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Technical Specification

**Universal Mobile Telecommunications System (UMTS);
UTRAN Iub/Iur interface user plane
protocol for DCH data streams
(3GPP TS 25.427 version 9.0.1 Release 9)**



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Contents

Intellectual Property Rights	2
Foreword.....	2
Foreword.....	6
1 Scope	7
2 References	7
3 Definitions and abbreviations.....	7
3.1 Definitions	7
3.2 Abbreviations	8
3.3 Specification Notations	8
4 General aspects.....	9
4.1 DCH and E-DCH FP services	9
4.2 Services expected from the Data Transport Network layer.....	10
4.3 Protocol Version.....	10
5 DCH Frame Protocol procedures	10
5.1 Data Transfer.....	10
5.1.0 General.....	10
5.1.1 Uplink for DCH	11
5.1.1a Uplink for E-DCH	11
5.1.2 Downlink	12
5.2 Timing Adjustment.....	12
5.3 DCH Synchronisation.....	13
5.4 Outer Loop PC Information Transfer [FDD, 1.28 Mcps TDD].....	14
5.5 Node Synchronisation	14
5.6 Rx Timing Deviation Measurement [3.84 Mcps and 7.68 Mcps TDD]	15
5.7 DSCH TFCI Signalling [FDD].....	15
5.8 Radio Interface Parameter Update [FDD]	15
5.9 Timing Advance [3.84 Mcps and 7.68 Mcps TDD].....	16
5.10 General	16
5.10.1 Transport bearer replacement	16
5.10.2 Transport channel addition	17
5.11 Generation of subframe number	17
5.12 Generation of number of HARQ retransmissions	17
5.13 Indication of HARQ failure	17
5.14 TNL Congestion Indication	18
6 Frame structure and coding	19
6.1 General	19
6.1.1 General principles for the coding.....	19
6.2 Data frames	20
6.2.1 Introduction.....	20
6.2.2 UL DATA FRAME	20
6.2.2.1 UL DATA FRAME FOR DCH	20
6.2.2.2 UL DATA FRAME FOR E-DCH TYPE 1.....	22
6.2.2.3 UL DATA FRAME FOR E-DCH TYPE 2.....	23
6.2.3 DL DATA FRAME	25
6.2.4 Coding of information elements in data frames	27
6.2.4.1 Header CRC	27
6.2.4.2 Frame Type (FT).....	27
6.2.4.3 Connection Frame Number (CFN).....	27
6.2.4.4 Transport Format Indicator (TFI).....	27
6.2.4.5 Quality Estimate (QE).....	27
6.2.4.6 Transport Block (TB).....	28
6.2.4.7 CRC indicator (CRCI).....	28

6.2.4.8	Payload CRC.....	28
6.2.4.9	Spare Extension.....	28
6.2.4.10	Subframe Number.....	28
6.2.4.11	Number of HARQ Retransmissions, NHR.....	28
6.2.4.12	Number of Subframes.....	29
6.2.4.13	Number of MAC-es PDUs.....	29
6.2.4.14	Data Description Indicator, DDI.....	29
6.2.4.15	Number of MAC-d PDUs, N.....	29
6.2.4.16	FSN – Frame Sequence Number.....	29
6.2.4.17	Number of MAC-is PDUs.....	30
6.2.4.18	User Buffer size.....	30
6.2.4.19	Number of MAC-is SDU in frame.....	30
6.2.4.20	MAC-is PDU descriptor.....	30
6.2.4.21	UL Multiplexing Information (UL Mux Info)[FDD].....	30
6.3	Control frames.....	30
6.3.1	Introduction.....	30
6.3.2	Header structure of the control frames.....	31
6.3.2.1	Frame CRC.....	31
6.3.2.2	Frame Type (FT).....	31
6.3.2.3	Control Frame Type.....	31
6.3.3	Payload structure and information elements.....	32
6.3.3.1	TIMING ADJUSTMENT.....	32
6.3.3.1.1	Payload structure.....	32
6.3.3.1.2	CFN.....	32
6.3.3.1.3	Time of Arrival (ToA).....	32
6.3.3.1.4	Spare Extension.....	33
6.3.3.2	DL SYNCHRONISATION.....	33
6.3.3.2.1	Payload structure.....	33
6.3.3.2.2	CFN.....	33
6.3.3.2.3	Spare Extension.....	33
6.3.3.3	UL SYNCHRONISATION.....	33
6.3.3.3.1	Payload structure.....	33
6.3.3.3.2	CFN.....	34
6.3.3.3.3	Time of Arrival (ToA).....	34
6.3.3.3.4	Spare Extension.....	34
6.3.3.4	OUTER LOOP POWER CONTROL [FDD, 1.28Mcps TDD].....	34
6.3.3.4.1	Payload structure.....	34
6.3.3.4.2	SIR Target.....	35
6.3.3.4.3	Spare Extension.....	35
6.3.3.4.4	UL Mux Info.....	35
6.3.3.5	DL NODE SYNCHRONISATION.....	35
6.3.3.5.1	Payload structure.....	35
6.3.3.5.2	T1.....	35
6.3.3.5.3	Spare Extension.....	36
6.3.3.6	UL NODE SYNCHRONISATION.....	36
6.3.3.6.1	Payload structure.....	36
6.3.3.6.2	T1.....	36
6.3.3.6.3	T2.....	37
6.3.3.6.4	T3.....	37
6.3.3.6.5	Spare Extension.....	37
6.3.3.7	RX TIMING DEVIATION [3.84 Mcps and 7.68Mcps TDD].....	37
6.3.3.7.1	Payload structure.....	37
6.3.3.7.2	Rx Timing Deviation [3.84 Mcps TDD].....	38
6.3.3.7.2A	Rx Timing Deviation [7.68 Mcps TDD].....	38
6.3.3.7.2B	E-RUCCH Flag.....	38
6.3.3.7.3	Spare Extension.....	38
6.3.3.7.4	CFN.....	38
6.3.3.7.5	New IE Flags.....	38
6.3.3.8	DSCH TFCI SIGNALLING [FDD].....	39
6.3.3.8.1	Payload structure.....	39
6.3.3.8.2	TFCI (field 2).....	39
6.3.3.8.3	Spare Extension.....	39

6.3.3.8.4	CFN	39
6.3.3.9	RADIO INTERFACE PARAMETER UPDATE [FDD]	39
6.3.3.9.1	Payload structure	39
6.3.3.9.2	Radio Interface Parameter Update flags	40
6.3.3.9.3	TPC Power Offset (TPC PO)	41
6.3.3.9.4	Spare Extension	41
6.3.3.9.4A	CFN	41
6.3.3.9.5	DPC Mode	41
6.3.3.9.6	TFCI Power Offset (TFCI PO)	41
6.3.3.9.7	TFCI Power Offset for primary cell (TFCI PO_primary)	41
6.3.3.9.8	Multiple RL Sets Indicator	41
6.3.3.9.9	Maximum UE TX Power	41
6.3.3.10	TIMING ADVANCE [3.84Mcps and 7.68 Mcps TDD]	42
6.3.3.10.1	Payload structure	42
6.3.3.10.2	CFN	43
6.3.3.10.3	TA [3.84 Mcps]	43
6.3.3.10.3A	TA [7.68 Mcps]	43
6.3.3.10.4	Spare Extension	43
6.3.3.10.5	New IE Flags [7.68Mcps TDD]	43
6.3.3.11	TNL CONGESTION INDICATION	43
6.3.3.11.1	Payload structure	43
6.3.3.11.2	Congestion Status	44
6.3.3.11.3	Spare Extension	44
7	Handling of Unknown, Unforeseen and Erroneous Protocol Data	44
7.1	General	44
7.2	Error detection	44
7.2.1	CRC Calculation	44
7.2.1.1	Relation between input and output of the Cyclic Redundancy Check	45
Annex A (informative):	Change history	46
History		48

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1 Scope

The present document shall provide a description of the UTRAN Iur and Iub interfaces user plane protocols for Dedicated 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.
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- 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 TS 25.301: "Radio Interface Protocol Architecture".
- [2] 3GPP TS 25.401: "UTRAN Overall Description".
- [3] 3GPP TS 25.302: "Services provided by the Physical Layer".
- [4] 3GPP TS 25.433: "UTRAN Iub interface NBAP signalling".
- [5] 3GPP TS 25.402: "Synchronization in UTRAN, Stage 2".
- [6] 3GPP TS 25.423: "UTRAN Iur interface RNSAP signalling".
- [7] 3GPP TS 25.133: 'Requirements for support of radio resource management (FDD)'.
- [8] 3GPP TS 25.123: 'Requirements for support of radio resource management (TDD)'.
- [9] 3GPP TS 25.212: "Multiplexing and channel coding (FDD)".
- [10] 3GPP TS 25.222: "Multiplexing and channel coding (TDD)".
- [11] 3GPP TS 25.224: "Physical Layer Procedures (TDD)".
- [12] 3GPP TS 25.214: "Physical Layer Procedures (FDD)".
- [13] 3GPP TS 25.319: 'Enhanced Uplink; Overall description; Stage 2'
- [14] 3GPP TS 25.101: 'User Equipment (UE) Radio Transmission and Reception (FDD)'
- [15] 3GPP TS 25.331: 'Radio Resource Control (RRC) Protocol Specification'
- [16] 3GPP TS 25.321: 'Medium Access Control (MAC) protocol specification'

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply:

Transport Bearer: service provided by the transport layer and used by frame protocol for the delivery of FP PDU

3.2 Abbreviations

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

BER	Bit Error Rate
CFN	Connection Frame Number
CRC	Cyclic Redundancy Checksum
CRCI	CRC Indicator
DCH	Dedicated Transport Channel
DL	Downlink
DPC	Downlink Power Control
DSCH	Downlink Shared Channel
DTX	Discontinuous Transmission
E-DCH	Enhanced DCH
FP	Frame Protocol
FT	Frame Type
HARQ	Hybrid ARQ
LTOA	Latest Time of Arrival
PC	Power Control
QE	Quality Estimate
RL	Radio Link
SIR	Signal-to-Interference Ratio
TB	Transport Block
TBS	Transport Block Set
TFI	Transport Format Indicator
TFCI	Transport Format Combination Indicator
ToA	Time of Arrival
ToAWE	Time of Arrival Window Endpoint
ToAWS	Time of Arrival Window Startpoint
TPC	Transmit Power Control
TTI	Transmission Time Interval
UE	User Equipment
UL	Uplink

3.3 Specification Notations

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

- [FDD] This tagging of a word indicates that the word preceding the tag "[FDD]" applies only to FDD. This tagging of a heading indicates that the heading preceding the tag "[FDD]" and the section following the heading applies only to FDD.
- [TDD] This tagging of a word indicates that the word preceding the tag "[TDD]" applies only to TDD, including 7.68 Mcps TDD, 3.84Mcps TDD and 1.28Mcps TDD. This tagging of a heading indicates that the heading preceding the tag "[TDD]" and the section following the heading applies only to TDD, including 7.68Mcps TDD, 3.84Mcps TDD and 1.28Mcps TDD.
- [7.68Mcps TDD] This tagging of a word indicates that the word preceding the tag "[7.68Mcps TDD]" applies only to 7.68Mcps TDD. This tagging of a heading indicates that the heading preceding the tag "[7.68Mcps TDD]" and the section following the heading applies only to 7.68Mcps TDD.
- [3.84Mcps TDD] This tagging of a word indicates that the word preceding the tag "[3.84Mcps TDD]" applies only to 3.84Mcps TDD. This tagging of a heading indicates that the heading preceding the tag "[3.84Mcps TDD]" and the section following the heading applies only to 3.84Mcps TDD.
- [1.28Mcps TDD] This tagging of a word indicates that the word preceding the tag "[1.28Mcps TDD]" applies only to 1.28Mcps TDD. This tagging of a heading indicates that the heading preceding the tag "[1.28Mcps TDD]" and the section following the heading applies only to 1.28Mcps TDD.
- [FDD - ...] This tagging indicates that the enclosed text following the "[FDD -]" applies only to FDD. Multiple sequential paragraphs applying only to FDD are enclosed separately to enable insertion of TDD specific (or common) paragraphs between the FDD specific paragraphs.

[TDD - ...]	This tagging indicates that the enclosed text following the "[TDD - " applies only to TDD including 7.68 Mcps TDD, 3.84Mcps TDD and 1.28Mcps TDD. Multiple sequential paragraphs applying only to TDD are enclosed separately to enable insertion of FDD specific (or common) paragraphs between the TDD specific paragraphs.
[7.68Mcps TDD - ...]	This tagging indicates that the enclosed text following the "[7.68Mcps TDD - " applies only to 7.68Mcps TDD. Multiple sequential paragraphs applying only to 7.68Mcps TDD are enclosed separately to enable insertion of FDD and TDD specific (or common) paragraphs between the 7.68Mcps TDD specific paragraphs.
[3.84Mcps TDD - ...]	This tagging indicates that the enclosed text following the "[3.84Mcps TDD - " applies only to 3.84Mcps TDD. Multiple sequential paragraphs applying only to 3.84Mcps TDD are enclosed separately to enable insertion of FDD and TDD specific (or common) paragraphs between the 3.84Mcps TDD specific paragraphs.
[1.28Mcps TDD - ...]	This tagging indicates that the enclosed text following the "[1.28Mcps TDD - " applies only to 1.28Mcps TDD. Multiple sequential paragraphs applying only to 1.28Mcps TDD are enclosed separately to enable insertion of FDD and TDD specific (or common) paragraphs between the 1.28Mcps TDD specific paragraphs.
Procedure	When referring to a procedure in the specification, the Procedure Name is written with the first letters in each word in upper case characters followed by the word "procedure", e.g. Timing Adjustment procedure.
Frame	When referring to a control or data frame in the specification, the CONTROL/DATA FRAME NAME is written with all letters in upper case characters followed by the words "control/data frame", e.g. DL SYNCHRONISATION control frame.
IE	When referring to an information element (IE) in the specification, the <i>Information Element Name</i> is written with the first letters in each word in upper case characters and all letters in Italic font followed by the abbreviation "IE", e.g. <i>Connection Frame Number</i> IE.
Value of an IE	When referring to the value of an information element (IE) in the specification, the "Value" is written as it is specified in subclause 6.2.4 or 6.3.3 enclosed by quotation marks, e.g. "0" or "255".

