

6.2.3 USCH Channels [TDD]

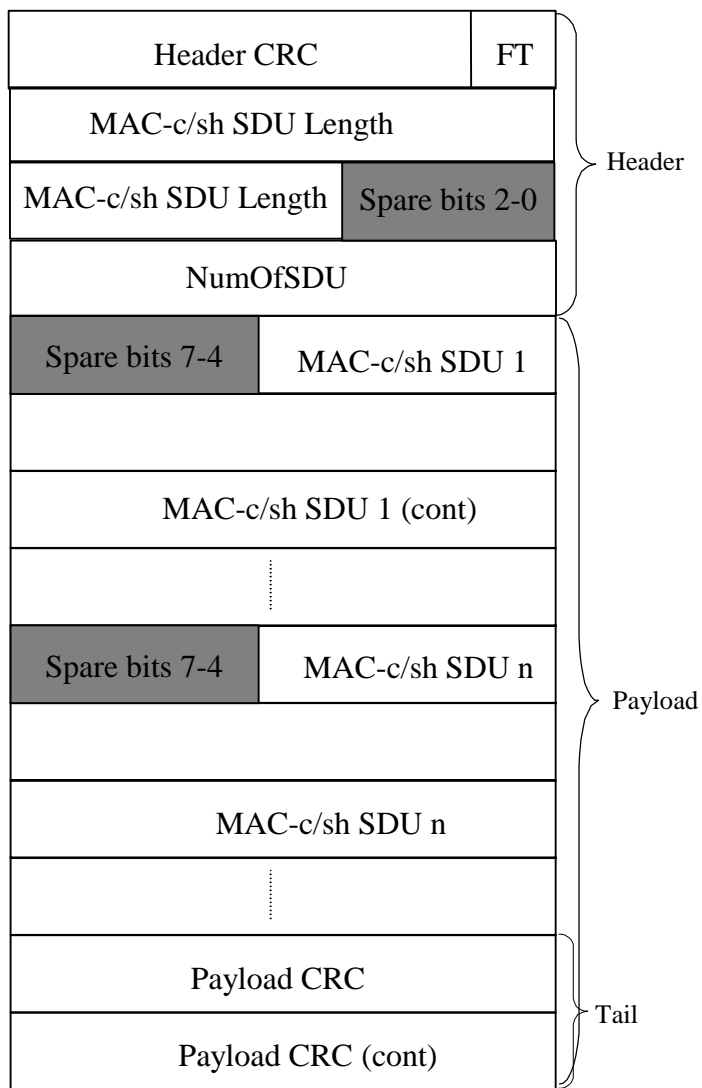


Figure 11: USCH DATA FRAME structure

6.2.4 DSCH Channels

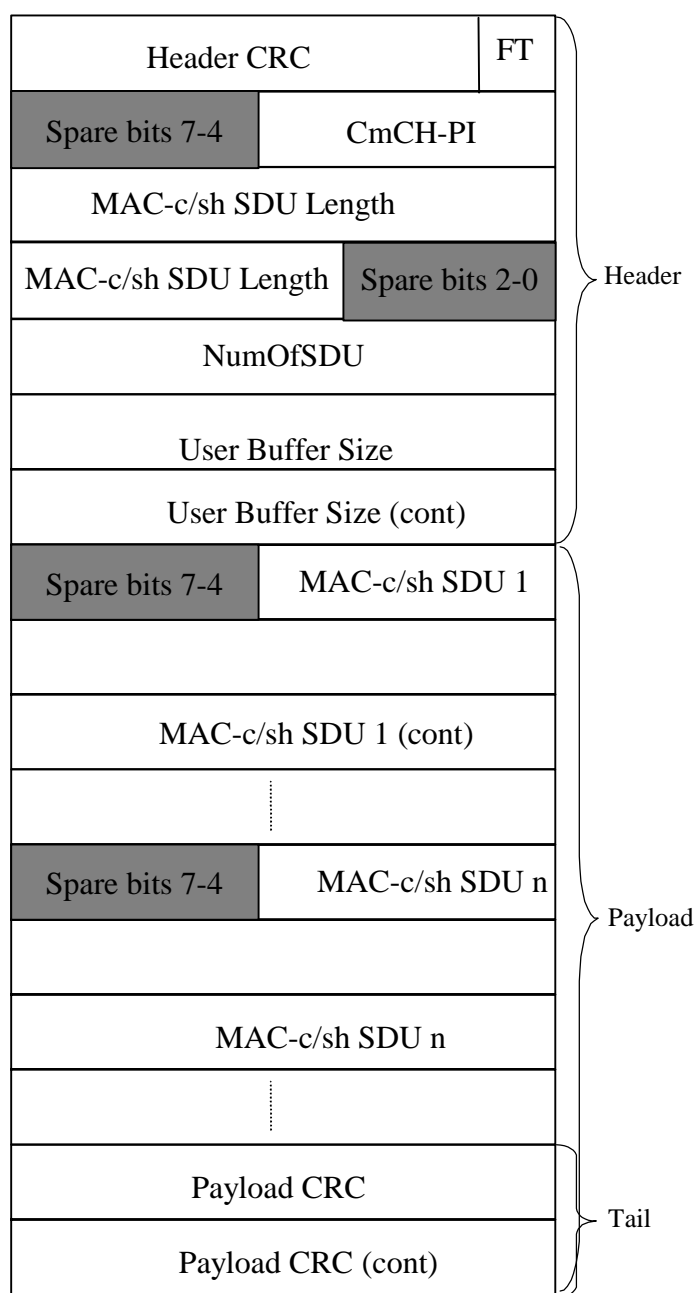


Figure 12: DSCH DATA FRAME structure

6.2.5 Coding of Information Elements in DATA FRAMES

6.2.5.1 Header CRC

Description: Cyclic Redundancy Polynomial calculated on the header of a data frame with polynomial $X^7+X^6+X^2+1$. The CRC calculation shall cover all bits in the header, starting from bit 0 in the first byte (FT field) up to the end of the header.

Value range: {0-127}.

Field length: 7 bits.

6.2.5.2 Frame Type (FT)

Description: Describes if it is a control frame or a data frame.

Value range: {0=data, 1=control}.

Field Length: 1 bit.

6.2.5.3 D-RNTI

Description: Identifies the UE in the DRNC.

Value range: {0-1048575}.

Field length: 20 bits.

6.2.5.4 S-RNTI

Description: S-RNTI is defined in [5]. S-RNTI is used in UL control frames to identify the UE context in the SRNC.

Value range: {0-1048575}.

Field length: 20 bits.

6.2.5.5 UE-ID Type Indicator (UE-ID Type)

