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*Technical Specification*

**Universal Mobile Telecommunications System (UMTS);
UTRAN Iub Interface User Plane Protocols for
Common Transport Channel Data Streams
(3G TS 25.435 version 3.1.0 Release 1999)**

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# Foreword

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# 1    Scope

This document shall provide a description of the UTRAN RNC-Node B(Iub) interface user plane protocols for Common Transport Channel data streams as agreed within the TSG-RAN working group 3.

NOTE:    By Common Transport Channel one must understand RACH, FACH/PCH, DSCH and USCH.

# 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.

[1]                TS UMTS 25.301, Radio Interface Protocol Architecture.

[2]                TS 25.402 Synchronisation in UTRAN, Stage 2.

[3]                TS 25.302 Services provided by the Physical Layer, Source WG2.

# 3    Definitions and abbreviations

## 3.1    Definitions

For the purpose of the present document, the following terms and definition apply:

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

For other definitions, please refer to [2]

## 3.2    Abbreviations

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

| | |
|---|---|
| CFN | Connection Frame Number |
| CRC | Cyclic Redundancy Checksum |
| CRCI | CRC Indicator |
| DCH | Dedicated Transport Channel |
| DL | Downlink |
| DSCH | Downlink Shared Channel |
| FP | Frame Protocol |
| FT | Frame Type |
| PC | Power Control |
| QE | Quality Estimate |
| TB | Transport Block |
| TBS | Transport Block Set |
| TFI | Transport Format Indicator |
| ToA | Time of arrival |
| TTI | Transmission Time Interval |
| UL | Uplink |

USCH          Uplink Shared Channel

For other abbreviations, please refer to [2].

# 4      General aspects

## 4.1      Common Transport Channel Data Stream User Plane Protocol Services

Common transport channel provides the following services:

- Transport of TBS between the Node B and the CRNC for common transport channels

- Support of transport channel synchronisation mechanism

- Support of Node Synchronisation mechanism

## 4.2      Services expected from data transport

The following services are expected from the transport layer:

- In sequence delivery of Frame Protocol PDUs.

# 5      Data Streams User Plane Procedures

## 5.1      Data Transfer

### 5.1.1      RACH Channels

Data Transfer procedure is used to transfer data received from Uu interface from NodeB to CRNC. Data Transfer procedure consists of a transmission of Data Frame from Node B to CRNC.



**Figure 1: RACH Data Transfer Procedure**

### 5.1.2      [FDD — Secondary-CCPCH]/[TDD — CCPCH] related transport Channels

For the FACH transport channel, a Data Transfer procedure is used to transfer data from CRNC to node B. Data Transfer Procedure Consists of a transmission of Data Frame from CRNC to node B.

**Figure 1: FACH Data Transfer Procedure**

For the PCH transport channel, a Data Transfer procedure is used to transfer data from CRNC to node B. Data Transfer Procedure Consists of a transmission of Data Frame from CRNC to node B.



**Figure 3: PCH Data Transfer Procedure**

In this case the PCH Data Frame may also transport information related to the PICH channel.

If the Node B does not receive a valid FP frame in a TTI, it assumes that there is no data to be transmitted in that TTI for this transport channel.

If the node B is aware of a TFI value corresponding to zero bits for this transport channel, this TFI is assumed. When combining the TFI's of the different transport channels, a valid TFCI might result and in this case data shall be transmitted on the Uu.

If the node B is not aware of a TFI value corresponding to zero bits for this transport channel or if combining the TFI corresponding to zero bits with other TFI's results in an unknown TFI combination, the handling as described in the following paragraph shall be applied.

At each frame, the Node B shall build the TFCI value of each [FDD — secondary-CCPCH]/[TDD — CCPCH] according to the TFIs of the transport channels  multiplexed on this [FDD — secondary-CCPCH]/[TDD — CCPCH] and scheduled for that frame. [FDD — In case the Node B receives an unknown TFI combination, it shall only transmit the pilot bits of the secondary-CCPCH (if configured) without TFCI bits or Data bits.] [TDD — In case the Node B receives an unknown TFI combination, it shall only transmit data obtained by rate matching.].

If the Node B does not receive a valid FP frame in a TTI or a frame without paging indication information, it assumes that no UE's have to be paged on the Uu in this TTI. In this case the default PICH bit pattern of all zeros shall be transmitted.

Data Frames sent on Iub for different transport channels multiplexed on one [FDD — secondary-CCPCH]/[TDD — CCPCH] might indicate different transmission power levels to be used in a certain Uu frame. Node-B shall determine the highest DL power level required for any of the transport channels multiplexed in a certain Uu frame and use this power level as the desired output level.

## 5.1.3     Downlink Shared Channels

Data Transfer procedure is used to transfer data from CRNC to node B. Data Transfer Procedure Consists of transmission a Data Frame from CRNC to node B.