4 General aspects

The specification of I_{ub} DCH and E-DCH data streams is also valid for I_{ur} DCH and E-DCH data streams.

The complete configuration of the transport channel is selected by the SRNC and signalled to the Node B via the Iub and Iur control plane protocols.

The parameters of a transport channel are described in TS 25.301 [1]. Transport channels are multiplexed on the downlink by the Node B on radio physical channels, and de-multiplexed on the uplink from radio physical channels to transport channels.

In Iur interface, every set of coordinated transport channels related to one UE context that is communicated over a set of cells that are macro-diversity combined within Node B or DRNC, is carried on one transport bearer. This means that there are as many transport bearers as set of coordinated transport channels and Iur DCH data ports for that communication.

In Iub interface, every set of coordinated transport channels related to one UE context that is communicated over a set of cells that are macro-diversity combined within Node B is carried on one transport bearer. This means that there are as many transport bearers as set of coordinated transport channels and Iub DCH data ports for that communication.

Bi-directional transport bearers are used.

4.1 DCH and E-DCH FP services

DCH frame protocol provides the following services:

- Transport of TBS across Iub and Iur interface.
- Transport of outer loop power control information between the SRNC and the Node B.
- Support of transport channel synchronisation mechanism.
- Support of node synchronization mechanism.
- [3.84 Mcps TDD and 7.68 Mcps - Transfer of Rx timing deviation from the Node B to the SRNC.]
- Transfer of radio interface parameters from the SRNC to the Node B.

[FDD – E-DCH frame protocol provides the following services:

- Transport of MAC-es or MAC-is PDUs across Iub and Iur interface from Node B to SRNC.
- Transport of outer loop power control information between the SRNC and the Node B.
- Transfer of radio interface parameters from the SRNC to the Node B.
- Transport of network congestion indication from SRNC across Iub and Iur interface.
- Transport of hybrid ARQ information between SRNC and Node B.]

[TDD – E-DCH frame protocol provides the following services:

- Transport of MAC-es or MAC-is PDUs across Iub and Iur interface from Node B to SRNC.
- Transport of outer loop power control information between the SRNC and the Node B.
- Transport of network congestion indication from SRNC across Iub and Iur interface.
- Transport of hybrid ARQ information between SRNC and Node B.]

4.2 Services expected from the Data Transport Network layer

Following service is required from the transport layer:

- Delivery of FP PDU.

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 protocol.

5 DCH Frame Protocol procedures

5.1 Data Transfer

5.1.0 General

When there is some data to be transmitted, DCH data frames are transferred every transmission time interval from the SRNC to the Node B for downlink transfer, and DCH/E-DCH data frames are transferred every transmission time interval from Node B to the SRNC for uplink transfer. [FDD – For 2 ms Uu TTI and depending on configuration from higher layers, the uplink E-DCH MAC-es or MAC-is PDU"s from one or more 2ms Uu TTI"s may be bundled into one E-DCH Data Frame before being transferred at an interval of e.g. 10ms from the Node B to the SRNC.]

An optional error detection mechanism may be used to protect the data transfer if needed. At the transport channel setup it shall be specified if the error detection on the user data is used.

5.1.1 Uplink for DCH

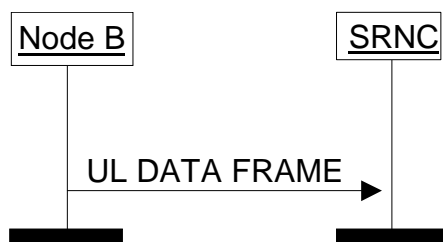


Figure 1: Uplink Data Transfer procedure

Two modes can be used for the UL transmission: *normal mode* and *silent mode*. The mode is selected by the SRNC when the transport bearer is setup and signalled to the Node B with the relevant control plane procedure.

- In normal mode, the Node B shall always send an UL DATA FRAME to the RNC for all the DCHs in a set of coordinated DCHs regardless of the number of Transport Blocks of the DCHs.
- In silent mode and in case only one transport channel is transported on a transport bearer, the Node B shall not send an UL DATA FRAME to the RNC when it has received a TFI indicating "number of TB equal to 0" for the transport channel during a TTI.
- In silent mode and in case of coordinated DCHs, when the Node B receives a TFI indicating "number of TB equal to 0" for all the DCHs in a set of coordinated DCHs, the Node B shall not send an UL DATA FRAME to the RNC for this set of coordinated DCHs.

For any TTI in which the Node B Layer 1 generated at least one CPHY-Out-of-Sync-IND primitive, the Node B is not required to send an UL DATA FRAME to the SRNC.

When Node B receives an invalid TFCI, no UL DATA FRAME shall be sent to the SRNC.

5.1.1a Uplink for E-DCH

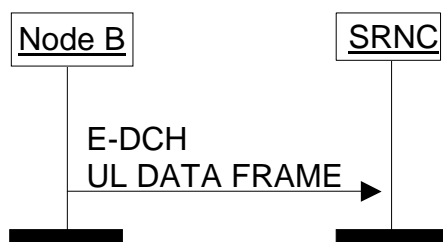


Figure 1a: Uplink Data Transfer procedure

When a MAC-e or MAC-i PDU is received, it is demultiplexed into MAC-d flows which are then each sent on separate transport bearers to the RNC using the E-DCH UL DATA FRAME TYPE 1 (MAC-e) or TYPE 2 (MAC-i).

Only silent mode is used, i.e. E-DCH user-plane payload is transmitted using the E-DCH UL DATA FRAME only when some payload has been successfully received.

[FDD – In case of Multi Cell E-DCH operation two transport bearer modes can be used for the E-DCH payload transmission: *separate Iub transport bearer mode* and *E-DCH UL flow multiplexing mode*. The mode is selected by the SRNC when the RL on secondary UL frequency is setup and signalled to the Node B with the relevant control plane procedure.

- In separate Iub transport bearer mode, the Node B shall send each MAC-d flow received in cells of the different UL frequencies (primary and secondary) on separate transport bearers, one per frequency, to the RNC using the E-DCH UL DATA FRAME TYPE 2 (MAC-i).

- In E-DCH UL flow multiplexing mode, the Node B shall send the MAC-d flows received on all UL frequencies (primary as well as secondary) on one transport bearer to the RNC using the E-DCH UL DATA FRAME TYPE 2 (MAC-i).]

5.1.2 Downlink

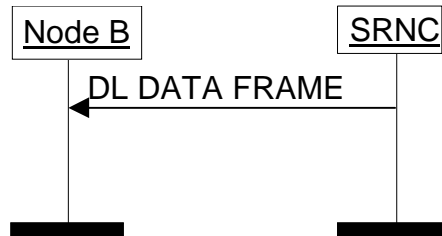


Figure 2: Downlink Data Transfer procedure

The Node B shall only consider a transport bearer synchronised after it has received at least one DL DATA FRAME on this transport bearer before LTOA (TS 25.402 [5]).

The Node B shall consider the DL user plane of a certain RL synchronised once all transport bearers established to carry DCH DL DATA FRAMEs included in the CCTrCH for this RL are considered as synchronised. Once synchronised, the Node B shall assume the DL user plane for this Radio Link stays synchronised as long as the Radio Link exists, even if transport bearers are added (see 5.10.2), replaced (see subclause 5.10.1), or removed. When a RL established through the Radio Link Addition procedure (TS 25.433 [4], TS 25.423 [6]) is combined with a RL whose DL user plane is considered as synchronised, the Node B shall consider the DL user plane of this newly established RL as synchronised.

[FDD - The Node B shall transmit on the DL DPDCH(s) of a certain RL only when the DL user plane of this RL is considered synchronised.]

[TDD – The Node B shall transmit special bursts on the DL DPCH as per TS 25.224 [11], until the DL user plane is considered synchronised].

When the DL user plane is considered synchronised and the Node B does not receive a valid DL DATA FRAME in a TTI, it assumes that there is no data to be transmitted in that TTI for this transport channel, and shall act as one of the following cases:

- [TDD – If the Node B receives no valid DL DATA FRAMEs for any transport channel assigned to a UE it shall assume DTX and transmit special bursts as per TS 25.224 [11]].
- If the Node B is aware of a TFI value corresponding to zero bits for this transport channel, this TFI is assumed. If the TFS contains both a TFI corresponding to "TB length equal to 0 bits" and a TFI corresponding to "number of TB equal to 0", the Node B shall assume the TFI corresponding to "number of TB equal to 0". When combining the TFI's of the different transport channels, a valid TFCI might result and in this case data shall be transmitted on 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 radio frame, the Node B shall build the TFCI value of each CCTrCH, according to the TFI of the DCH data frames multiplexed on this CCTrCH and scheduled for that frame. [FDD - In case the Node B receives an unknown combination of TFIs from the DL DATA FRAMEs, it shall transmit only the DPCH without TFCI bits.] [TDD - In case the Node B receives an unknown combination of DCH DL DATA FRAMEs, it shall apply DTX, i.e. suspend transmission on the corresponding DPCHs.]

5.2 Timing Adjustment

The Timing Adjustment procedure is used to keep the synchronization of the DCH data stream in DL direction, i.e to ensure that the Node B receives the DL frames in an appropriate time for the transmission of the data in the air interface.

SRNC always includes the Connection Frame Number (CFN) to all DCH DL DATA FRAMES.

If a DL DATA FRAME arrives outside the arrival window defined in the Node B, the Node B shall send a TIMING ADJUSTMENT control frame, containing the measured ToA and the CFN value of the received DL DATA FRAME.

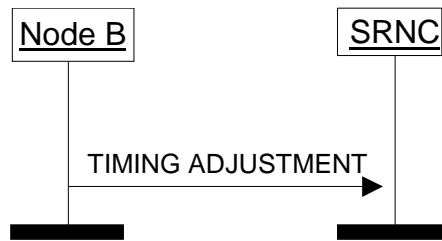


Figure 3: Timing Adjustment procedure

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 TS 25.401 [2].

5.3 DCH Synchronisation

DCH Synchronisation procedure is used to achieve or restore the synchronisation of the DCH data stream in DL direction, and as a keep alive procedure in order to maintain activity on the Iur/Iub transport bearer.

The procedure is initiated by the SRNC by sending a DL SYNCHRONISATION control frame towards Node B. This control frame 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 control frame and the CFN indicated in the received DL SYNCHRONISATION control frame.

UL SYNCHRONISATION control frame shall always be sent, even if the DL SYNCHRONISATION control frame is received by the Node B within the arrival window.

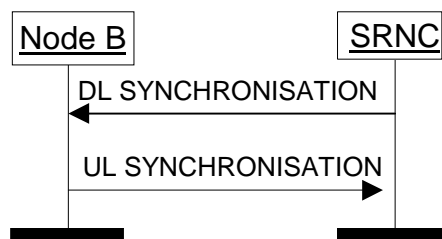


Figure 4: DCH Synchronisation procedure

5.4 Outer Loop PC Information Transfer [FDD, 1.28 Mcps TDD]

Based, for example, on the CRCI values and on the quality estimate in the UL DATA FRAME, SRNC modifies the SIR target used by the UL inner loop power control by including the absolute value of the new SIR target in the OUTER LOOP PC control frame sent to the Node B's.

At the reception of the OUTER LOOP PC control frame, the Node B shall immediately update the SIR target used for the inner loop power control [1.28 Mcps TDD - of the respective CCTrCH for UL DCHs] with the specified value.

The OUTER LOOP PC control frame can be sent via any of the transport bearers dedicated to one UE. [1.28 Mcps TDD - In case of multiple CCTrCHs carrying DCHs, the OUTER LOOP PC control frame can be sent via any of the transport bearers carrying DCHs which belong to the CCTrCH for which the UL SIR target shall be adjusted.]

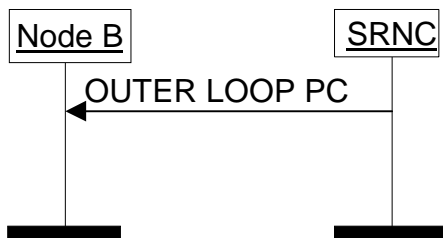


Figure 5: Outer Loop Power Control Information Transfer procedure

5.5 Node Synchronisation

The Node Synchronisation procedure is used by the SRNC to acquire information on the Node B timing.

The procedure is initiated by the SRNC by sending 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, including the parameters T2 and T3, as well as the 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 DL NODE SYNCHRONISATION control 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 SYNCHRONIZATION control frame through the SAP from the transport layer.
- T3: Node B specific frame number (BFN) that indicates the time when Node B sends the UL NODE SYNCHRONISATION control frame through the SAP to the transport layer.

The general overview on the Node Synchronisation procedure is reported in TS 25.401 [2].

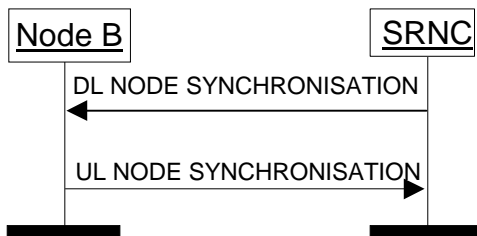


Figure 6: Node Synchronisation procedure

5.6 Rx Timing Deviation Measurement [3.84 Mcps and 7.68 Mcps TDD]

In case the *Timing Advance Applied* IE indicates "Yes" (see TS 25.433 [4]) in a cell, the Node B shall, for all UEs using DCHs/E-DCHs, monitor the receiving time of the uplink DPCH/E-PUCH bursts arriving over the radio interface, and shall calculate the Rx timing deviation. Additionally, the Rx timing deviation shall be calculated when an E-RUCCH or a TA Request (TS 25.319 [13]) transmission is received. If the calculated value, after rounding, is not zero, it shall be reported to the SRNC in a RX TIMING DEVIATION control frame belonging to that UE. For limitation of the frequency of this reporting, the Node B shall not send more than one RX TIMING DEVIATION control frame per UE within one radio frame. The RX TIMING DEVIATION control frame indicates whether the deviation is derived from a conventional E-RUCCH or a TA Request reception.

