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Technical Specification

3GPP

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Contents

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Foreword

This Technical Specification (TS) has been produced by the 3rd Generation Partnership Project (3GPP).
The contents of this TS are subject to continuing work within 3GPP TSG RAN and may change following formal TSG RAN approval. Should the TSG modify the contents of this TS, it will be re-released with an identifying change of release date and an increase in version number as follows:

Version m.t.e

where:

m indicates [major version number]

x the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

y the third digit is incremented when editorial only changes have been incorporated into the specification.

Introduction

This clause is optional. If it exists, it is always the third unnumbered clause.
No text block identified.

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

References may be made to:

a) specific versions of publications (identified by date of publication, edition number, version number, etc.), in which case, subsequent revisions to the referenced document do not apply;

b) all versions up to and including the identified version (identified by "up to and including" before the version identity);

c) all versions subsequent to and including the identified version (identified by "onwards" following the version identity); or

d) publications without mention of a specific version, in which case the latest version applies.

A non-specific reference to an ETS shall also be taken to refer to later versions published as an EN with the same number.

[1] TS UMTS 25.301, Radio Interface Protocol Architecture
[2] TS 25.401 UTRAN architecture description
[3] TS 25.302 Services provided by the Physical Layer, Source WG2

3 Definitions, symbols 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 Symbols

3.3 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

DCH frame protocol 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.

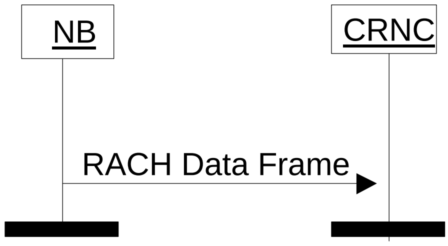


Figure 1. RACH Data Transfer Procedure.

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 CRC to node B.

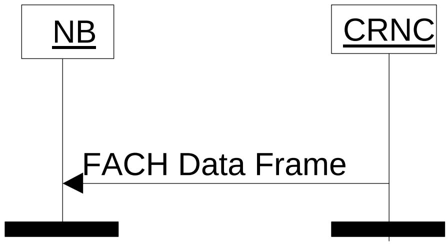


Figure 2. FACH Data Transfer Procedure.

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 CRC 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 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.

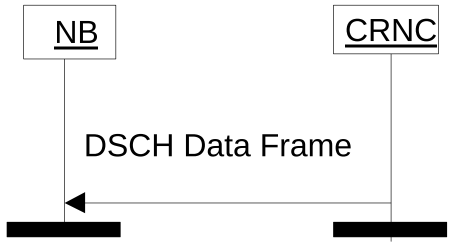


Figure 4. DSCH Data Transfer Procedure.

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.

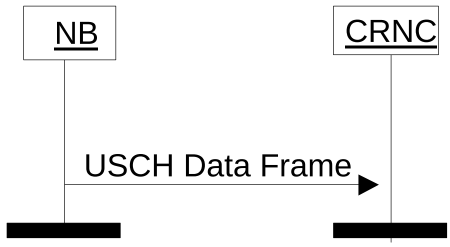


Figure 5. RACH Data Transfer Procedure.

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 Synchronisation control frame, the Node B shall respond with UL 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 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].

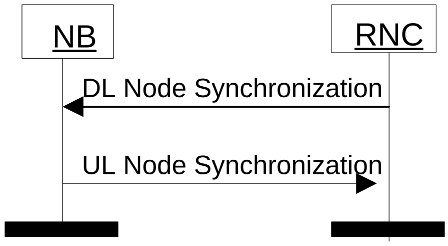


Figure 6. Node Synchronisation procedure.

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.

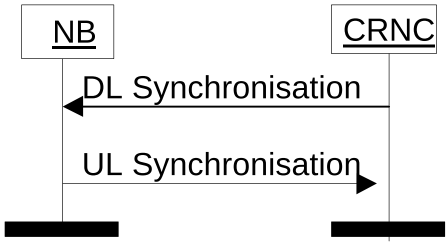


Figure 7. DL Transport Channels Synchronisation procedure.