**Figure 4: DSCH Data Transfer Procedure**

## 5.1.4 [TDD — Uplink Shared Channels]

Data Transfer procedure is used to transfer data received from Uu interface from NodeB to CRNC. Data Transfer procedure consists of a transmission of Data Frame from Node B to CRNC.
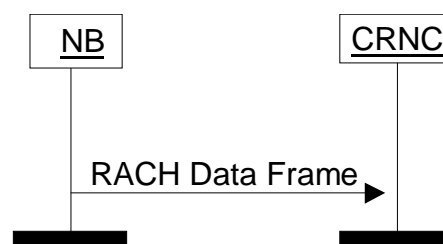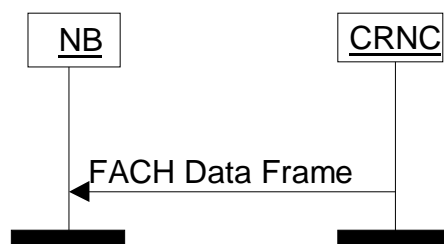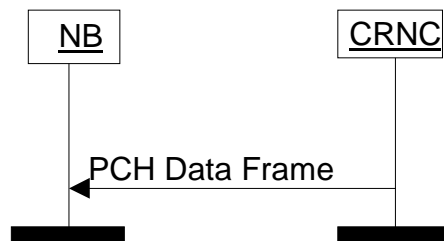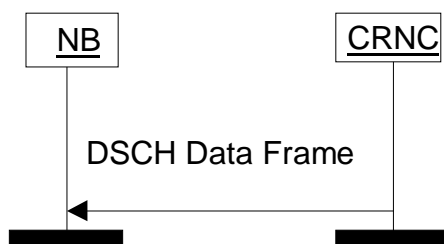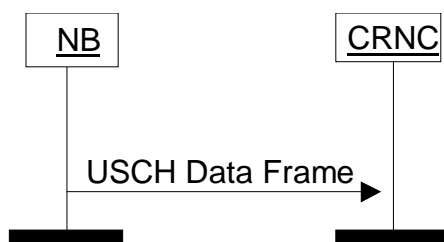


**Figure 5: USCH Data Transfer Procedure**

## 5.2 Node Synchronisation

In the Node Synchronisation procedure, the RNC sends a DL Node Synchronisation control frame to Node B Containing the parameter T1. Upon reception of a DL Node Synchronisation control frame, the Node B shall respond with UL Node Synchronisation Control Frame, indicating t2 and t3, as well as t1 which was indicated in the initiating DL Node Synchronisation control frame.

The t1, t2, t3 parameters are defined as:

  t1: RNC specific frame number (RFN) that indicates the time when RNC sends the frame through the SAP to the transport layer.

  t2: Node B specific frame number (BFN) that indicates the time when Node B receives the correspondent DL Node synchronisation frame through the SAP from the transport layer.

  t3: Node B specific frame number (BFN) that indicates the time when Node B sends the frame through the SAP to the transport layer.

The general overview on the Node Synchronisation procedure is reported in [2].



**Figure 6: Node Synchronisation procedure**

## 5.3 DL Transport Channels Synchronisation

CRNC sends a DL SYNCHRONISATION Control Frame to node B. This message indicates the target CFN.

Upon reception of the DL SYNCHRONISATION Control Frame Node B shall immediately respond with UL SYNCHRONISATION Control Frame indicating the ToA for the DL Synchronisation frame and the CFN indicated in the received message.
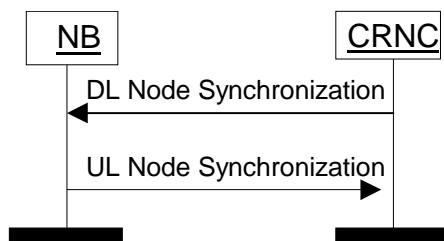
The procedure shall not be applied on transport bearers transporting UL traffic channels RACH or USCH.
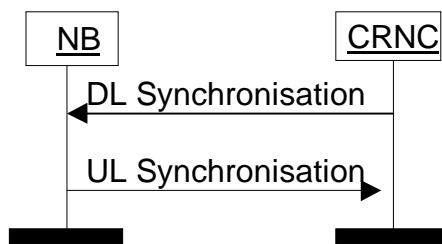


**Figure 7: FACH, PCH and DSCH Transport Channels Synchronisation procedure**

# 5.4      DL Timing Adjustment

Timing Adjustment procedure is used to indicate for the CRNC the incorrect arrival time of downlink data to node B.

Timing adjustment procedure is initiated by the node B if a DL frame arrives outside of the defined arrival window.

If the DL frame has arrived before the ToAWS or after the ToAWE nodeB includes the ToA and the target CFN as message parameters for TIMING ADJUSTMENT Control Frame.

The arrival window and the time of arrival are defined as follows:

**Time of Arrival Window Endpoint (ToAWE):** ToAWE represents the time point by which the DL data shall arrive to the node B from Iub. The ToAWE  is defined as the amount of milliseconds before the last time point from which a timely DL transmission for the identified CFN would still be possible taking into account the node B internal delays. ToAWE is set via control plane. If data does not arrive before ToAWE a Timing Adjustment Control Frame shall be sent by node B.