If the *Timing Advance Applied* IE indicates "No" (see TS 25.433 [4]) in a cell, monitoring of the receiving time of the uplink DPCH bursts is not necessary and no RX TIMING DEVIATION control frame shall be sent.

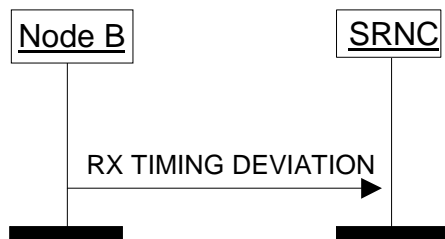


Figure 7: Rx Timing Deviation Measurement procedure

5.7 DSCH TFCI Signalling [FDD]

Void.

5.8 Radio Interface Parameter Update [FDD]

This procedure is used to update radio interface parameters which are applicable to all RL's, or E-DCH Serving Radio Link Set, for the concerning UE. Both synchronised and unsynchronised parameter updates are supported.

The procedure consists of a RADIO INTERFACE PARAMETER UPDATE control frame sent by the SRNC to the Node B.

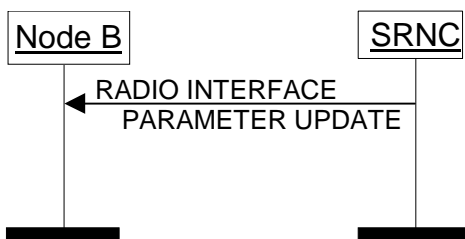


Figure 9: Radio Interface Parameter Update procedure

If the RADIO INTERFACE PARAMETER UPDATE control frame contains a valid TPC power offset value, the Node B shall apply the newly provided TPC PO in DL.

If the RADIO INTERFACE PARAMETER UPDATE control frame contains a valid Maximum UE TX Power value, the E-DCH serving Node B may use the provided value to improve E-DCH scheduling.

If the frame contains a valid DPC mode value, the Node B shall apply the newly provided value in DL power control.

The new values shall be applied as soon as possible in case no valid CFN is included or from the indicated CFN. If the frame contains a valid Multiple RL Sets Indicator value, the Node B may use the newly provided value in Multiple RL Sets Indicator whenever the Node B loses UL synchronization on a RL Set after initial UL synchronization as described in TS 25.214 [12].

5.9 Timing Advance [3.84 Mcps and 7.68 Mcps TDD]

This procedure is used in order to signal to the Node B the adjustment to be performed by the UE in the uplink timing.

The Node B shall use the CFN and timing adjustment values to adjust its layer 1 to allow for accurate impulse averaging.

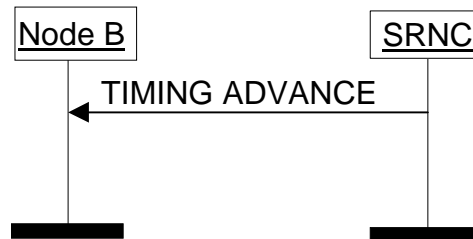


Figure 9A: Timing Advance procedure

5.10 General

5.10.1 Transport bearer replacement

As described in NBAP (TS 25.433 [4]) and RNSAP (TS 25.423 [6]), transport bearer replacement can be achieved by using the Synchronised Radio Link Reconfiguration Preparation procedure in combination with the Synchronised Radio Link Reconfiguration Commit procedure, or by using the Unsynchronised Radio Link Reconfiguration procedure. In both cases the following steps can be discerned:

- 1) The new transport bearer is established after which 2 transport bearers exist in parallel.
- 2) The transport channel(s) is/are switched to the new transport bearer.
- 3) The old transport bearer is released.

In step 1), communication on the old transport bearer continues as normal. In addition, the Node B shall support DL DATA FRAMES, the DCH Synchronisation procedure (see section 5.3) and the Timing Adjustment procedure (see section 5.2) on the new bearer. This enables the SRNC to determine the timing on the new transport bearer. DL DATA FRAMES transported on the new transport bearer shall not be transmitted on the DL DPDCH before the CFN indicated in the RADIO LINK RECONFIGURATION COMMIT message.

Regarding step 2), the moment of switching is determined differently in the synchronised and unsynchronised case:

- When using the combination of the Synchronised Radio Link Reconfiguration Preparation procedure and the Synchronised Radio Link Reconfiguration Commit procedure, the UL/DL DATA FRAMES shall be transported on the new transport bearer from the CFN indicated in the RADIO LINK RECONFIGURATION COMMIT message [FDD - or in the case the the *Fast Reconfiguration* IE is included in the RADIO LINK RECONFIGURATION COMMIT message the Node B shall start using the new transport bearer for the transport of UL DATA FRAMES from the CFN at which the NodeB detects that the UE uses the new configuration in the uplink].
- When using the Unsynchronised Radio Link Reconfiguration procedure, the Node B shall start using the new transport bearer for the transport of UL DATA FRAMES from the CFN at which the new transport bearer is considered synchronised (i.e. has received a DL DATA FRAME before LTOA (TS 25.433 [4])). Not applicable for E-DCH. Change is done directly in case of an E-DCH.

In both cases, starting from this CFN the Node-B shall support all applicable DCH/E-DCH Frame Protocol procedures on the new transport bearer and no requirements exist regarding support of DCH/E-DCH Frame Protocol procedures on the old transport bearer.

Finally in step 3), the old transport bearer is released.

5.10.2 Transport channel addition

As described in NBAP (TS 25.433 [4]) and RNSAP (TS 25.423 [6]), transport channel addition can be achieved by using the Synchronised Radio Link Reconfiguration Preparation procedure in combination with the Synchronised Radio Link Reconfiguration Commit procedure, or by using the Unsynchronised Radio Link Reconfiguration procedure.

When using the Synchronised Radio Link Reconfiguration Preparation procedure the Node B shall support DL DATA FRAMEs, the Synchronisation procedure (see section 5.3) and the Timing Adjustment procedure (see section 5.2) on the new transport bearer also before the CFN indicated in the RADIO LINK RECONFIGURATION COMMIT message, in order to enable the SRNC to determine the timing on the new transport bearer. DL DATA FRAMEs transported on the new transport bearer before this CFN shall not be transmitted on the DL DPDCH. Starting from this CFN the Node B shall support all applicable DCH and E-DCH frame protocol procedures on the new transport bearer.

When using the Unsynchronised Radio Link Reconfiguration procedure the Node B shall support data frames and control frames when the new transport bearer is established.

5.11 Generation of subframe number

The *CFN* and *Subframe Number* IE's values in the E-DCH Data Frame shall reflect the CFN and subframe number when the payload in the E-DCH Data Frame was correctly received on the Uu. This corresponds to when the HARQ process correctly decoded the data. [FDD - The subframe number is for 2 ms TTI set to values {0-4} and for 10 ms TTI set to {0}]. [3.84Mcps TDD, 7.68 Mcps TDD - the subframe number is set to {0}]. [1.28 Mcps TDD - the subframe number is set to {0-1}].

5.12 Generation of number of HARQ retransmissions

After successful decoding of E-DCH payload received over Uu, the Node B shall insert the following values in the *Number of HARQ Retransmissions* IE:

- If the RSN value in the last HARQ retransmission that resulted in successful decoding has the value 0, 1 [FDD - or 2], then the Node B shall insert the same value in the *Number of HARQ Retransmissions* IE in the E-DCH Data Frame.
- If the RSN value in the last HARQ retransmission that resulted in successful decoding has the value [TDD -2 or] 3, then the Node B shall insert the calculated value of the actual number of retransmissions used for the successful decoding into the *Number of HARQ Retransmissions* IE in the E-DCH Data Frame. If the actual number of retransmission cannot be calculated, then the Node B shall insert the value 15 in the *Number of HARQ Retransmissions* IE, indicating that the number of HARQ retransmissions is unknown.
- If the UE was power limited at the time the subframe was received, or another condition applies in which the number of retransmissions should not influence the SIR target level, then the Node B shall insert value 13 into the *Number of HARQ Retransmissions* IE, indicating that the *Number of HARQ Retransmissions* IE is inappropriate as input to the outer loop power control.

After unsuccessful decoding of the E-DCH payload, the serving Node B shall act according to section 5.13, Indication of HARQ failure.

5.13 Indication of HARQ failure

After unsuccessful decoding of the E-DCH payload and under conditions listed below, the serving Node B shall send a HARQ Failure Indication to the SRNC. [FDD - The non-serving Node B(s) shall not send a HARQ Failure Indication.]

The serving Node B shall send a HARQ Failure Indication to the SRNC under any of the following conditions:

- A MAC-e or MAC-i PDU for a HARQ process has not yet been successfully decoded and the RSN [TDD -and HARQ process ID] indicates the transmission of a new MAC-e or MAC-i PDU for the same HARQ process and the number of HARQ retransmissions that had already occurred was equal or higher than the lowest of the maximum HARQ retransmissions values for the UE"s configured MAC-d flows.
- A MAC-e or MAC-i PDU for a HARQ process has not yet been successfully decoded and the maximum retransmissions for the MAC-d flow with the highest maximum HARQ retransmissions value valid for the UE connection have occurred, or should have occurred in case the HARQ related outband signalling (RSN) on the [FDD - E-DPCCH] [TDD - E-UCCH] could not be decoded.
- A MAC-e or MAC-i PDU for a HARQ process has not yet been successfully decoded when the MAC-e or MAC-i Reset is performed in UE. The Node B knows the timing of the MAC-e or MAC-i Reset in the UE via higher layer.

The HARQ Failure Indication shall be sent on only one transport bearer. The Node B may select any of the transport bearers associated with the UE for which the HARQ failure relates to.

[FDD – In case of Multi Cell E-DCH operation:

- In E-DCH UL flow multiplexing mode, the NodeB may select any of the transport bearers associated with the UE for which the HARQ failure relates to, and including UL Mux Info (UL Multiplexing Information) into data frame to indicate on which frequency the HARQ failure happens - primary UL frequency or secondary UL frequency.
- In separate Iub transport bearer mode, the NodeB may select any of the transport bearers associated with the frequency of the UE for which the HARQ failure relates to].

The HARQ failure is indicated in a user data frame with values set as follows:

- The *CFN* and *Subframe Number* IE values shall reflect the time when the failure was detected
- TYPE 1: The *Number of MAC-es PDUs* IE shall be set to zero. As a consequence there are no *DDI* and *N* IEs in the header and 4 bits padding is used after *Number of MAC-es PDUs* IE in order to have the octet aligned structure, and there are no *MAC-es PDUs* IEs in the payload part of the data frame related to the HARQ failure.
- TYPE 2: The *Number of MAC-is PDUs* IE shall be set to zero. As a consequence there are no *MAC-is PDU descriptor* IE and there are no *MAC-is PDUs* IEs in the payload part of the data frame related to the HARQ failure.
- The *Number of HARQ Retransmissions* IE shall be set to the number of HARQ retransmissions that occurred when the failure was detected. The coding shall be the same as for a correctly decoded payload as described in section 5.12.
- [FDD - In case of Multi Cell E-DCH operation, the *UL Mux Info* IE shall indicate the frequency in which the failure was detected - primary UL frequency or secondary UL frequency as described in subclause [6.2.4.21 in E-DCH UL flow multiplexing mode of Multi Cell E-DCH operation.](#)]

5.14 TNL Congestion Indication

This procedure is used by the SRNC to signal, on a transport bearer carrying an E-DCH MAC-d flow, that a transport network congestion situation on Iub/Iur has been detected.

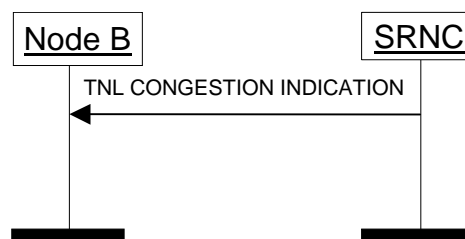


Figure 9AB: TNL Congestion Indication procedure

At the reception of the TNL CONGESTION INDICATION control frame, the Node B should reduce the bit rate on the Iub interface.

If the TNL CONGESTION INDICATION control frame is indicating 'TNL Congestion – detected by frame loss', or the TNL CONGESTION INDICATION control frame is indicating 'TNL Congestion – detected by delay build-up', the Node B should reduce the bit rate for at least the MAC-d flow on which the congestion indication control frame was received.

If the TNL CONGESTION INDICATION control frame is indicating 'No TNL Congestion', the Node B can gradually go back to normal operation.

6 Frame structure and coding

6.1 General

The general structure of a DCH FP frame consists of a header and a payload. The structure is depicted in figure 9B.



Figure 9B: General structure of a frame protocol PDU

The header contains a CRC checksum, the frame type field and information related to the frame type.

There are two types of DCH FP frames (indicated by the *FT IE*):

- DCH data frame.
- DCH control frame.

For the UL direction there is also an E-DCH data frame (indicated by signalling). The E-DCH data frame is defined with two structures, TYPE 1 and TYPE 2 depending of if it contains MAC-es PDUs (TYPE 1) or MAC-is PDUs (TYPE 2).

- E-DCH data frame.

The payload of the data frames contains radio interface user data, quality information for the transport blocks and for the radio interface physical channel during the transmission time interval (for UL only), and an optional CRC field.

The payload of the control frames contains commands and measurement reports related to transport bearer and the radio interface physical channel but not directly related to specific radio interface user data.

6.1.1 General principles for the coding

In the present document the structure of frames will be specified by using pictures similar to figure 10.

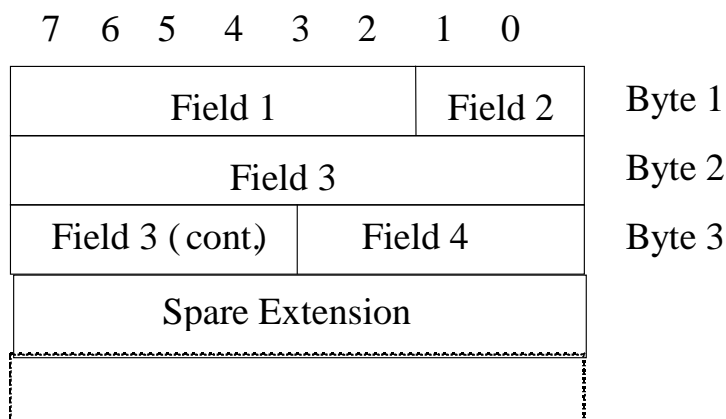


Figure 10: Example of notation used for the definition of the frame structure

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/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 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 coded with the 2's complement notation.