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].

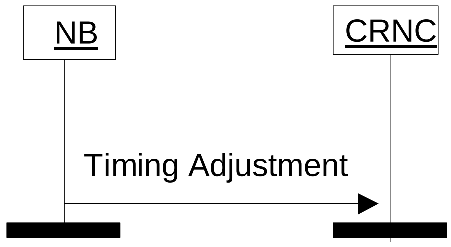


Figure 8. FACH and PCH Timing Adjustment procedure.

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 table 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:

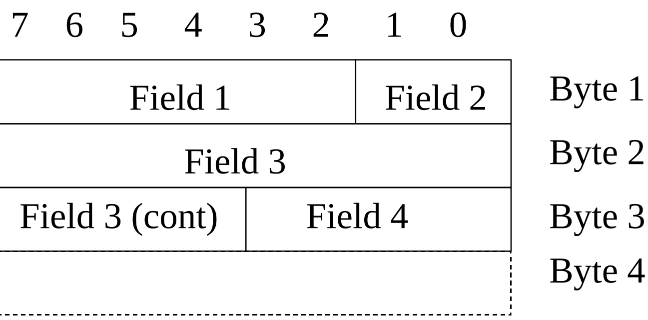


Figure 10.Example frame structure

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 picture 1). In addition, if a field spans several bytes, more significant bits will be located in lower numbered bytes (right of frame in picture 1).

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.

The RACH Data frame structure is different for FDD and TDD.