**Time of Arrival Window Startpoint (ToAWS):** ToAWS represents the time after which the DL data shall arrive to the node B from Iub. The ToAWS  is defined as the amount of milliseconds from the ToAWE. ToAWS is set via control plane. If data arrives before ToAWS a Timing Adjustment Control Frame shall be sent by node B.

**Time of Arrival  (ToA):** ToA is the time difference between the end point of the DL arrival window  (ToAWE) and the actual arrival time of DL frame for a specific CFN. A positive ToA means that the frame is received before the ToAWE, a negative ToA means that the frame is received after the ToAWE.

The general overview on the timing adjustment procedure is reported in [2].
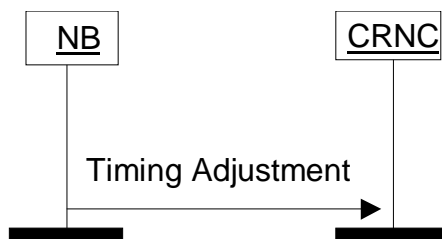


**Figure 8: FACH, PCH and DSCH Timing Adjustment procedure**

# 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  below:

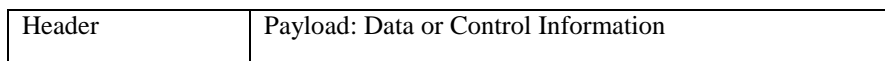| Header | Payload: Data or Control Information |
|--------|--------------------------------------|

**Figure 9: 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).

- Data frame

- Control frame

In this specification the structure of  frames will be specified by using pictures similar to the following figure:
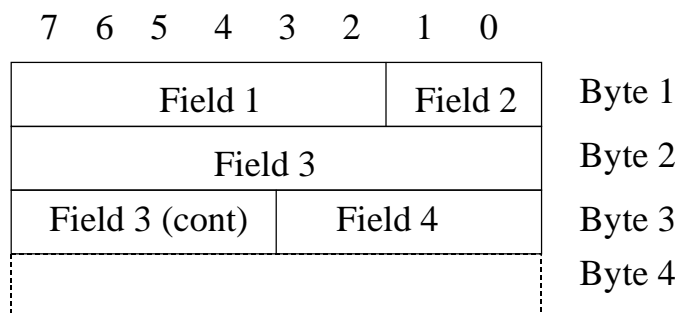


**Figure 10: Example frame structure**

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 10). In addition, if a field spans several bytes, more significant bits will be located in lower numbered bytes (right of frame in Figure 10).

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

- Unsigned values are binary coded

- Signed values are 2's complement binary coded

# 6.2     Data frame structure

## 6.2.1     RACH Channels

The RACH Data Frame includes the CFN corresponding to the SFN of the frame in which the payload was received. If the payload was received in several frames, the CFN corresponding to the first Uu frame in which the information was received shall be indicated.

**Figure 11: RACH Data Frame structure**

Propagation delay is a conditional Information Element which is only present when the Cell supporting the RACH 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

FACH Data Frame includes the CFN corresponding to the Uu frame at which this data in which the payload (FACH TBS) has to be transmitted. If the payload is to be sent in several frames, the CFN corresponding to the first frame shall be indicated.

**Figure 12: FACH Data Frame structure**

## 6.2.3    PCH Channels

PCH Data Frame includes the CFN corresponding to the Uu frame at which this data in which the payload (PCH TBS, Paging indicator information) has to be transmitted. If the payload is to be sent in several frames, the CFN corresponding to the first frame shall be indicated. In contrast to all other Common Transport Channel data frames, which use a CFN of length 8, the PCH Data Frame includes a CFN of length 12.

The node-B has no responsibility concerning ensuring the consistency between the paging indication information and the corresponding paging messages. E.g. if the paging indication information is lost over the Iub, the paging messages might be sent over the Uu while no UE is actually listening.
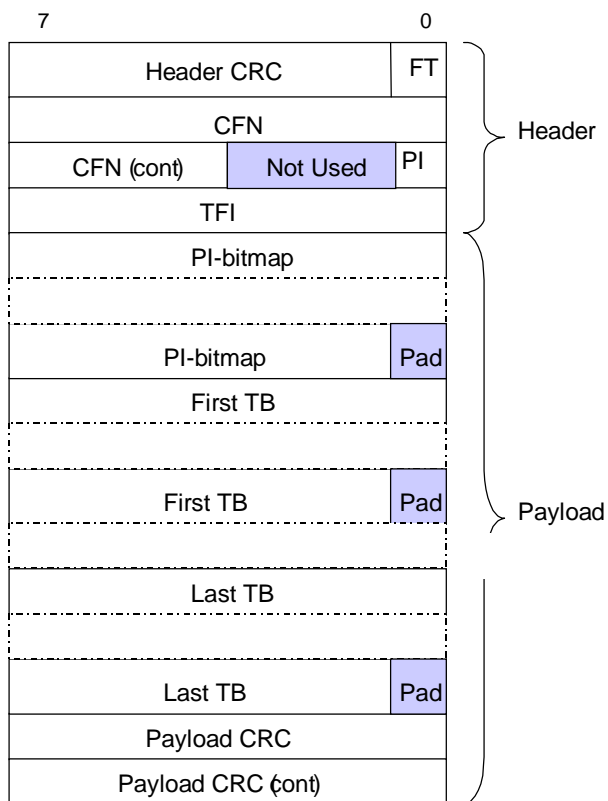


**Figure 13: PCH Data Frame structure**

"Not Used" bits shall be set to 0 by the RNC and ignored by the Node B.