Bits labelled "Spare" shall be set to zero by the transmitter and shall be ignored by the receiver. The *Spare Extension* IE indicates the location where new IEs can in the future be added in a backward compatible way. The *Spare Extension* IE shall not be used by the transmitter and shall be ignored by the receiver.

6.2 Data frames

6.2.1 Introduction

The purpose of the user data frames is to transparently transport the transport blocks between Node B and SRNC.

The protocol allows for multiplexing of coordinated dedicated transport channels, with the same transmission time interval, onto one transport bearer.

The transport blocks of all the coordinated DCHs for one transmission time interval are included in one frame.

SRNC indicates the multiplexing of coordinated dedicated transport channels in the appropriate RNSAP/NBAP message.

6.2.2 UL DATA FRAME

6.2.2.1 UL DATA FRAME FOR DCH

The structure of the UL DATA FRAME is shown in figure 11.

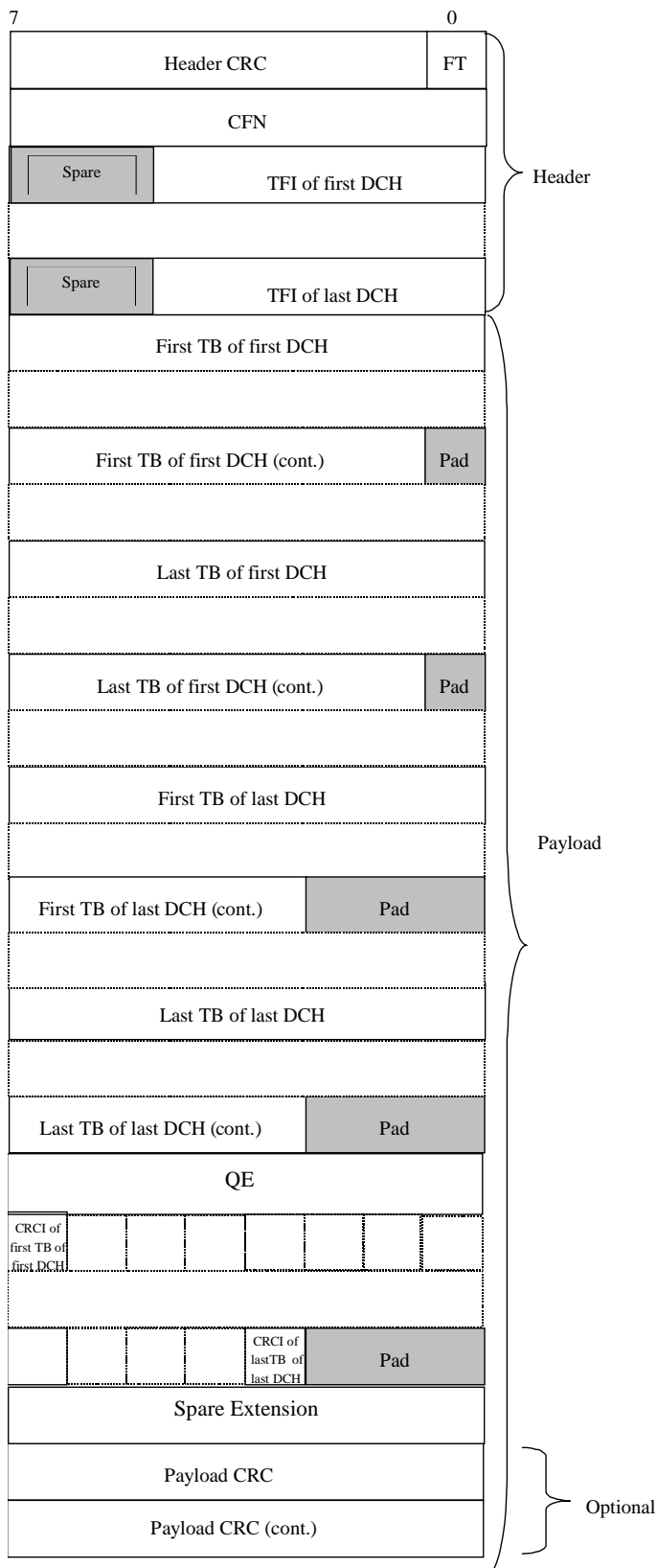


Figure 11: UL DATA FRAME structure

For the description of the fields see subclause 6.2.4.

There are as many TFI fields as number of DCH multiplexed in the same transport bearer.

The DCHs in the frame structure are ordered from the lower DCH id ('first DCH') to the higher DCH id ('last DCH').

The size and the number of TBs for each DCH are defined by the correspondent TFI.

If the TB does not fill an integer number of bytes, then bit padding is used as shown in the figure in order to have the octet aligned structure (ex: a TB of 21 bits requires 3 bits of padding).

There is a CRCI for each TB included in the frame irrespective of the size of the TB, i.e. the CRCI is included also when the TB length is zero. If the CRCIs of one data frame do not fill an integer number of bytes, then bit padding is used as shown in the figure in order to have the octet aligned structure (ex. 3 CRCI bits require 5 bits of padding, but there are no CRCI bits and no padding, when the number of TBs is zero).

The *Payload CRC IE* is optional, i.e. the whole 2 bytes field may or may not be present in the frame structure (this is defined at the setup of the transport bearer).

6.2.2.2 UL DATA FRAME FOR E-DCH TYPE 1

The structure of the E-DCH UL DATA FRAME TYPE 1 is shown in Figure 11a. TYPE 1 frame structure is used when the E-DCH UL DATA FRAME is carrying MAC-es PDUs (TS 25.321 [16]).

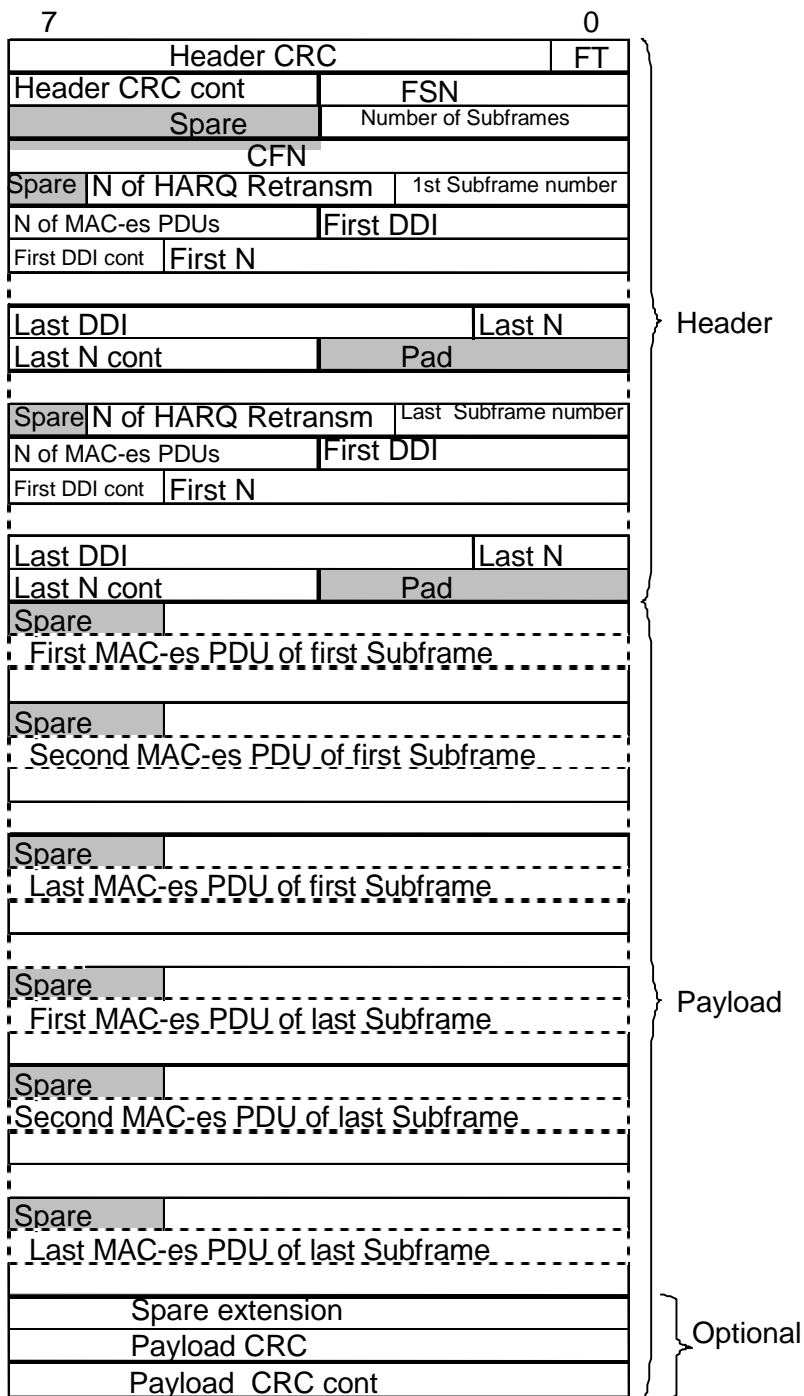


Figure 11a: E-DCH UL DATA FRAME TYPE 1 structure

For the description of the fields see subclause 6.2.4.

When there is an even, including zero, number of DDI + N field pairs for a subframe, then 4 bits padding is used as shown in the figure in order to have the octet aligned structure.

The *Payload CRC* IE is optional in frames that contain a Payload, i.e. the whole 2 bytes field may or may not be present in the frame structure (this is defined at the setup of the transport bearer). The *Payload CRC* IE may only be present if the E-DCH UL data frame contains payload.

6.2.2.3 UL DATA FRAME FOR E-DCH TYPE 2

The structure of the E-DCH UL DATA FRAME TYPE 2 is shown in Figure 11b. TYPE 2 frame structure is used when the E-DCH UL DATA FRAME is carrying MAC-is PDUs (TS 25.321 [16]).

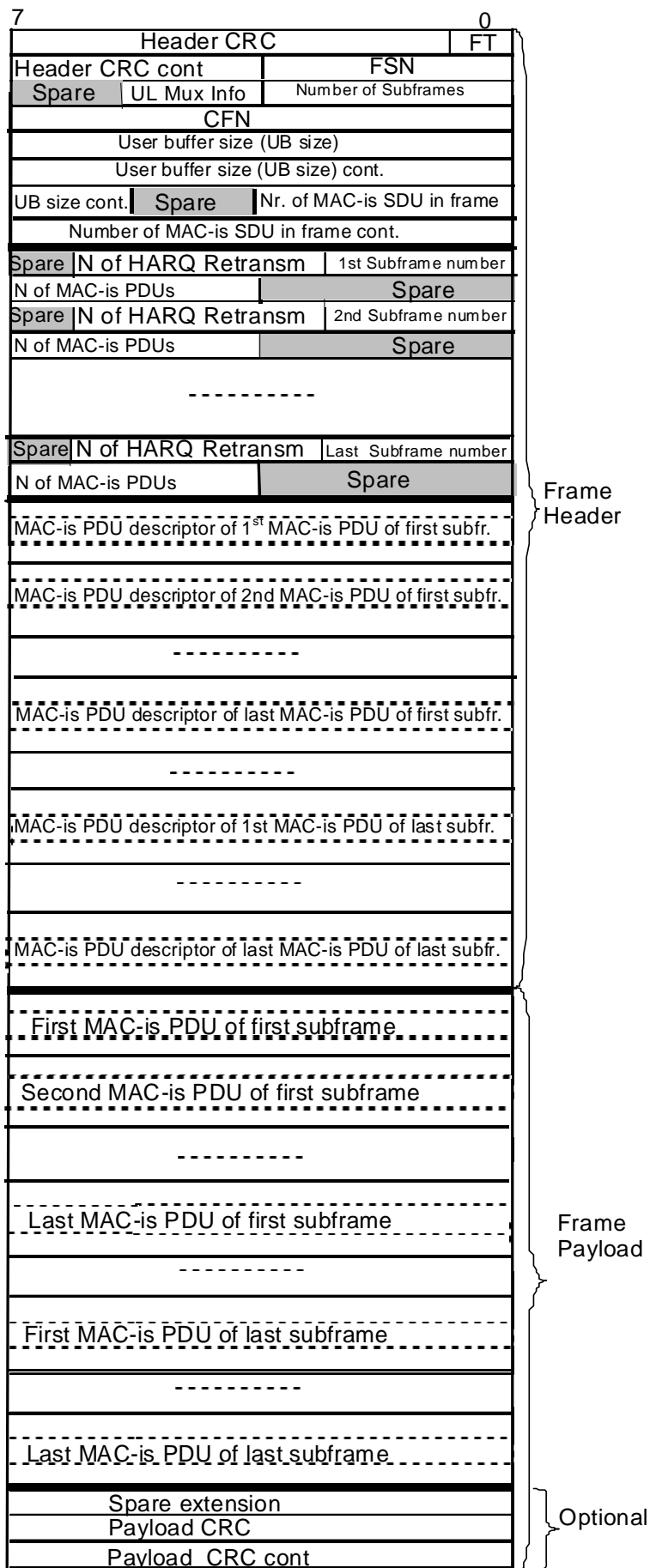


Figure 11b: E-DCH UL DATA FRAME TYPE 2 structure

For the description of the fields see subclause 6.2.4.

The *Payload CRC* IE is optional in frames that contain a Payload, i.e. the whole 2 bytes field may or may not be present in the frame structure (this is defined at the setup of the transport bearer). The *Payload CRC* IE may only be present if the E-DCH UL data frame contains payload.

6.2.3 DL DATA FRAME

The structure of the DL DATA FRAME is shown in figure 12.