Description: Indicates the UE Identifier Type to be included by MAC-c/sh in the MAC header.

Value range: {0=U-RNTI, 1=C-RNTI}.

Field Length: 1 bit.

6.2.5.6 S-CCPCH Indicator (S-CI)

Void.

6.2.5.7 Common Transport Channel Priority Indicator (CmCH-PI)

Description: CmCH-PI is the relative priority of the data frame and the SDUs included.

Value range: {0-15, where 0=lowest priority, 15=highest priority}.

Field length: 4 bits.

6.2.5.8 MAC-c/sh SDU Length

Description: The value of that field indicates the length of every MAC-c/sh SDU in the payload of the FACH, DSCH and [TDD USCH] DATA FRAME in number of bits.

Value range: {0-5000}.

Field Length: 13 bits.

6.2.5.9 NumOfSDU

Description: Indicates the number of MAC-c/sh SDUs in the payload.

Value range: {1-255}.

Field Length: 8 bits.

6.2.5.10 [FDD - Propagation delay]

Description: One-way air interface delay as measured during RACH access.

Value range: {0 - 765 chips}.

Granularity: 3 chips.

Field length: 8 bits.

6.2.5.11 [TDD - Rx Timing Deviation]

Description: Measured Rx Timing Deviation as a basis for timing advance.