## 6.2.4    Downlink Shared Channels

DSCH Data Frame includes a CFN indicating the frame in which the payload shall be sent. If the payload is to be sent over several frames, the CFN corresponding to the first frame shall be indicated.
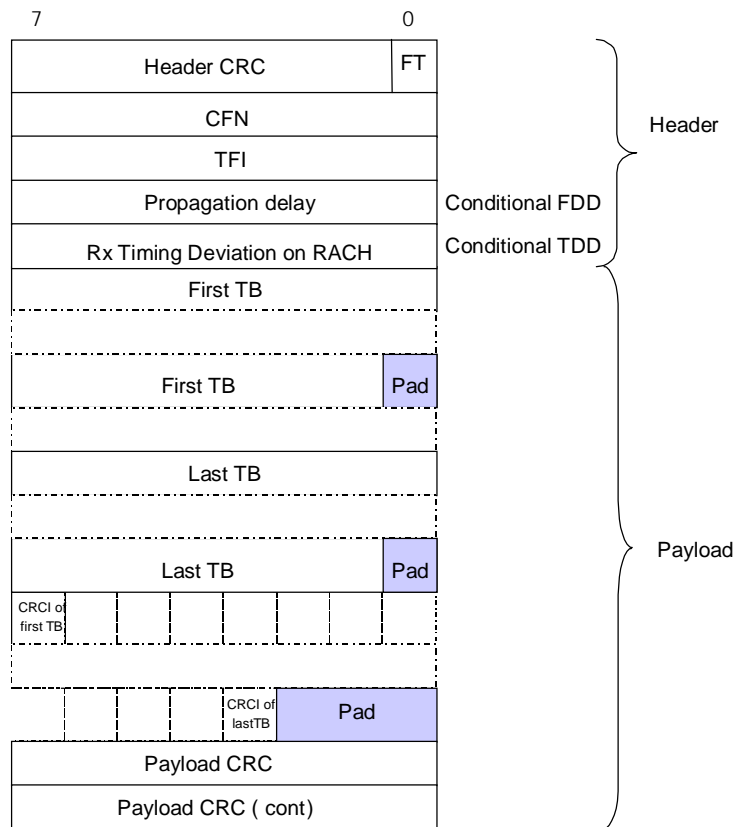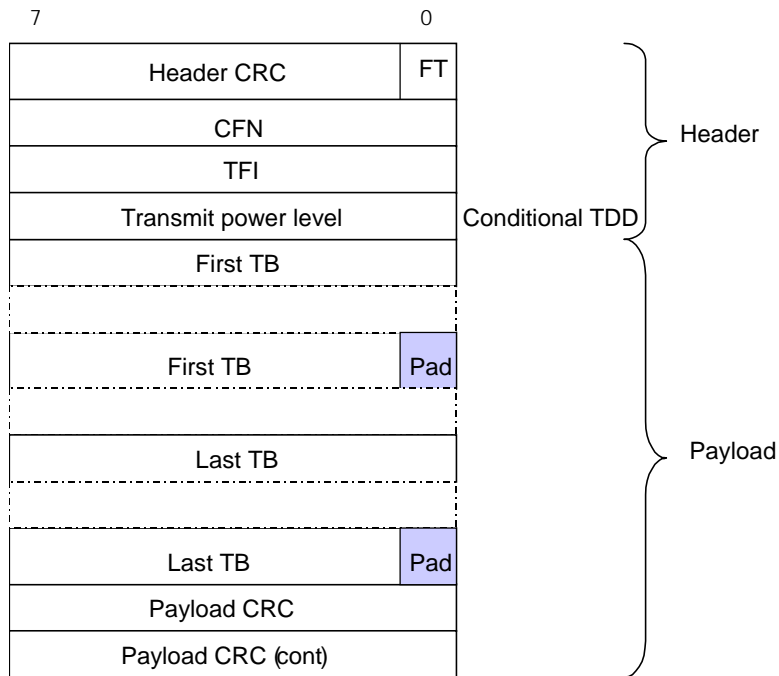


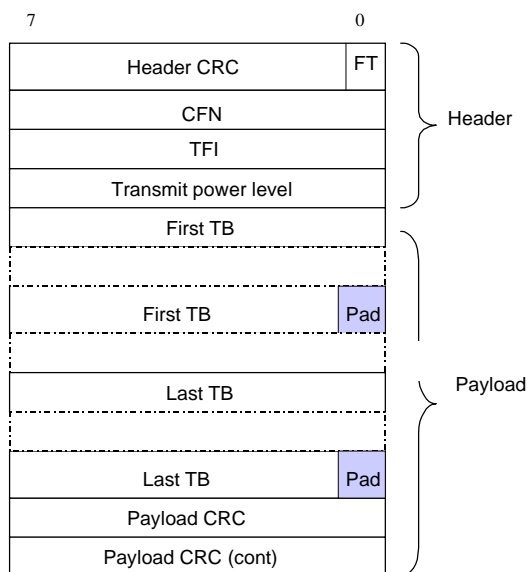**Figure 14: DSCH Data Frame structure**

Transmit power level is a conditional Information Element which is only present when the Cell supporting the DSCH Transport Channel is a TDD Cell.