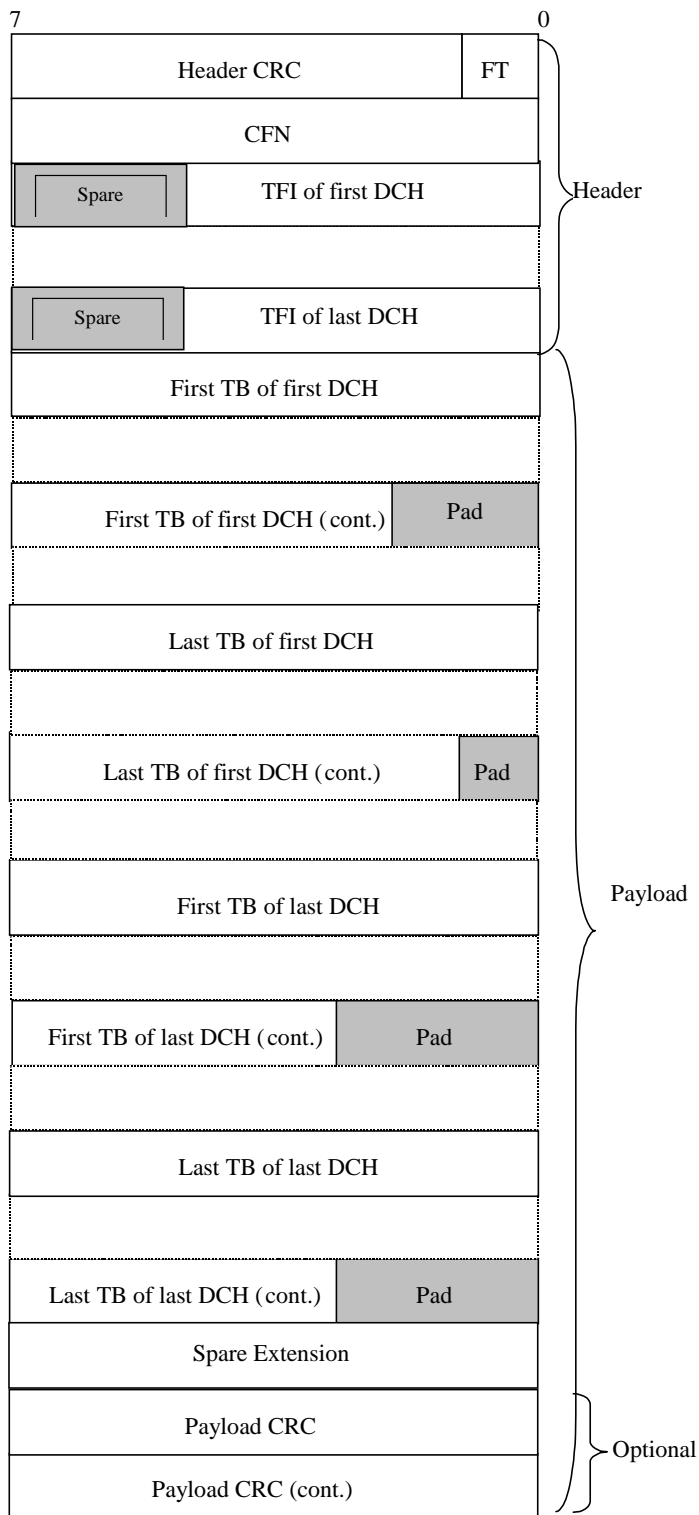


Figure 12: DL DATA FRAME structure

For the description of the fields see subclause 6.2.4.

There are as many TFI fields as number of DCH multiplexed in the same transport bearer.

The DCHs in the frame structure are ordered from the lower DCH id ('first DCH') to the higher DCH id ('last DCH').

The size and the number of TBs for each DCH is defined by the correspondent TFI.

If the TB does not fill an integer number of bytes, then bit padding is used as shown in the figure in order to have the octet aligned structure (ex: a TB of 21 bits requires 3 bits of padding).

The *Payload CRC* IE is optional, i.e. the whole 2 bytes field may or may not be present in the frame structure (this is defined at the setup of the transport bearer).

6.2.4 Coding of information elements in data frames

6.2.4.1 Header CRC

Description: Result of the CRC applied to the remaining part of the header, i.e. from bit 0 of the first byte (the *FT* IE) to the bit 0 (included) of the last byte of the header (not including the *Header CRC Cont* four bits), with one of the corresponding generator polynomials:

$G(D) = D^7 + D^6 + D^2 + 1$ for the 7 bit header CRC,

$G(D) = D^{11} + D^9 + D^8 + D^2 + D + 1$ for the 11 bit header CRC.

See subclause 7.2.

Field Length: 7 bits. 11 bits for UL Data Frame for E-DCH.

6.2.4.2 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.

6.2.4.3 Connection Frame Number (CFN)

Description: Indicator as to which radio frame the first data was received on uplink or shall be transmitted on downlink. See TS 25.401 [2]. For E-DCH the Connection Frame Number shall indicate the radio frame when the HARQ process correctly decoded the data.

For E-DCH apart from reordering purposes, CFN (and Subframe number) can be used for dynamic delay measurements.

Value range: {0-255}.

Field length: 8 bits.

6.2.4.4 Transport Format Indicator (TFI)

Description: TFI is the local number of the transport format used for the transmission time interval. For information about what the transport format includes see TS 25.302 [3].

Value range: {0-31}.

Field length: 5 bits.

6.2.4.5 Quality Estimate (QE)

Description: The quality estimate is derived from the transport channel BER [FDD - or physical channel BER.]

[FDD - If the DCH FP frame includes TB's for the DCH which was indicated as "selected" with the *QE-selector* IE in the control plane (TS 25.433 [4], TS 25.423 [6]), then the QE is the transport channel BER for the selected DCH. If no transport channel BER is available the QE is the physical channel BER.]

[FDD - If the value of the *QE-Selector* IE equals "non-selected" for all DCHs in the DCH FP frame, then the QE is the physical channel BER.]

[TDD - If no transport channel BER is available, then the QE shall be set to 0. This is in particular the case when no transport blocks have been received. The value of QE will be ignored by the RNC in this case.]

The quality estimate shall be set to the transport channel BER [FDD - or physical channel BER] and be measured in the units TrCh_BER_LOG [FDD - and PhCh_BER_LOG respectively] (see TS 25.133 [7] and TS 25.123 [8]). The quality estimate is needed in order to select a transport block when all CRC indications are showing bad (or good) frame. The UL outer loop power control may also use the quality estimate.

Value range: {0-255}.

Granularity: 1.

Field length: 8 bits.

6.2.4.6 Transport Block (TB)

Description: A block of data to be transmitted or received over the air interface. The transport format indicated by the TFI describes the transport block length and transport block set size. See TS 25.302 [3].

Field length: The length of the TB is specified by the TFI.

6.2.4.7 CRC indicator (CRCI)

Description: Indicates the correctness/incorrectness of the TB CRC received on the Uu interface. For every transport block included in the data frame a CRCI bit will be present, irrespective of the presence of a TB CRC on the Uu interface. If no CRC was present on the Uu for a certain TB, the corresponding CRCI bit shall be set to "0".

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

Field length: 1 bit.

6.2.4.8 Payload CRC

Description: CRC for the payload. This field is optional. It is the result of the CRC applied to the remaining part of the payload, i.e. from the bit 7 of the first byte of the payload to the bit 0 of the byte of the payload before the *Payload CRC* IE, with the corresponding generator polynomial:
 $G(D) = D^{16} + D^{15} + D^2 + 1$. See clause 7.2.

Field length: 16 bits.

6.2.4.9 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.

6.2.4.10 Subframe Number

Description: Indicates the subframe number in which the payload was received. Apart from reordering purposes, Subframe number (and CFN) can be used for dynamic delay measurements. [3.84 Mcps TDD, 7.68 Mcps TDD – This will always be set to "0".][1.28 Mcps TDD – This will be set to {0-1}.]

Value range: {0-4}

Field length: 3 bits.

6.2.4.11 Number of HARQ Retransmissions, NHR

Description: Indicates the number of HARQ retransmissions used for successful decoding of the payload, or in case of HARQ decoding failure the number of HARQ retransmissions that were used at the time when the HARQ decoding failure was detected. The value 13 indicates that the actual number of retransmissions is inappropriate as input to the

outer loop power control. The value 15 indicates that the Node B could not calculate the number of HARQ retransmissions.

Value range: {0-15}

Value {12}: Used for indicating that the number of HARQ retransmissions was 12 or higher.

Value {13}: Used for indicating that the number of HARQ retransmissions shall not be used by the outer loop power control

Values {14}: Reserved in this user plane revision. Shall be ignored by the receiver.

Value {15}: Used for indicating that the number of HARQ retransmissions is unknown.

Field length: 4 bits.

6.2.4.12 Number of Subframes

Description: The *Number of Subframes* field indicates how many subframes that follows in the frame. [TDD – This will always be set to "1".]

Note: A subframe has both a header portion and a payload portion in the frame.

Value range: {1-16}

The binary coding is derived from the value minus 1. E.g. value 1 is coded as binary '0000' and value 16 is coded as binary '1111'.

Values {11, 12, 13, 14, 15, 16}: Reserved in this user plane revision. Shall be ignored by the receiver.

Field length: 4 bits.

6.2.4.13 Number of MAC-es PDUs

Description: Indicates the number of MAC-es PDUs in the user data frame in the payload part for the corresponding subframe number.

Value range: {0-15}

Field length: 4 bits.

6.2.4.14 Data Description Indicator, DDI

Description: The *Data Description Indicator* is mapped directly from the DDI field received over the Uu.

Field length: 6 bits.

6.2.4.15 Number of MAC-d PDUs, N

Description: The *Number of MAC-d PDUs* is mapped directly from the N field received over the Uu.

Field length: 6 bits.

6.2.4.16 FSN – Frame Sequence Number

Description: The 4-bit *Frame Sequence Number* is incremented (modulo 16) for each transmitted data frame. Each flow generates its own Frame Sequence. [FDD – In case E-DCH UL flow multiplexing mode is used for secondary E-DCH, Node B shall set the value per carrier.]

Value range: {0..15}.

Granularity: 1.

Field length: 4 bits.

6.2.4.17 Number of MAC-is PDUs

Description: Indicates the number of MAC-is PDUs in the user data frame in the payload part for the corresponding subframe number.

Value range: {0-15}

Field length: 4 bits.

6.2.4.18 User Buffer size

Description: Indicates the the total size of the UL DATA FRAME TYPE 2 in octets

Value range: {0-262 140}.

Field length: 18 bits.

6.2.4.19 Number of MAC-is SDU in frame

Description: Total number of MAC-is SDUs in all MAC-is PDUs in the UL DATA FRAME TYPE 2. One MAC-is SDU corresponds to one MAC-d PDU as described in TS 25.321 [16].

Value range: {0-4095}.

Field length: 12 bits.

6.2.4.20 MAC-is PDU descriptor

Description: The *MAC-is PDU descriptor* contains the Length (L), Logical channel identifier (LCH-ID) and Flag (F) fields mapped directly from the "MAC-i Header n" field ($n > 0$) received over the Uu (TS 25.321 [16]).

Field length: variable; length of *MAC-is PDU descriptor* in octets = $2 * \text{number of MAC-is SDU contained in the corresponding MAC-is PDU as described in TS 25.321 [16]}$.

6.2.4.21 UL Multiplexing Information (UL Mux Info)[FDD]

Description: Applicable to Multi Cell E-DCH operation in E-DCH UL flow multiplexing mode. Indicates the frequency of the cell in which the MAC-i frame was received - primary UL frequency or secondary UL frequency.

Primary UL frequency Value = "0"

Secondary UL frequency Value = "1"

In separate Iub transport bearer mode or non Multi Cell E-DCH operation Value = "0" shall be used, ignored by the receiver

Value range: {0-3}.

Values {2, 3}: Reserved in this user plane revision. Shall be ignored by the receiver.

Field length: 2 bits

6.3 Control frames

6.3.1 Introduction

Control frames are used to transport control information between SRNC and Node B.

On the uplink, these frames are not combined – all frames are passed transparently from Node B to SRNC. On the downlink, the same control frame is copied and sent transparently to all the Node Bs from the SRNC.

The structure of the control frames is shown in the figure 13.

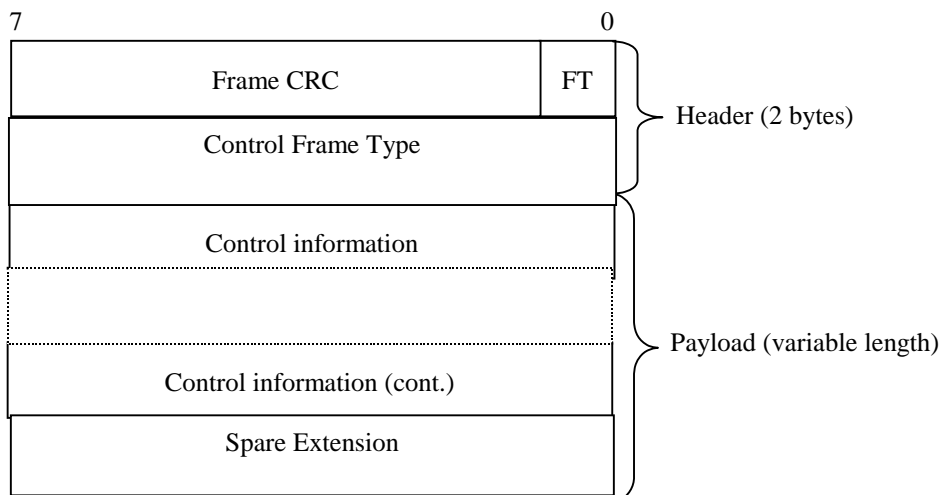


Figure 13: General structure of the control frames

Control Frame Type IE defines the type of the control frame.

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 Frame CRC

Description: It is the result of the CRC applied to the remaining part of the frame, i.e. from bit 0 of the first byte of the header (the *FT* IE) to bit 0 of the last byte of the payload, with the corresponding generator polynomial: $G(D) = D^7 + D^6 + D^2 + 1$. See subclause 7.2.

Field Length: 7 bits.

6.3.2.2 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.

6.3.2.3 Control Frame Type

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

Value: The values are defined in table 1.