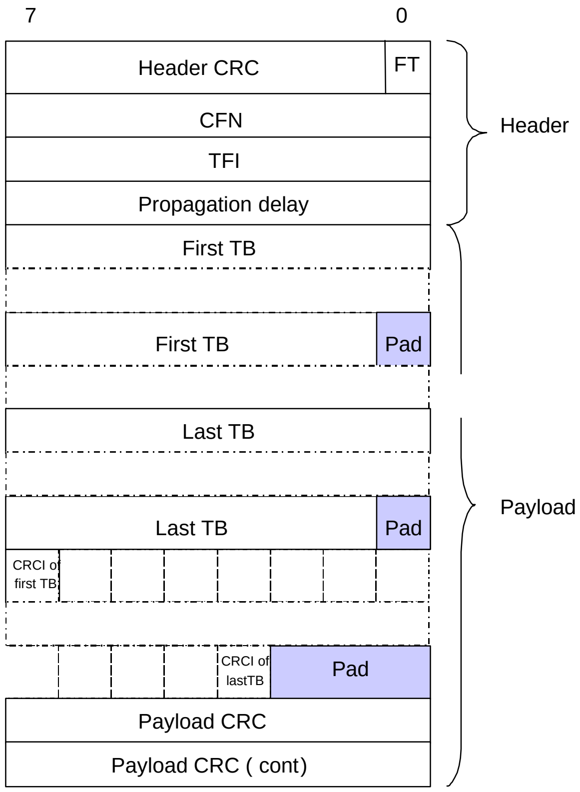


Figure 11. FDD RACH Data Frame structure

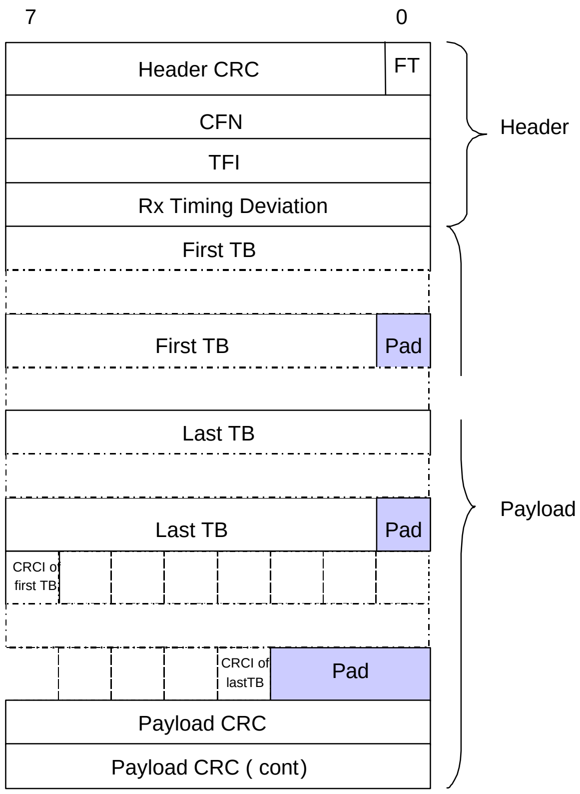


Figure 12.TDD RACH Data Frame structure

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.

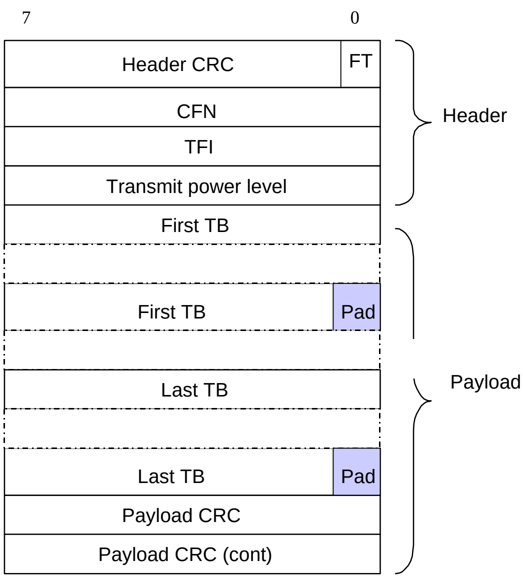


Figure 13. FACH Data Frame structure

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.

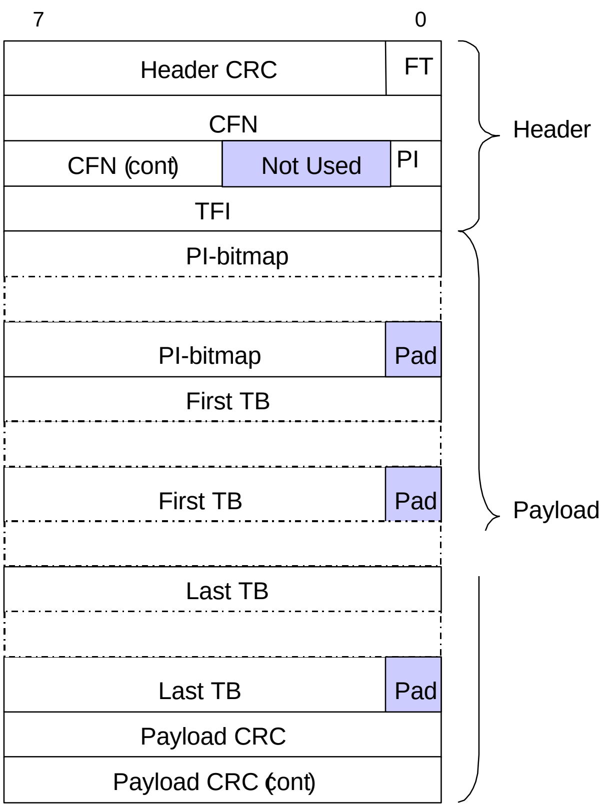


Figure 14. PCH Data Frame structure

"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.

The DSCH Data frame structure is different for FDD and TDD.