## 6.2.5    Uplink Shared Channels [TDD]

USCH Data Frame includes the CFN in which the payload was received. If the payload was received in several frames, the CFN corresponding to the first frame will be indicated.
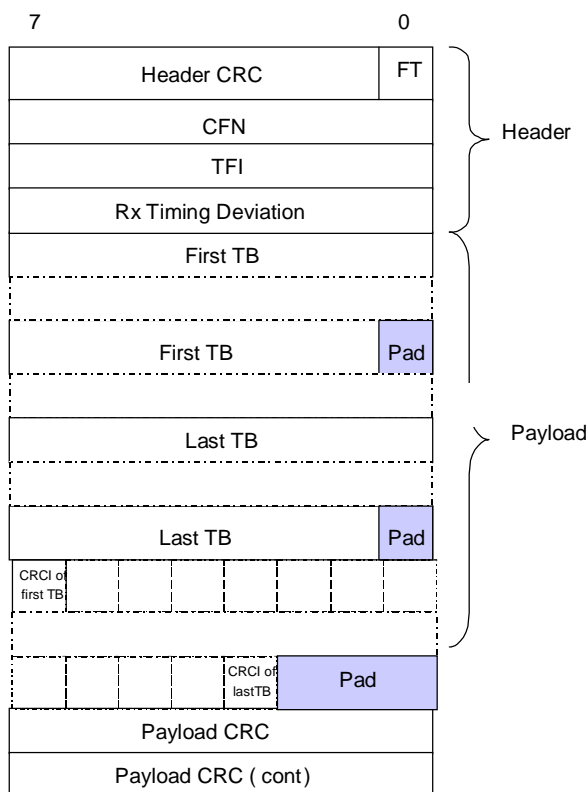
**Figure 15: USCH Data Frame structure**

## 6.2.6   Coding of information elements in data frames

### 6.2.6.1      Header CRC

**Description:** Cyclic Redundancy Polynomial calculated on the header of a data frame with polynom: $X^7+X^6+X^2+1$.

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

### 6.2.6.2      Frame Type

**Description**: describes if it is a control frame or a data frame.

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

**Field Length**: 1 bit

### 6.2.6.3      Connection Frame Number (CFN)

**Description**: indicator as to which radio frame the first data was received on uplink or shall be transmitted on downlink. The value range and field length depend on the transport channel for which the CFN is used.

**Value range (PCH)**: {0-4095}

**Value range (other)**: {0-255}

**Field length (PCH)**: 12 bits
**Field length (other)**: 8 bits

### 6.2.6.4      Transport Format Indicator

**Description**: TFI is the local number of the transport format used for the transmission time interval.

**Value range**: {0-255}

**Field length**: 8 bits

### 6.2.6.5      [FDD — Propagation delay]

**Description:** One-way radio interface delay as measured during RACH access

**Value range:** {0 – 765 chips}

**Granularity:** 3 chips

**Field length:** 8 bits

### 6.2.6.6      [TDD — Rx Timing Deviation]

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

**Value range:** { -512 ... 508 chips}

**Granularity:** 4 chips

**Field length:** 8 bits

### 6.2.6.7      Transport Block

**Description**: A block of data to be transmitted or have been received over the radio interface. The transport format indicated by the TFI describes the transport block length and transport block set size. See [3]

### 6.2.6.8      CRC indicator

**Description**: Shows if the transport block has a correct CRC. The UL Outer Loop Power Control may use the CRC indication.

**Value range**: {0=Correct, 1=Not Correct}

**Field length**: 1 bit

### 6.2.6.9      Payload CRC

**Description:** Cyclic Redundancy Polynomial calculated on the payload of a data frame with polynom $X^{16}+X^{15}+X^2+1$.

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

### 6.2.6.10      Transmit power level

**Description:** Preferred transmission power level during this TTI for the corresponding transport channel. The indicated value is the negative offset relative to the maximum power configured for the physical channel(s) used for the respective transport channel.

**Value range:** {0 .. 25.5 dB }

**Granularity:** 0.1 dB

**Field length:** 8 bits

### 6.2.6.11 Paging Indication (PI)

**Description:** Describes if the PI Bitmap is present in the payload

**Value range:** {0=no PI-bitmap in payload, 1=PI-bitmap in payload}

**Field length:** 1 bit

### 6.2.6.12 Paging Indication bitmap (PI-bitmap)

**Description**: Bitmap of Paging Indications. The order of the PI's in the bitmap corresponds to the order of the PI's on the Uu: bit 7 of the first byte contains PI0.