Table 1

Control frame type	Coding
OUTER LOOP POWER CONTROL	0000 0001
TIMING ADJUSTMENT	0000 0010
DL SYNCHRONISATION	0000 0011
UL SYNCHRONISATION	0000 0100
Reserved Value	0000 0101
DL NODE SYNCHRONISATION	0000 0110
UL NODE SYNCHRONISATION	0000 0111
RX TIMING DEVIATION	0000 1000
RADIO INTERFACE PARAMETER UPDATE	0000 1001
TIMING ADVANCE	0000 1010
TNL CONGESTION INDICATION	0000 1011

Field length: 8 bits.

The "Reserved Value" for the *Control Frame Type* IE shall not be used by the SRNC. A control frame whose *Control Frame Type* IE is set to the "Reserved Value" shall be ignored by the Node B.

6.3.3 Payload structure and information elements

6.3.3.1 TIMING ADJUSTMENT

6.3.3.1.1 Payload structure

Figure 14 shows the structure of the payload when control frame is used for the timing adjustment.

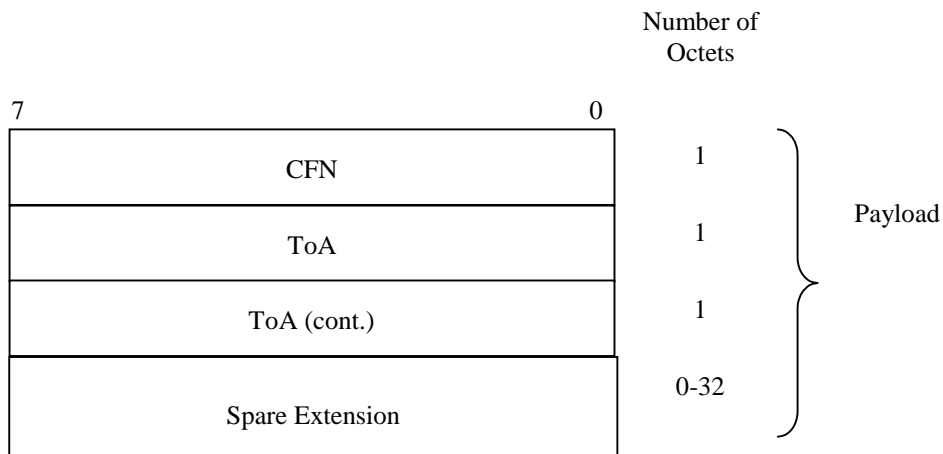


Figure 14: Structure of the payload for the TIMING ADJUSTMENT control frame

6.3.3.1.2 CFN

Description: The CFN value is extracted from the corresponding DL DATA FRAME.

Value range: As defined in subclause 6.2.4.3.

Field length: 8 bits.

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 value in the frame).

Value range: {-1280, +1279.875 msec}.

Granularity: 125 μs.

Field length: 16 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 DL SYNCHRONISATION

6.3.3.2.1 Payload structure

Figure 15 shows the structure of the payload when control frame is used for the user plane synchronisation.

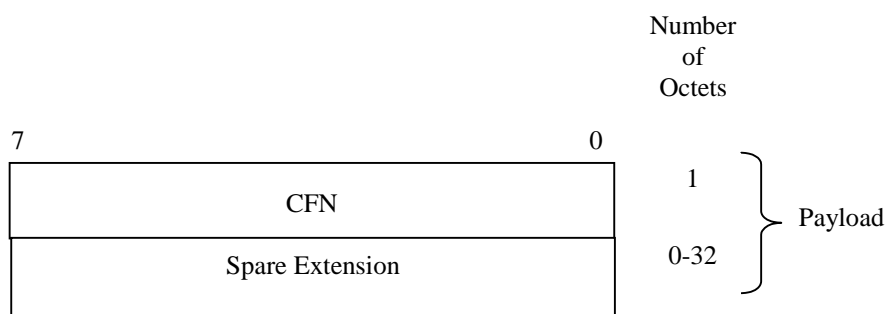


Figure 15: Structure of the payload for the DL SYNCHRONISATION control frame

6.3.3.2.2 CFN

Description: The CFN value is the target CFN and used to calculate ToA.

Value range: As defined in subclause 6.2.4.3.

Field length: 8 bits.

6.3.3.2.3 Spare Extension

The *Spare Extension* IE is described in subclause 6.3.3.1.4.

6.3.3.3 UL SYNCHRONISATION

6.3.3.3.1 Payload structure

Figure 16 shows the structure of the payload when the control frame is used for the user plane synchronisation.

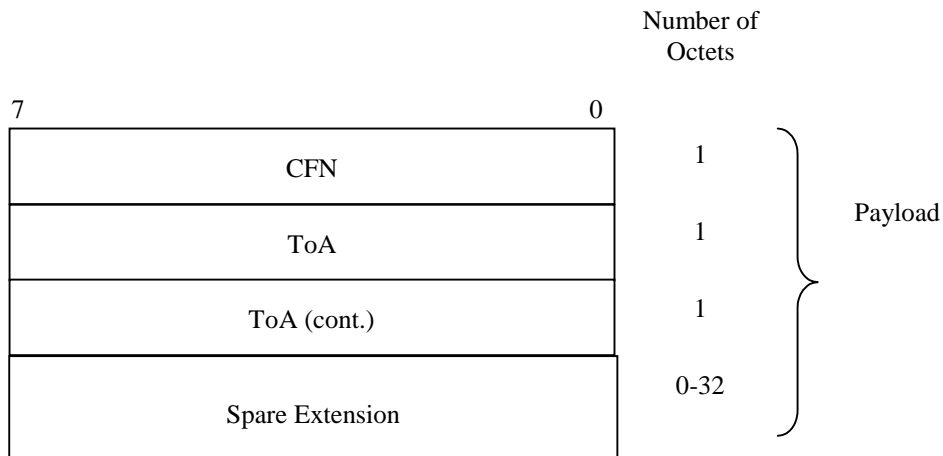


Figure 16: Structure of the UL SYNCHRONISATION control frame

6.3.3.3.2 CFN

Description: The CFN value is extracted from the corresponding DL SYNCHRONISATION control frame.

Value range: As defined in subclause 6.2.4.3.

Field length: 8 bits.

6.3.3.3.3 Time of Arrival (ToA)

The *ToA* IE is described in subclause 6.3.3.1.3.

6.3.3.3.4 Spare Extension

The *Spare Extension* IE is described in subclause 6.3.3.1.4.

6.3.3.4 OUTER LOOP POWER CONTROL [FDD, 1.28Mcps TDD]

6.3.3.4.1 Payload structure

Figure 17 shows the structure of the payload when control frame is used for the UL outer loop power control.

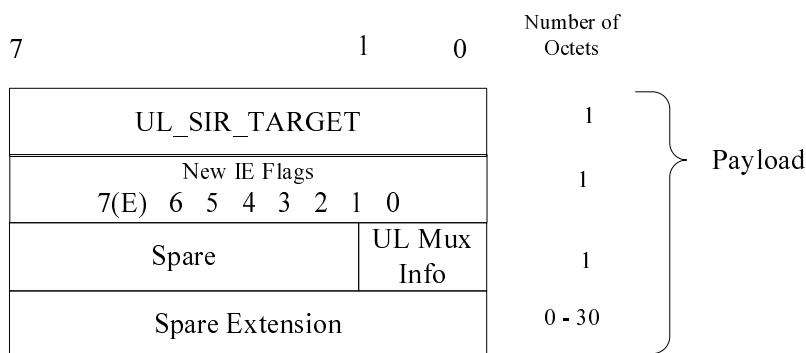


Figure 17: Structure of the payload for OUTER LOOP PC control frame

Bit 0 of New IE Flags in OUTER LOOP POWER CONTROL indicates if the UL Mux Info is present (1) or not present (0) in the byte following the *New IE Flags* IE.

Bits 1 through 6 of New IE Flags in OUTER LOOP POWER CONTROL shall be set to 0.

6.3.3.4.2 SIR Target

Description: Value (in dB) of the SIR target to be used by the UL inner loop power control.

SIR Target is given in the unit UL_SIR_TARGET where:

UL_SIR_TARGET = 000	SIR Target = -8.2 dB
UL_SIR_TARGET = 001	SIR Target = -8.1 dB
UL_SIR_TARGET = 002	SIR Target = -8.0 dB
...	
UL_SIR_TARGET = 254	SIR Target = 17.2 dB
UL_SIR_TARGET = 255	SIR Target = 17.3 dB

Value range: {-8.2...17.3 dB}.

Granularity: 0.1 dB.

Field length: 8 bits.

6.3.3.4.3 Spare Extension

The *Spare Extension* IE is described in subclause 6.3.3.1.4.

6.3.3.4.4 UL Mux Info

The *UL Mux Info* IE is described in subclause [6.2.4.21](#).

6.3.3.5 DL NODE SYNCHRONISATION

6.3.3.5.1 Payload structure

Figure 18 shows the structure of the payload for the DL NODE SYNCHRONISATION control frame.

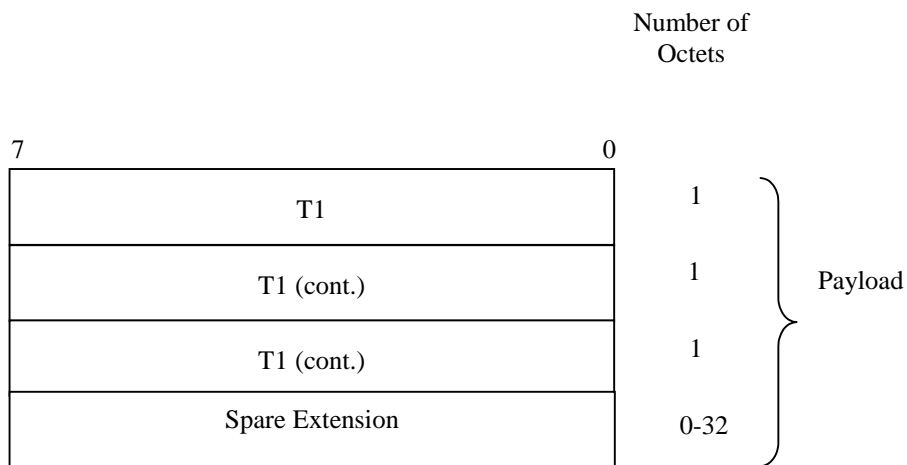


Figure 18: Structure of the payload for the DL NODE SYNCHRONISATION control frame

6.3.3.5.2 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: As defined in subclause 6.3.3.6.2.

Field length: 24 bits.

6.3.3.5.3 Spare Extension

The *Spare Extension* IE is described in subclause 6.3.3.1.4.

6.3.3.6 UL NODE SYNCHRONISATION

6.3.3.6.1 Payload structure

The payload of the UL NODE SYNCHRONISATION control frames is shown in figure 19.

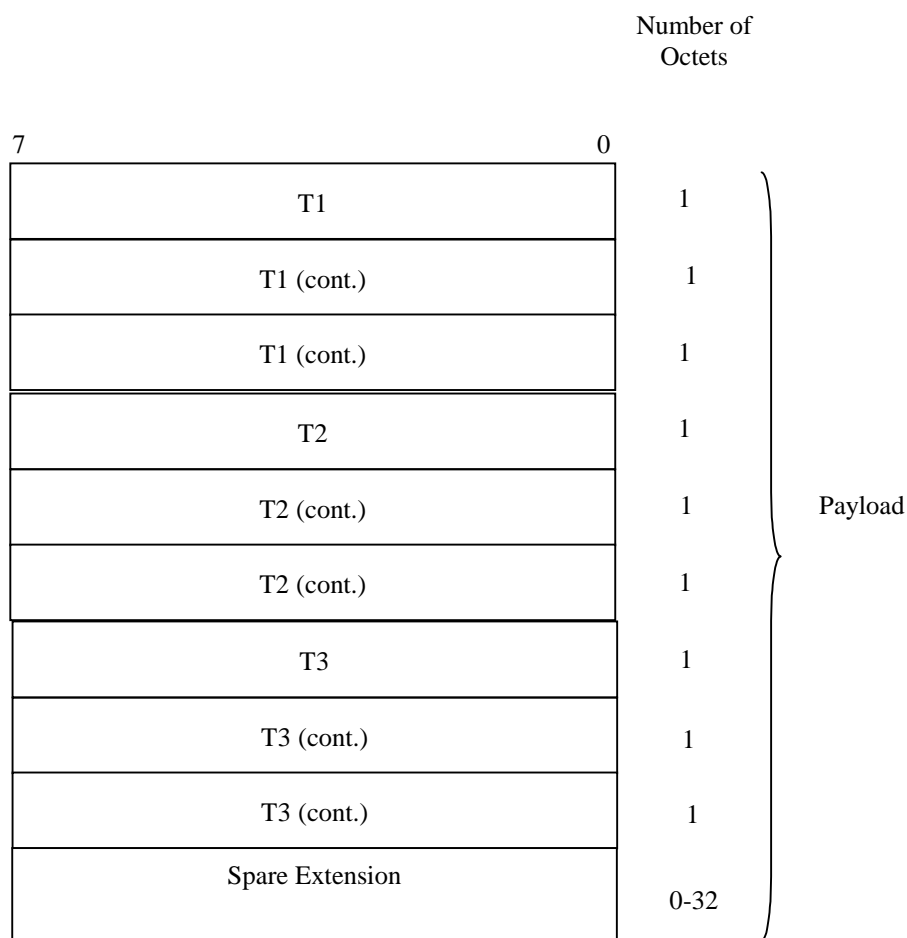


Figure 19: Structure of the payload for UL NODE SYNCHRONISATION control frame

6.3.3.6.2 T1

Description: T1 timer is extracted from the correspondent DL NODE SYNCHRONISATION control frame.

Value range: {0-40959.875 ms}.

Granularity: 0.125 ms.

Field length: 24 bits.

6.3.3.6.3 T2

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

Value range: {0-40959.875 ms}.

Granularity: 0.125 ms.

Field length: 24 bits.

6.3.3.6.4 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}.

Granularity: 0.125 ms.

Field length: 24 bits.

6.3.3.6.5 Spare Extension

The *Spare Extension* IE is described in subclause 6.3.3.1.4.

6.3.3.7 RX TIMING DEVIATION [3.84 Mcps and 7.68Mcps TDD]

6.3.3.7.1 Payload structure

Figure 20 shows the structure of the payload when the control frame is used for the Rx timing deviation.