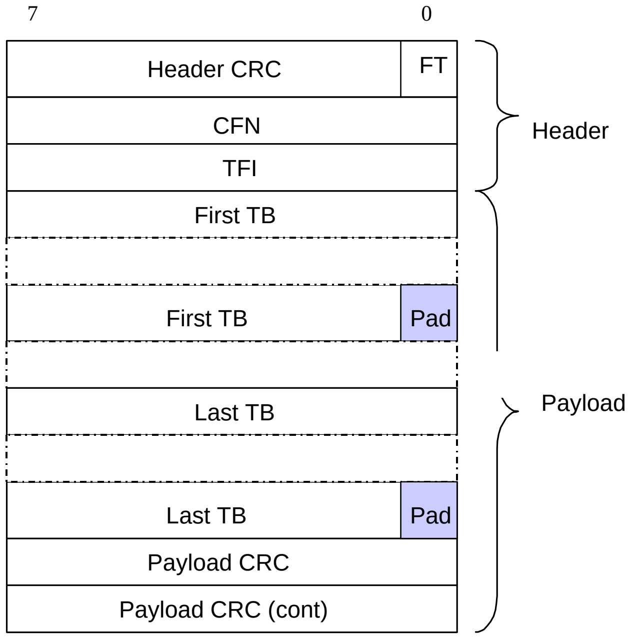


Figure 15.FDD DSCH Data Frame structure

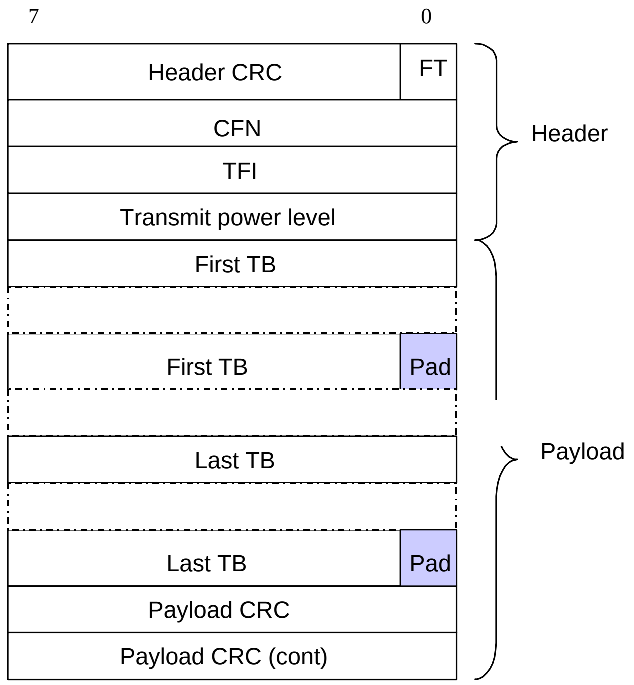


Figure 16.TDD DSCH Data Frame structure

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.