Value range: {-256, ..., +256} chips

$$\{N*4 - 256\} \text{ chips} \leq \text{RxTiming Deviation} < \{(N+1)*4 - 256\} \text{ chips}$$

With $N = 0, 1, \dots, 127$

Granularity: 4 chips.

Field length: 7 bits.

6.2.5.12 User Buffer Size

Description: Indicates the users' buffer size (i.e. the amount of data in the buffer) in octets for a given Common Transport Channel Priority Indicator level.

Value range: {0-65535}.

Field length: 16 bits.

6.2.5.13 MAC-c/sh SDU

Description: A MAC-c/sh SDU contains the *C/T* IE field [7] of the MAC header followed by one RLC PDU. Field length: See the value of the MAC-c/sh SDU Length IE.

6.2.5.14 Payload CRC

Description: Cyclic Redundancy Polynomial calculated on the payload of a data frame with polynomial $X^{16}+X^{15}+X^2+1$. The CRC calculation shall cover all bits in the data frame payload, starting from bit 7 in the first byte up to bit 0 in the byte before the payload CRC.

Field length: 16 bits.

6.2.5.15 Spare Extension

Description: Indicates the location where new IEs can in the future be added in a backward compatible way.

Field length: 0-2 octets.

6.3 Control Frame structure

6.3.1 Introduction

Control Frames are used to transport control information between SRNC and DRNC.

Figure 13 defines the Control Frame structure for common transport channels.

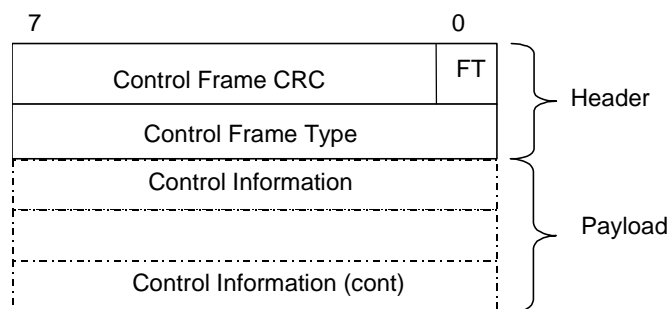


Figure 13: Iur Common Transport Channel Control Frame Format

The *Control Frame Type* IE defines the type of the control frames.

The length of the payload is variable accordingly to the control frame type.

The structure of the header and the payload of the control frames is defined in the following subclauses.

6.3.2 Header structure of the control frames

6.3.2.1 Control frame CRC

Description: Cyclic Redundancy Polynomial calculated on a control frame with polynomial $X^7+X^6+X^2+1$. The CRC calculation shall cover all bits in the control frame, starting from bit 0 in the first byte (FT field) up to the end of the control frame.

Value range: {0-127}.

Field length: 7 bits.

6.3.2.2 Frame type (FT)

Refer to subclause 6.2.5.2.

6.3.2.3 Control Frame Type

Description: Indicates the type of the control information (information elements and length) contained in the payload (=type of control frame).

Value: values of the *Control Frame Type* IE parameter are defined in the table 1.

Table 1: Control Frame Type

| Type of control frame | Value |
|--------------------------|-----------|
| FACH Flow Control | 0000 0010 |
| FACH Capacity Request | 0000 0011 |
| DSCH Capacity Request | 0000 0100 |
| DSCH Capacity Allocation | 0000 0101 |

6.3.3 Payload structure and information elements

6.3.3.1 FACH FLOW CONTROL

Figure 14 shows the payload structure when the control frame is used for the above mentioned purpose. This control information is sent in the UL only.

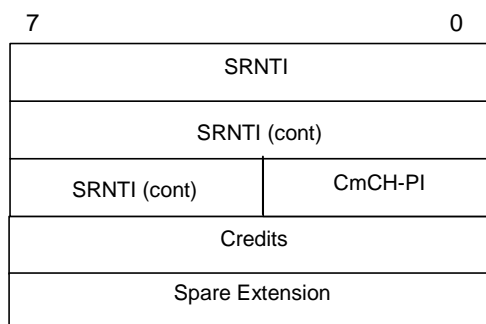


Figure 14: FACH FLOW CONTROL payload structure

6.3.3.1.1 S-RNTI

Refer to subclause 6.2.5.4.