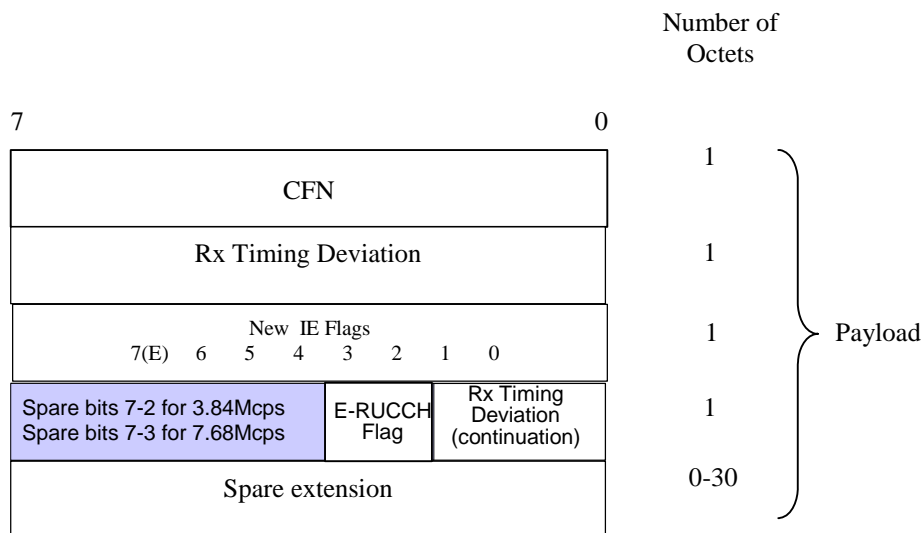


Figure 20: Structure of the payload for RX TIMING DEVIATION control frame

Bit 0 of New IE Flags in RX TIMING DEVIATION CONTROL FRAME indicates if the extended bits of the Rx Timing Deviation are present (1) or not present (0) in the byte (bit 0 for 3.84 Mcps TDD, bits 0 and 1 for 7.68 Mcps TDD) following the *New IE Flags* IE.

Bit 1 of New IE Flags in RX TIMING DEVIATION CONTROL FRAME indicates if the E-RUCCH Flag is present (1) or not present (0) in the byte (bit 1 for 3.84 Mcps TDD, bit2 for 7.68 Mcps TDD) following the *New IE Flags* IE.

Bits 2 through 6 of New IE Flags in RX TIMING DEVIATION CONTROL FRAME shall be set to 0.

6.3.3.7.2 Rx Timing Deviation [3.84 Mcps TDD]

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

Value range: $\{-1024, \dots, +1023\}$ chips.

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

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

$$\{(N-128)*4 - 1024\} \text{ chips} \leq \text{Rx Timing Deviation} < \{(N-127)*4 - 1024\} \text{ chips}$$

With $N = 128, 129, \dots, 319$

$$\{N*4 - 1024\} \text{ chips} \leq \text{Rx Timing Deviation} < \{(N+1)*4 - 1024\} \text{ chips}$$

With $N = 320, 321, \dots, 511$

Granularity: 4 chips.

Field length: 9 bits. The least significant 8 bits are contained in the RX timing deviation field and the most significant bit is contained in the RX timing deviation (continuation) field.

6.3.3.7.2A Rx Timing Deviation [7.68 Mcps TDD]

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

Value range: $\{-2056, \dots, +2055\}$ chips

$$\{N*4 - 2056\} \text{ chips} \leq \text{RxTiming Deviation} < \{(N+1)*4 - 2056\} \text{ chips}$$

With $N = 0, 1, \dots, 1027$

Granularity: 4 chips.

Field length: 10 bits. The least significant 8 bits are contained in the RX timing deviation field and the most significant 2 bits are contained in the RX timing deviation (continuation) field.

6.3.3.7.2B E-RUCCH Flag

Description: Indicates whether the timing deviation is derived from a conventional E-RUCCH (carrying Scheduling Information) reception or a TA Request reception.

Value range: $\{0 \text{ conventional E-RUCCH reception}, 1 \text{ TA Request reception}\}$

Field length: 1 bit.

6.3.3.7.3 Spare Extension

The *Spare Extension* IE is described in subclause 6.3.3.1.4.

Field length of *Spare Extension* IE in RX TIMING DEVIATION CONTROL FRAME is 0-30 octets.

6.3.3.7.4 CFN

Description: The CFN value in this control frame is the CFN when the RX timing deviation was measured.

Value range: As defined in subclause 6.2.4.3.

Field length: 8 bits.

6.3.3.7.5 New IE Flags

Description: The *New IE Flags* IE is only present if at least one new IE is present. The *New IE Flags* IE contains flags indicating which new IEs that are present following the *New IE Flags* IE. The last bit position of the *New IE Flags* IE is

used as the Extension Flag to allow the extension of the *New IE Flags* IE in the future. Extension octets of the *New IE Flags* IE shall follow directly after the first octet of the *New IE Flags* IE. When an extension octet of the *New IE Flags* IE is present, then all previous extension octets of the *New IE Flags* IE and the *New IE Flags* IE shall also be present, even if they have all their flag bits indicating no presence of their respective new IEs.

Value range:

Bit 0-6 of each octet: Indicates if a new IE is present (1) or not present (0) in the bytes following the *New IE Flags* IE. The meaning of each bit is explained in the corresponding DATA FRAME subclause;

Bit 7 of each octet: Indicates if an extension octet of the *New IE Flags* IE follows (1) or not (0).

Field length: 1 – 31 octets.

6.3.3.8 DSCH TFCI SIGNALLING [FDD]

6.3.3.8.1 Payload structure

Void.

6.3.3.8.2 TFCI (field 2)

Void.

6.3.3.8.3 Spare Extension

Void.

6.3.3.8.4 CFN

Void.

6.3.3.9 RADIO INTERFACE PARAMETER UPDATE [FDD]

6.3.3.9.1 Payload structure

The figure 22 shows the structure of the payload when the control frame is used for signalling radio interface parameter updates.

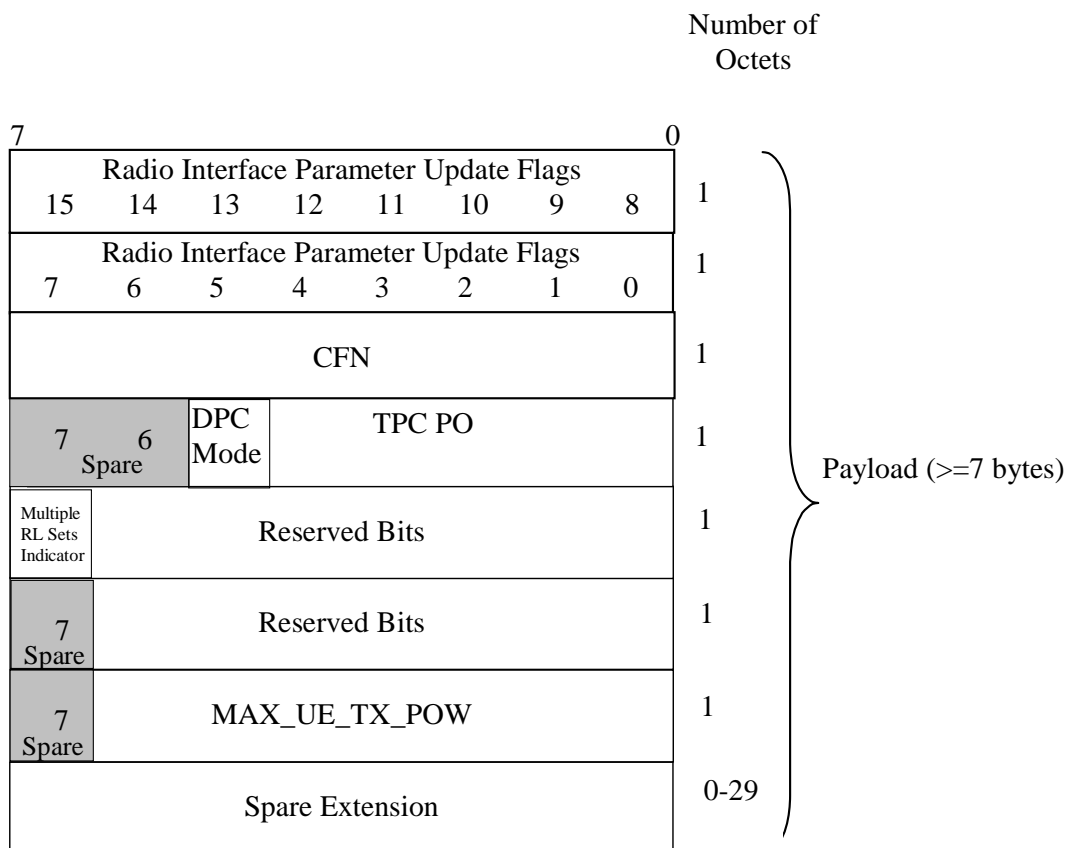


Figure 22: Structure of the payload for the RADIO INTERFACE PARAMETER UPDATE control frame

6.3.3.9.2 Radio Interface Parameter Update flags

Description: Contains flags indicating which information is valid in this control frame.

Value range:

- Bit 0: Indicates if the 3rd byte of the control frame payload contains a valid CFN (1) or not (0);
- Bit 1: Indicates if the 4th byte (bits 0-4) of the control frame payload contains a valid TPC PO (1) or not (0);
- Bit 2: Indicates if the 4th byte (bit 5) of the control frame payload contains a valid DPC mode (1) or not (0);
- Bit 3: Reserved bit;
- Bit 4: Reserved bit;
- Bit 5: Indicates if the 5th byte (bit 7) of the control frame payload contains a valid Multiple RL Sets Indicator (1) or not (0);
- Bit 6: Indicates if the 7th byte (bits 0-6) of the control frame payload contains a valid Maximum UE TX Power (1) or not (0);
- Bit 7-15: Set to (0): reserved in this user plane revision. Any indicated flags shall be ignored by the receiver.

Reserved bits shall be set to 0 by the SRNC and ignored by the Node B.

Field length: 16 bits.

6.3.3.9.3 TPC Power Offset (TPC PO)

Description: Power offset to be applied in the DL between the DPDCH information and the TPC bits on the DPCCH as specified in the clause 5.2 of TS 25.214 [12].

Value range: {0-7.75 dB}.

Granularity: 0.25 dB.

Field length: 5 bits.

6.3.3.9.4 Spare Extension

The *Spare Extension* IE is described in subclause 6.3.3.1.4.

6.3.3.9.4A CFN

Description: The CFN value indicates when the presented parameters shall be applied.

Value range: As defined in subclause 6.2.4.3.

Field length: 8 bits.

6.3.3.9.5 DPC Mode

Description: DPC mode to be applied in the UL.

Value range: {0,1}.

The DPC mode shall be applied as specified in TS 25.214 [12].

Field length: 1 bit.

6.3.3.9.6 TFCI Power Offset (TFCI PO)

Void.

6.3.3.9.7 TFCI Power Offset for primary cell (TFCI PO_primary)

Void.

6.3.3.9.8 Multiple RL Sets Indicator

Description: Multiple RL Sets Indicator indicates whether the UE has several RL Sets or not.

Value range: {0=UE has only one RL Set, 1=UE has several RL Sets}.

Field length: 1 bit.

6.3.3.9.9 Maximum UE TX Power

Description: The Maximum UE TX Power is the lower of the maximum output power of the UE power class, defined in ref TS 25.101 [14], and the Maximum Allowed UL TX Power that is also sent to the UE, see ref TS 25.331 [15].

Maximum UE TX Power is given in the unit MAX_UE_TX_POW where:

MAX_UE_TX_POW = 00 Maximum UE TX Power = -55 dBm
 MAX_UE_TX_POW = 01 Maximum UE TX Power = -54 dBm
 MAX_UE_TX_POW = 02 Maximum UE TX Power = -53 dBm
 ...
 MAX_UE_TX_POW = 87 Maximum UE TX Power = 32 dBm
 MAX_UE_TX_POW = 88 Maximum UE TX Power = 33 dBm

Value range: {-55..33 dBm}.

Granularity: 1 dBm

Field length: 7 bit

6.3.3.10 TIMING ADVANCE [3.84Mcps and 7.68 Mcps TDD]

6.3.3.10.1 Payload structure

Figure 23 shows the structure of the payload when the control frame is used for timing advance.

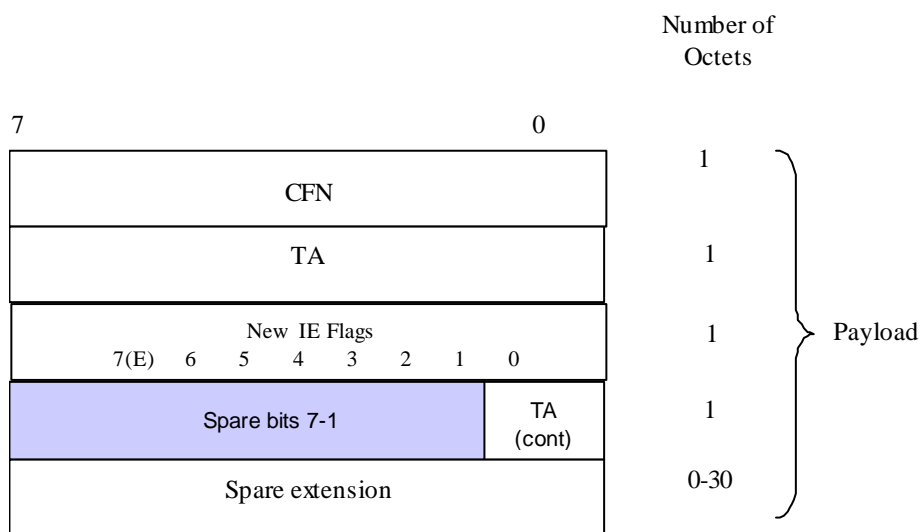


Figure 23a: Structure of the TIMING ADVANCE control frame for 7.68Mcps TDD

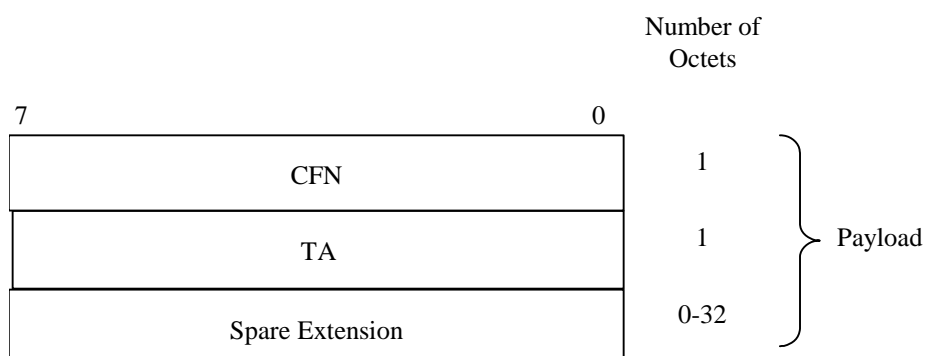


Figure 23b: Structure of the TIMING ADVANCE control frame for 3.84Mcps TDD

[7.68Mcps TDD - Bit 0 of New IE Flags in TIMING ADVANCE CONTROL FRAME indicates if the extended bits of the TA are present (1) or not present (0) in the byte following the *New IE Flags* IE. Bits 1 through 6 of New IE Flags in TIMING ADVANCE CONTROL FRAME shall be set to 0.]