**Value range**: {18, 36, 72 or 144 Paging Indications}

**Field length**: 3, 4, 9 or 18 bytes  (the PI-bitmap field is padded at the end up to an octet boundary)

### 6.2.6.13 [TDD — Rx Timing Deviation on RACH]

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

**Value range:** {0-1020 chips}

**Granularity:** 4 chips

**Field length:** 8 bits

## 6.3 Control frame structure

## 6.3.1 Introduction

The Common Control Channel control frames are used to transport control information between the CRNC and the Node B. The figure below defines the Control Frame structure for common transport channels.
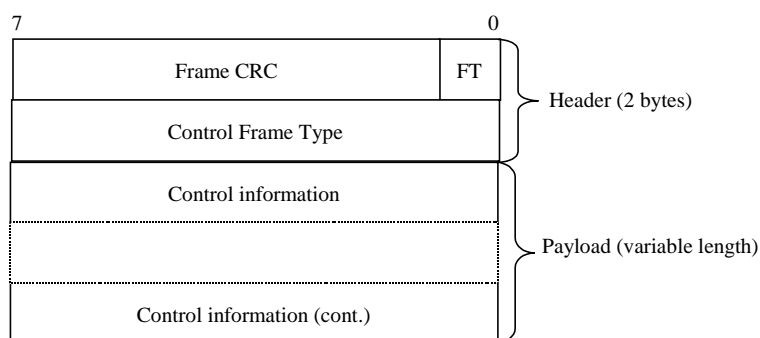


**Figure 16: Iub Common Transport Channel Control Frame Format**

The structure of the header and the payload of the control frames is defined in the following sections:

## 6.3.2 Coding of information elements of the Control frame header

### 6.3.2.1 Frame CRC

**Description:** Cyclic Redundancy Polynomial calculated on a control frame with polynom:
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 section 6.2.6.2.

## 6.3.2.3 Control Frame Type

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

**Value** values of the Control Frame Type parameter are defined in the following table:

| Type of control frame | Value |
|---|---|
| Timing adjustment | 0000 0010 |
| DL synchronisation | 0000 0011 |
| UL synchronisation | 0000 0100 |
| DL Node synchronisation | 0000 0110 |
| UL Node synchronisation | 0000 0111 |

**Field Length:** 8 bits

## 6.3.3 Payload structure and information elements

### 6.3.3.1 Timing Adjustment

#### 6.3.3.1.1 Payload Structure

Table below shows the structure of the payload when control frame is used for the timing adjustment.
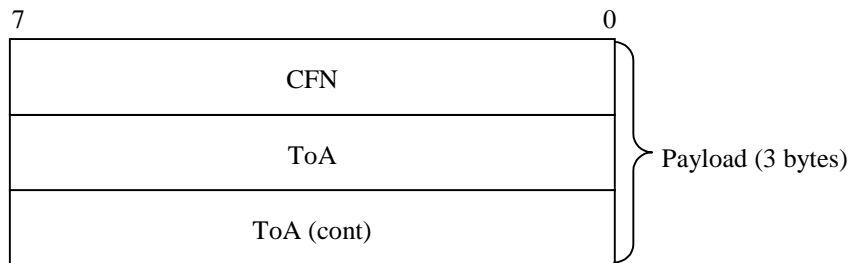


**Figure 17: Timing adjustment payload structure (non-PCH transport bearers)**
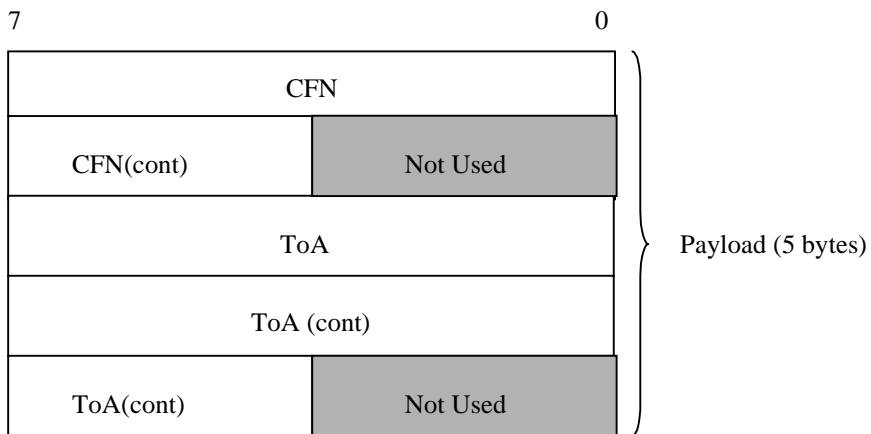
**Figure 18: Timing adjustment payload structure (PCH transport bearer)**

### 6.3.3.1.2 CFN

Refer to section 6.2.6.3.

### 6.3.3.1.3 Time of arrival (ToA)

**Description:** Time difference between the arrival of the DL frame with respect to TOAWE (based on the CFN in the frame). The value range and field length depend on the transport channel for which the CFN is used.