6.3.3.1.2 Common Transport Channel Priority Indicator (CmCH-PI)

Refer to subclause 6.2.5.7.

6.3.3.1.3 Credits

Description: The *Credits* IE indicates the number of MAC-c/sh SDUs that a user may transmit.

Value range: {0-255, where 0=stop transmission, 255=unlimited}.

Field length: 8 bits.

6.3.3.1.4 Spare Extension

Description: Indicates the location where new IEs can in the future be added in a backward compatible way.

Field length: 0-32 octets.

6.3.3.2 DSCH CAPACITY REQUEST

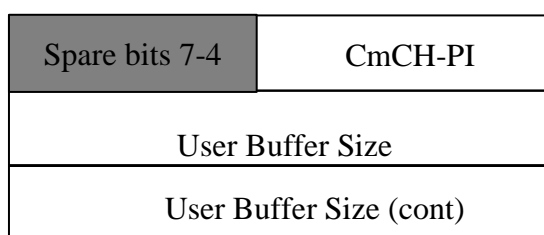


Figure 15: CAPACITY REQUEST payload structure

The DSCH CAPACITY REQUEST is sent to the DRNC for each priority level to indicate the user buffer size in the SRNC. The control frame is sent by the SRNC when the SRNC considers the user buffer size needs an increased buffer reporting frequency. This may be sent to signal an event, such as, data arrival or user-buffer discard. The CAPACITY REQUEST Control Frame is used to improve user-buffer reporting above the level produced by the user-buffer reporting associated with the DSCH DATA FRAMES.

6.3.3.2.1 Common Transport Channel Priority Indicator (CmCH-PI)

Refer to subclause 6.2.5.7.

6.3.3.2.2 User Buffer Size

Refer to subclause 6.2.5.12.

6.3.3.3 DSCH CAPACITY ALLOCATION

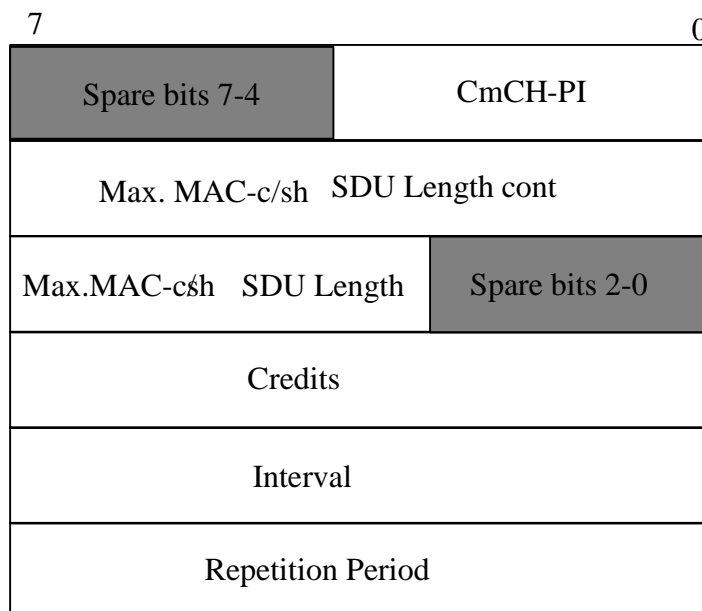


Figure 16: CAPACITY ALLOCATION payload structure

The CAPACITY ALLOCATION Control Frame describes an allocation that the SRNC may use. When the *Credits* IE has a value of 0 it signifies that there is no resources allocated for transmission and to thus stop transmission. When the *Credits* IE has a value of 255, it signifies unlimited capacity for transmission of SDUs. When the *Repetition Period* IE has a value of 0, it signifies that the allocation (*Maximum MAC-c/sh SDU Length*, *Credits* and *Interval* IEs) can be repeated without limit.