6.3.3.10.2 CFN

Description: The CFN value in this control frame is the frame that the timing advance will occur.

Value range: As defined in subclause 6.2.4.3.

Field length: 8 bits.

6.3.3.10.3 TA [3.84 Mcps]

Description: UE applied UL timing advance adjustment.

Value range: {0-1020 chips}.

Granularity: 4 chips.

Field length: 8 bits.

6.3.3.10.3A TA [7.68 Mcps]

Description: UE applied UL timing advance adjustment.

Value range: {0-2044 chips}.

Granularity: 4 chips.

Field length: 9 bits.

6.3.3.10.4 Spare Extension

The *Spare Extension* IE is described in subclause 6.3.3.1.4.

[7.68Mcps TDD - Field length of *Spare Extension* IE in TIMING ADVANCE CONTROL FRAME is 0-30 octets].

6.3.3.10.5 New IE Flags [7.68Mcps TDD]

The *New IE Flags* IE is described in subclause 6.3.3.7.5.

6.3.3.11 TNL CONGESTION INDICATION

6.3.3.11.1 Payload structure

Figure 24 shows the structure of the payload when the control frame is used for TNL CONGESTION INDICATION.

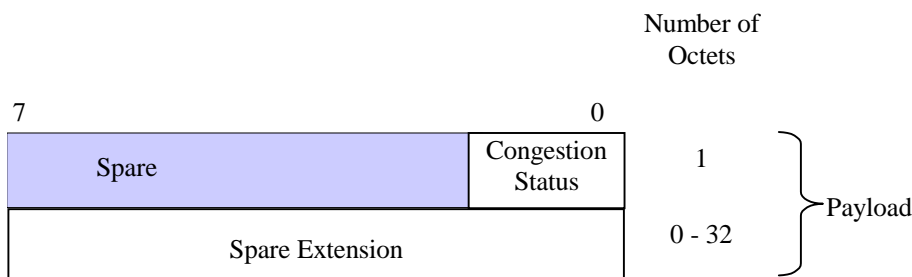


Figure 24: Structure of the TNL CONGESTION INDICATION control frame

6.3.3.11.2 Congestion Status

Description: The Congestion Status indicates whether there is transport network congestion or not.

Value range:

- 0 No TNL congestion
- 1 Reserved for future use.
- 2 TNL Congestion – detected by delay build-up
- 3 TNL Congestion – detected by frame loss

Field length: 2 bits.

6.3.3.11.3 Spare Extension

The *Spare Extension* IE is described in subclause 6.3.3.1.4.

7 Handling of Unknown, Unforeseen and Erroneous Protocol Data

7.1 General

A frame protocol frame with illegal or not comprehended parameter value shall be ignored. Frame protocol frames sent with a CFN in which the radio resources assigned to the associated Iub data port are not available, shall be ignored.

Frame protocol data frames with CFN value that does not fulfil the requirement set in clause [FDD - 4.2.14 of TS 25.212 [9]] [TDD - 4.2.12 of TS 25.222 [10]], shall be ignored.

7.2 Error detection

Error detection is provided on frames through a Cyclic Redundancy Check. The length of the CRC for the payload is 16 bits, for the data frame header 7 or 11 bits and for control frames it is 7 bits.

7.2.1 CRC Calculation

The parity bits are generated by one of the following cyclic generator polynomials:

$$g_{\text{CRC16}}(D) = D^{16} + D^{15} + D^2 + 1$$

$$g_{\text{CRC11}}(D) = D^{11} + D^9 + D^8 + D^2 + D + 1$$

$$g_{\text{CRC7}}(D) = D^7 + D^6 + D^2 + 1$$

Denote the bits in a frame by $a_1, a_2, a_3, \dots, a_{A_i}$, and the parity bits by $p_1, p_2, p_3, \dots, p_{L_i}$. A_i is the length of a protected data and L_i is 16, 11 or 7 depending on the CRC length.

The encoding is performed in a systematic form, which means that in GF(2), the polynomial for the payload

$$a_1 D^{A_i+15} + a_2 D^{A_i+14} + \dots + a_{A_i} D^{16} + p_1 D^{15} + p_2 D^{14} + \dots + p_{15} D^1 + p_{16}$$

yields a remainder equal to 0 when divided by $g_{\text{CRC16}}(D)$, the polynomial for the data frame header with 11 bit CRC

$$a_1 D^{A_i+11} + a_2 D^{A_i+10} + \dots + a_{A_i} D^{11} + p_1 D^{10} + p_2 D^9 + \dots + p_{10} D^1 + p_{11}$$

yields a remainder equal to 0 when divided by $g_{\text{CRC11}}(D)$ and the polynomial for the data frame header with 7 bit CRC and control frame

$$a_1 D^{A_i+6} + a_2 D^{A_i+5} + \dots + a_{A_i} D^7 + p_1 D^6 + p_2 D^5 + \dots + p_6 D^1 + p_7$$

yields a remainder equal to 0 when divided by $g_{\text{CRC7}}(D)$. If $A_i = 0$, $p_1 = p_2 = p_3 = \dots = p_{L_i} = 0$.

7.2.1.1 Relation between input and output of the Cyclic Redundancy Check

The bits after CRC attachment are denoted by $b_1, b_2, b_3, \dots, b_{B_i}$, where $B_i = A_i + L_i$.

The parity bits for the payload are attached at the end of the frame:

$$b_k = a_k \quad k = 1, 2, 3, \dots, A_i$$

$$b_k = p_{(k-A_i)} \quad k = A_i + 1, A_i + 2, A_i + 3, \dots, A_i + L_i$$

The parity bits for the frame header and the control frames are attached at the beginning of the frame:

$$b_k = p_k \quad k = 1, 2, 3, \dots, L_i$$

$$b_k = a_{(k-L_i)} \quad k = L_i + 1, L_i + 2, L_i + 3, \dots, L_i + A_i$$

Annex A (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	-	RP-99758	3.1.0	Approved at TSG RAN #6
RAN_06	3.0.0	-	RP-99759	3.1.0	Approved at TSG RAN #6
RAN_06	3.0.0	005	RP-99760	3.1.0	Approved at TSG RAN #6
RAN_07	3.1.0	-	-	3.2.0	Approved at TSG RAN #7
RAN_08	3.2.0	-	RP-000248	3.3.0	Approved at TSG RAN #8
RAN_09	3.3.0	026 028 029 031 032 033 034 035	RP-000384	3.4.0	Approved at TSG RAN #9
RAN_10	3.4.0	036 037 038	RP-000625	3.5.0	Approved at TSG RAN #10
RAN_11	3.5.0	039 040 043	RP-010122	3.6.0	Approved at TSG RAN #11

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
March 01	11	RP-010160	045		Approved at TSG RAN #11 and placed under Change Control	-	4.0.0
March 01	11	RP-010164	042		Approved at TSG RAN #11 and placed under Change Control	-	4.0.0
06/2001	12	RP-010381	050, 054		Approved at TSG RAN #12	4.0.0	4.1.0
06/2001	12	RP-010395	047		Approved at TSG RAN #12	4.0.0	4.1.0
09/2001	13	RP-010586	056		Transport bearer replacement clarification	4.1.0	4.2.0
09/2001	13	RP-010586	063	1	General Corrections on lub_lur UP protocol for DCH data streams	4.1.0	4.2.0
09/2001	13	RP-010598	057		Uplink power control for LCR TDD	4.1.0	4.2.0
09/2001	13	RP-010598	060	1	DPC Mode Correction in the User Plane	4.1.0	4.2.0
09/2001	13	RP-010598	061		25.427 Correction	4.1.0	4.2.0
12/2001	14	RP-010860	067		Correction to inconsistencies in TS 25.427	4.2.0	4.3.0
12/2001	14	RP-010860	069	1	Clarifications on data/control frame support	4.2.0	4.3.0
12/2001	14	RP-010860	071		Specification Notations	4.2.0	4.3.0
12/2001	14	RP-010860	077	2	Terminology Correction – Rel4	4.2.0	4.3.0
03/2002	15	RP-020194	082	1	DCH FP changes for TFCI power control in DSCH hard split mode	4.3.0	5.0.0
12/2002	18	RP-020744	088		Correction for the DL DPDCH transmission	5.0.0	5.1.0
09/2003	21	RP-030447	089	1	Coordination with RRC about the TFS of DL DCH for HS-DSCH	5.1.0	5.2.0
12/2003	22	RP-030678	090	1	Signalling support for soft handover indicator	5.2.0	5.3.0
12/2003	22	RP-030682	093	1	Spare Extension in Data frame	5.2.0	5.3.0
12/2003	22	-	-	-	Introduction of Release 6 specification	5.3.0	6.0.0
12/2004	26	RP-040440	095	2	Changes on 25.427 due to the introduction of Enhanced Uplink	6.0.0	6.1.0
03/2005	27	RP-050054	097	-	Reference for QE mapping is incorrect	6.1.0	6.2.0
03/2005	27	RP-050137	102	1	EDCH Frame format update	6.1.0	6.2.0
06/2005	28	RP-050234	103		Correction to the range of TDD parameter in RX TIMING DEVIATION [3.84Mcps TDD] FRAME	6.2.0	6.3.0
06/2005	28	RP-050229	104	1	Support for HARQ Retransmission and Failure Indication	6.2.0	6.3.0
06/2005	28	RP-050229	105		Clarification of the use of CFN for Enhanced Uplink	6.2.0	6.3.0
06/2005	28	RP-050229	106		Removing the abbreviation SFN for Subframe Number	6.2.0	6.3.0
06/2005	28	RP-050222	108	1	Feature clean-up: Removal of DSCH (FDD mode)	6.2.0	6.3.0
06/2005	28	RP-050229	109	1	Transport Network CongestionDetection and Control	6.2.0	6.3.0

Change history							
Date	TSG #	TSG Doc.	CR	Rev	Subject/Comment	Old	New
09/2005	29	RP-050434	110	1	CRC-11 Polynomial for E-DCH	6.3.0	6.4.0
09/2005	29	RP-050434	115	1	Value range missing for Number of Subframes and Number of Mac-es PDUs fields	6.3.0	6.4.0
09/2005	29	RP-050434	118	3	Maximum UE Tx Power for EDCH	6.3.0	6.4.0
12/2005	30	RP-050702	120	1	Conditions for sending HARQ Failure	6.4.0	6.5.0
12/2005	30	RP-050702	121	1	HARQ failure shall be sent on highest bearer	6.4.0	6.5.0
03/2006	31	RP-060066	125	1	HARQ Failure Indication due to MAC-e Reset in UE	6.5.0	6.6.0
03/2006	31	RP-060066	126	2	Clarification for HARQ Failure Indication	6.5.0	6.6.0
03/2006	31	RP-060073	124		Introduction of 7.68Mcps TDD option	6.6.0	7.0.0
06/2006	32	RP-060290	127	1	Release 7 Timing Advance (3.84 Mcps and 7.68 Mcps TDD)	7.0.0	7.1.0
06/2006	32	RP-060284	129	1	Missing new frame protocol services in list of services in clause 4.1	7.0.0	7.1.0
09/2006	33	RP-060511	133	1	Introduction of 3.84 Mcps and 7.68Mcps TDD Enhanced Uplink	7.1.0	7.2.0
12/2006	34	RP-060709	135	1	Fast Reconfiguration	7.2.0	7.3.0
12/2006	34	RP-060699	137	1	No Payload CRC if no Payload	7.2.0	7.3.0
12/2006	34	RP-060702	139		TNL congestion indication signal not applicable for DCH	7.2.0	7.3.0
12/2006	34	RP-060837	140	1	Consistency of Specification Notations	7.2.0	7.3.0
03/2007	35	RP-070062	141	1	Introduction of 1.28 Mcps TDD Enhanced Uplink	7.3.0	7.4.0
09/2007	37	RP-070629	142		Timing Advance Corrections for 3.84/7.68 Mcps TDD EDCH	7.4.0	7.5.0
03/2008	39	RP-080083	144	1	Introduction of Improved L2 for Uplink	7.5.0	8.0.0
12/2008	42	RP-080843	145		Corrections to IE definitions for UL DATA FRAME FOR E-DCH TYPE 2	8.0.0	8.1.0
12/2008	42	RP-080855	146	1	Improved EUL power control at UE power limitation freeze SIR target	8.0.0	8.1.0
12/2009	46	RP-091181	149		Correction on value range for Number of MAC-is SDU in frame	8.1.0	8.2.0
12/2009	-	-	-	-	Creation of version 9.0.0 based on v 8.2.0	8.2.0	9.0.0
12/2009	46	RP-091186	148	1	Introduction of Dual-Cell HSUPA	8.2.0	9.0.0
03/2011	SP-49	SP-100629			Clarification on the use of References (TS 21.801 CR#0030)	9.0.0	9.0.1

History

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V9.0.1	April 2011	Publication