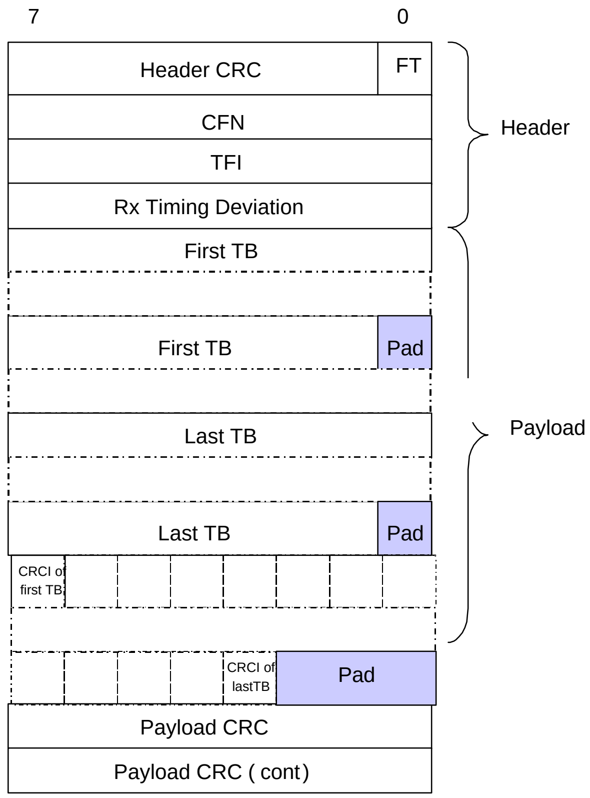


Figure 17. USCH Data Frame structure

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: {0-1020 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 offset relative to the maximum power configured for the [FDD — secondary CCPCH]/[TDD — CCPCH]
Value range: {0 - 25.4 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)

6.3 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.

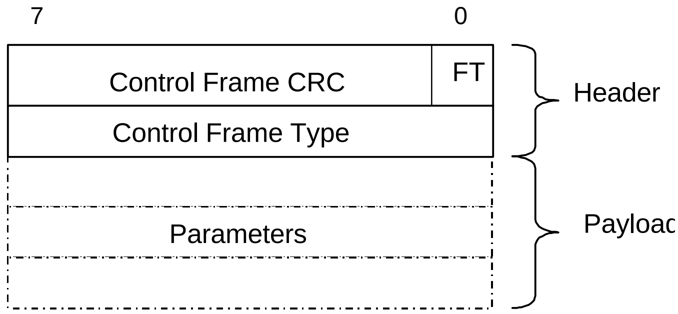


Figure 18. Iub Common Transport Channel Control Frame Format

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 Control 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

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.

7	0	
CFN		Payload (3 bytes)
ToA		
ToA (cont)		

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, +20470ms}
Value range (other): {-1280ms, +1270ms}**Granularity:** 1ms
Field length: coding is 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.

7	0	
CFN		Payload (1 byte)

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).

6.3.3.3.2 CFN

Refer to section 6.2.6.3

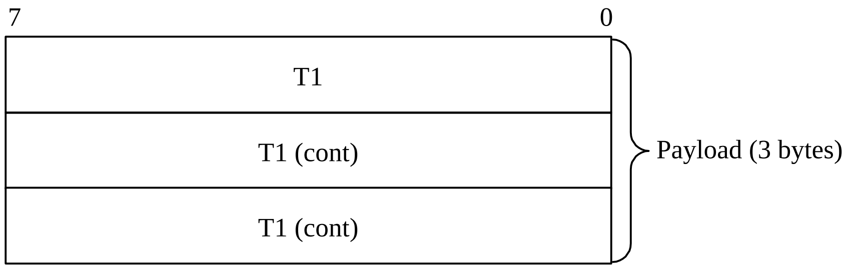
6.3.3.3.3 Time of Arrival (TOA)

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:



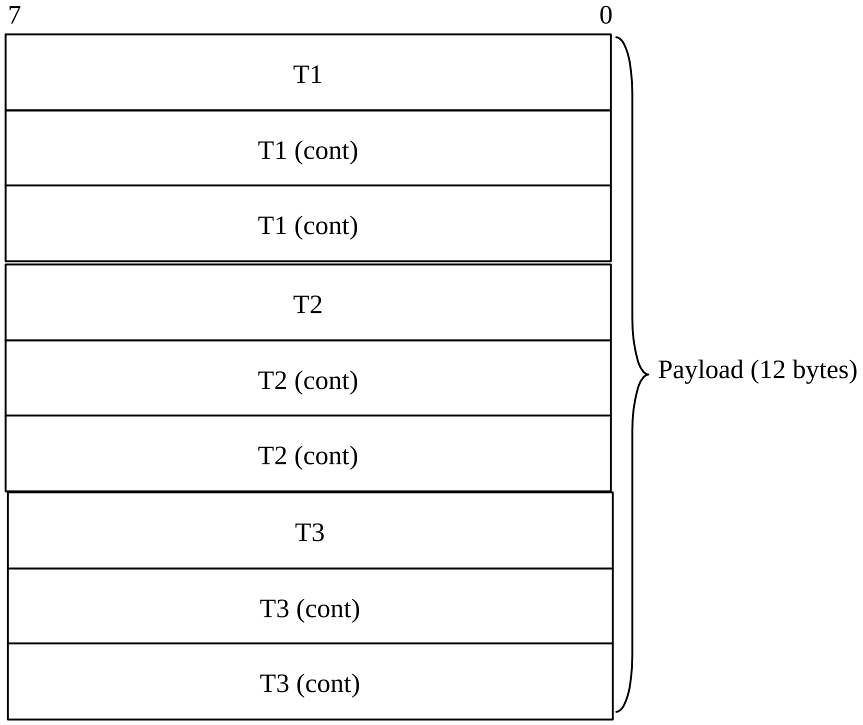
6.3.3.4.2 T1

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:



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.

Appendices

Annex A 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 List of Open Issues

The open issues identified are the following:

1. Backward compatibility and definition of the compatibility information
2. Support for CPCH

History

Document history		
Edition x	<MMMM yyyy>	Publication as <old doctype> <old docnumber>
0.0.1	February 1999	Proposal for document structure.
0.0.2	February 1999	Renaming of section 4.1, 5.1 and 6.1 to RACH/FACH instead of common channels.
0.0.3	March 1999	• Alignment of document structure to the structure of S3.25 • Renaming of CCH to Common Transport Channel.
0.1.0	April 1999	Mail Approval of version 0.0.3 by TSG RAN WG3.
0.1.1	May 1999	Addition of Document Stability Assessment Table
0.2.0	June 1999	Approval of 0.1.1 by 3GPP TSG RAN WG3. Version raised to 0.2.0
0.2.1	June 1999	Revised according to the decisions of 3GPP TSG RAN WG3 Meeting #4 • Creation of sections related to USCH (sections 4.1.3, 5.1.3, 5.2.3, 6.1.3 and 6.2.3) from Tdoc R3-99497
0.3.0	July 1999	Approval of 0.2.1 by 3GPP TSG RAN WG3. Version raised to 0.3.0
0.3.1	July 1999	Revised according to the decisions of 3GPP TSG RAN WG3 Meeting #5 • Filling of section "6 Frame Structure and Coding" from Tdocs R3-99632, R3-99633, R3-99674 and R3-99735. • Filling of section "6 Data Streams User Plane Procedures" from Tdoc R3-99663 • Editorial work to reach some consistency. • New Stability Assessment proposal.

0.3.0	September 1999	Addition to the FACH/PCH frame of the following note: *" Note: The presence of the FACH related part and/or PCH related part in the Frame is determined at the setup of the common channel."* Approval of 0.3.1 by 3GPP TSG RAN WG3. Version raised to 0.4.0
0.3.1	September 1999	Revised according to the decisions of 3GPP TSG RAN WG3 meeting #6 • Separation of the FACH/PCH FP into FACH FP and PCH FP. • Add precision on the meaning of the frame number in the FACH FP and PCH FP according to Tdoc R3-99934 • Modified RACH FP layout according to Tdoc R3-99848 and R3-99923. • Reflect the use of CFN on common channels instead of FN_{CELL}. • Addition as editorial proposal of sections "6.3.3.4 DL Node Synchronisation", "6.3.3.5 UL Node Synchronisation" and "6.2.1. Node Synchronisation" to reflect the outcome of the Sync Ad Hoc on Node Synchronisation according to Tdoc R3-99A45. • Addition of "Annex B List of Open Issues"
0.4.2.	September 1999	Update according to decisions of 3GPP TSG RAN WG3 meeting #7. Addressed contributions are: B64, B65, B66, B67, B96, C04, C09, C10, C11, C12, C13 Alignment of the structure of the document with TS25.427 Proposals for IE coding
0.5.0	September 1999	Update according to remarks agreed during 3GPP TSG RAN WG3 meeting #7

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