**Value range (PCH):** { -20480ms, +20479.875ms}

**Value range (other):** {-1280ms, +1279.875ms}

**Granularity:** 125μs

**Field length (PCH):** 20 bits

**Field length (other):** 16 bits

### 6.3.3.2 DL synchronisation

### 6.3.3.2.1 Payload Structure

Table below shows the structure of the payload when control frame is used for the user plane synchronisation.



**Figure 19: DL Synchronisation payload structure (non-PCH transport bearers)**

**Figure 20: DL Synchronisation payload structure (PCH transport bearers)**

### 6.3.3.2.2          CFN

Refer to section 6.2.6.3.

## 6.3.3.3          UL Synchronisation

### 6.3.3.3.1          Payload Structure

Table below shows the structure of the payload when the control frame is used for the user plane synchronisation (UL).



**Figure 21: UL Synchronisation payload structure (non-PCH transport bearers)**
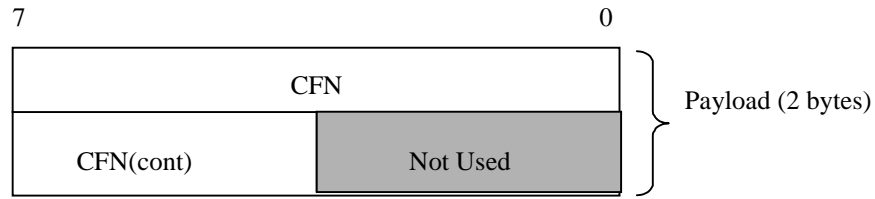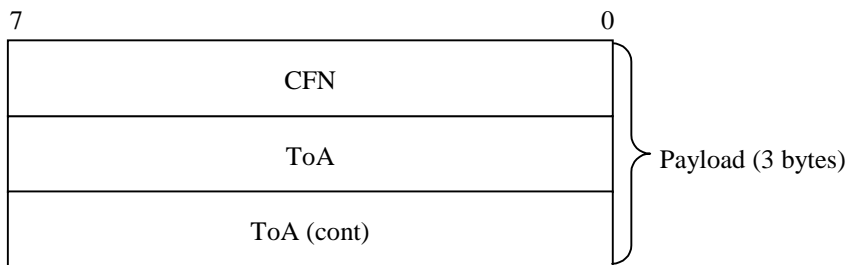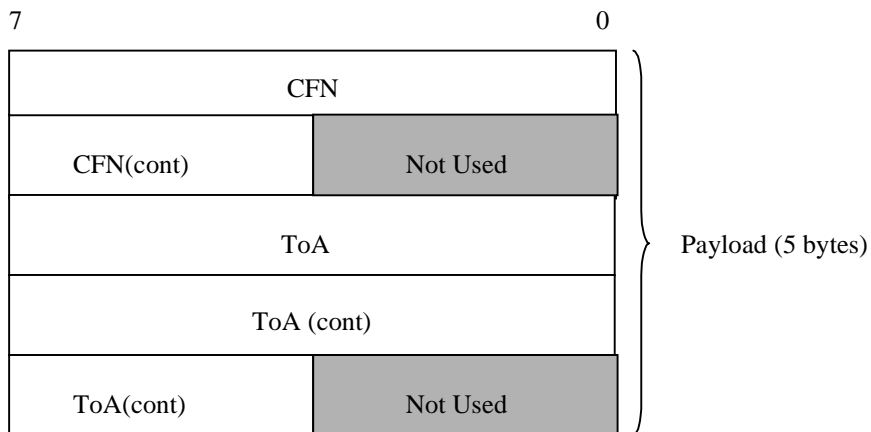


**Figure 22: UL Synchronisation payload structure (PCH transport bearers)**

### 6.3.3.3.2          CFN

Refer to section 6.2.6.3.

### 6.3.3.3.3          Time of Arrival (TOA)

Refer to section 6.3.3.1.3.

## 6.3.3.4      DL Node Synchronisation

### 6.3.3.4.1      Payload Structure

The payload of the DL Node synchronisation control frames is shown in the figure below:
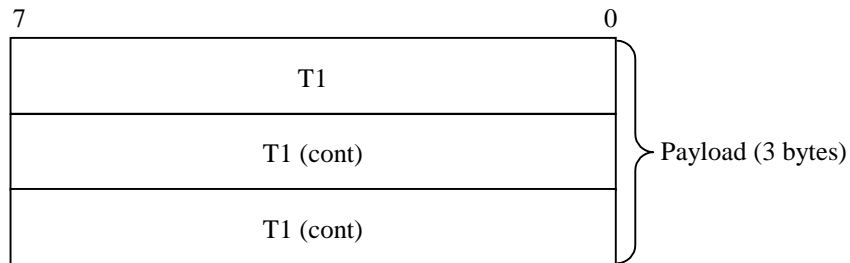


### 6.3.3.4.2      T1

**Description:** RNC specific frame number (RFN) that indicates the time when RNC sends the frame through the SAP to the transport layer.