6.3.3.3.1 Common Transport Channel Priority Indicator (CmCH-PI)

Refer to subclause 6.2.5.7.

6.3.3.3.2 Maximum MAC-c/sh SDU Length

Description: The value indicates the maximum allowable SDU size. MAC-c/sh SDU contains the C/T field of the MAC header followed by one RLC PDU Field length: See the value of the MAC-c/sh SDU Length IE.

6.3.3.3.3 Credits

Refer to subclause 6.3.3.1.3.

6.3.3.3.4 Interval

Description: The value of this field indicates the time interval during which the *Credits* IE granted in the DSCH CAPACITY ALLOCATION Control Frame may be transmitted. This value is only applied to the DSCH transport channel.

Value range: {0-2550 ms}.

Granularity: 10ms.

Field Length: 8 bits.

6.3.3.3.5 Repetition Period

Description: The value of this field indicates the number of subsequent intervals that the *Credits* IE granted in the DSCH CAPACITY ALLOCATION Control Frame may be transmitted. These values represent an integer number of Intervals (see subclause 6.3.3.3.4). This field is only applied to the DSCH transport channel.

Value range: {0-255, where 0= unlimited repetition period}.

Field Length: 8 bits.

6.3.3.4 FACH CAPACITY REQUEST

Figure 17 shows the payload structure when the control frame is used for the above mentioned purpose. This control information is sent in the DL only.

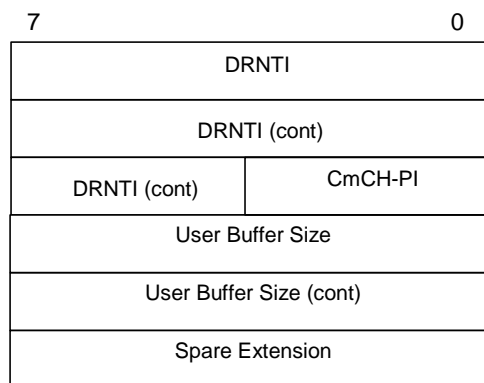


Figure 17: FACH CAPACITY REQUEST payload structure

6.3.3.4.1 D-RNTI

Refer to subclause 6.2.5.3.

6.3.3.4.2 Common Transport Channel Priority Indicator (CmCH-PI)

Refer to subclause 6.2.5.7.

6.3.3.4.3 User Buffer Size

Refer to subclause 6.2.5.12.

6.3.3.4.4 Spare extension

Refer to subclause 6.3.3.1.4.

7 Handling of Unknown, Unforeseen and Erroneous Protocol Data

7.1 General

A Frame Protocol frame with an unknown IE or an illegal IE value shall be ignored.

Annex A (informative): Change history

| Change history | | | | | |
|----------------|---------|--------------------------|-----------|-------------|--|
| TSG RAN# | Version | CR | Tdoc RAN | New Version | Subject/Comment |
| RAN_06 | - | - | RP-99757 | 3.0.0 | Approved at TSG RAN #6 and placed under Change Control |
| RAN_07 | 3.0.0 | - | - | 3.1.0 | Approved at TSG RAN #7 |
| RAN_08 | 3.1.0 | - | RP-000246 | 3.2.0 | Approved at TSG RAN #8 |
| RAN_10 | 3.2.0 | 018 019 021 | RP-000623 | 3.3.0 | Approved at TSG RAN #10 |
| RAN_11 | 3.3.0 | 022 024 026 028 | RP-010120 | 3.4.0 | Approved at TSG RAN #11 |
| RAN_13 | 3.4.0 | 032 | RP-010585 | 3.5.0 | General Corrections on Common Transport Channel Data Streams |
| | | | | | |

History

| Document history | | |
|-------------------------|----------------|-------------|
| V3.0.0 | January 2000 | Publication |
| V3.1.0 | March 2000 | Publication |
| V3.2.0 | June 2000 | Publication |
| V3.3.0 | December 2000 | Publication |
| V3.4.0 | March 2001 | Publication |
| V3.5.0 | September 2001 | Publication |