**Value range:** 0-40959.875 ms, and the granularity is 0.125 ms.

**Field length**: 24 bits.

## 6.3.3.5      UL Node Synchronisation

### 6.3.3.5.1      Payload Structure

The payload of the UL Node synchronisation control frames is shown in the figure below:

```
       7                                   0
      ┌─────────────────────────────┐  ⎫
      │             T1              │  │
      ├─────────────────────────────┤  │
      │          T1 (cont)          │  │
      ├─────────────────────────────┤  │
      │          T1 (cont)          │  │
      ├─────────────────────────────┤  │
      │             T2              │  │
      ├─────────────────────────────┤  ⎬  Payload (9 bytes)
      │          T2 (cont)          │  │
      ├─────────────────────────────┤  │
      │          T2 (cont)          │  │
      ├─────────────────────────────┤  │
      │             T3              │  │
      ├─────────────────────────────┤  │
      │          T3 (cont)          │  │
      ├─────────────────────────────┤  │
      │          T3 (cont)          │  ⎭
      └─────────────────────────────┘
```
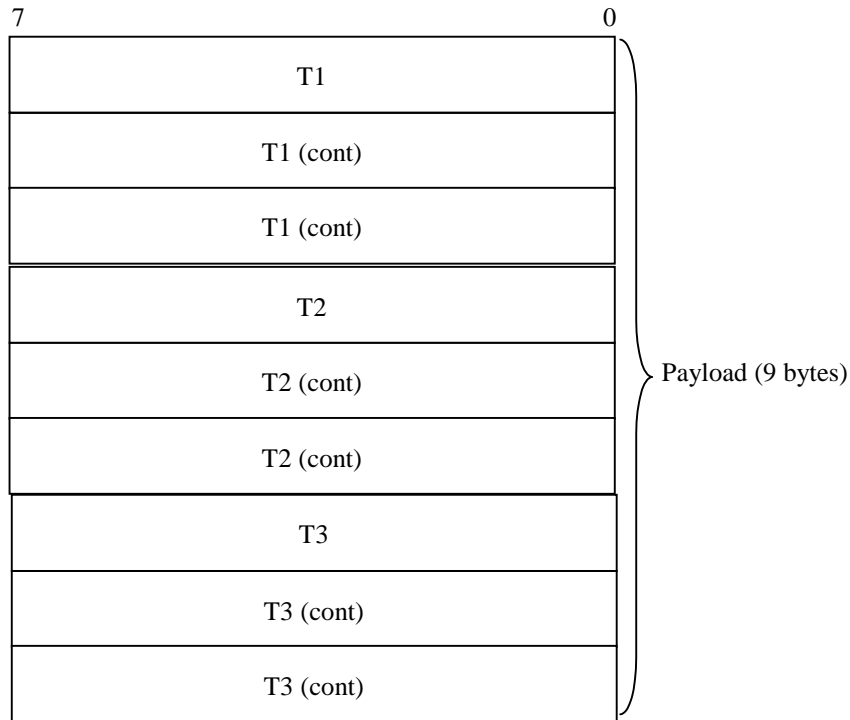
### 6.3.3.5.2     T1

**Description:** T1 timer is extracted from the correspondent DL Node synchronisation control frame.

**Value range:** 0-40959.875 ms, and the granularity is 0.125 ms.

**Field length**: 24 bits.

### 6.3.3.5.3     T2

**Description:** Node B specific frame number (BFN) that indicates the time when Node B received the correspondent DL synchronisation frame through the SAP from the transport layer.

**Value range:** 0-40959.875 ms, and the granularity is 0.125 ms.

**Field length**: 24 bits.

### 6.3.3.5.4     T3

**Description:** Node B specific frame number (BFN) that indicates the time when Node B sends the frame through the SAP to the transport layer.

**Value range:** 0-40959.875 ms, and the granularity is 0.125 ms.

**Field length**: 24 bits.

# 7     Frame protocol error handling

A received frame protocol frame with unknown Information element or with illegal Information element value shall be ignored.

# Annex A (informative):
# Document Stability Assessment Table

| Section | Content missing | Incomplete | Restructuring needed | Checking needed | Editorial work required | Finalisation needed | Almost stable | Stable |
|---|---|---|---|---|---|---|---|---|
| 1 | | | | | | | | √ |
| 2 | | | | | | | | √ |
| 3 | | | | | | | | √ |
| 4 | | | | | | | | √ |
| 5 | | | | | | | | √ |
| 6 | | | | | | | | √ |
| 7 | | | | | | | | √ |

# Annex B (informative):
# List of Open Issues

The open issues identified are the following:

1. Backward compatibility and definition of the compatibility information

2. Support for CPCH

# Annex C (informative): Change History

| Change history | | | | | |
|---|---|---|---|---|---|
| TSG RAN# | Version | CR | Tdoc RAN | New Version | Subject/Comment |
| RAN_05 | - | - | - | 3.0.0 | Approved at TSG RAN #5 and placed under Change Control |
| RAN_06 | 3.0.0 | 001 | RP-99765 | 3.1.0 | Approved at TSG RAN #6 |
| RAN_06 | 3.0.0 | 002 | RP-99766 | 3.1.0 | Approved at TSG RAN #6 |

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# History

| Document history | | |
|---|---|---|
| V3.1.0 | January 2000 | Publication |
| | | |
| | | |
| | | |