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Technical Specification

Universal Mobile Telecommunications System (UMTS);
UTRAN Iur and Iub interface user plane protocols
for DCH data streams
(3GPP TS 25.427 version 5.3.0 Release 5)

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650 Route des Lucioles
F-06921 Sophia Antipolis Cedex - FRANCE

Tel.: +33 4 92 94 42 00 Fax: +33 4 93 65 47 16

Siret N° 348 623 562 00017 - NAF 742 C
Association à but non lucratif enregistrée à la
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Contents

Foreword

This Technical Specification (TS) has been produced by the 3rd Generation Partnership Project (3GPP).

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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 25.215: "Physical layer – Measurements (FDD)".

[8] 3GPP TS 25.225: "Physical layer – Measurements (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)".

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
FP	Frame Protocol
FT	Frame Type
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 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 3.84Mcps TDD and 1.28Mcps 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 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.

[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 *Information Element Name* 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. *Connection Frame Number* 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 data streams is also valid for I_{ur} 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 [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 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.
- Transfer of DSCH TFCI from SRNC to Node B.
- [3.84 Mcps TDD - Transfer of Rx timing deviation from the Node B to the SRNC.]

- Transfer of radio interface parameters from the SRNC to the 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 from Node B to the SRNC for uplink transfer.

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

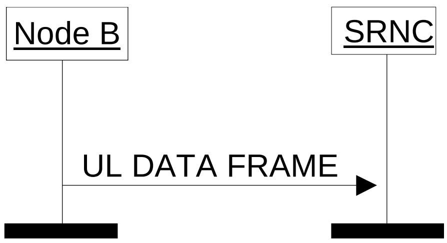

Figure 1: Uplink Data Transfer procedure

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.

5.1.2 Downlink

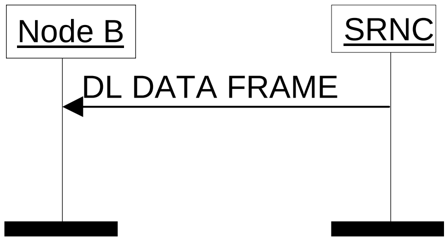

Figure 2: Downlink Data Transfer procedure

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 [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 [4] [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 [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 [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 DPCCH 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. The same applies to the DSCH TFCI SIGNALLING control frame.

If a DL DATA FRAME or a DSCH TFCI SIGNALLING control 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.

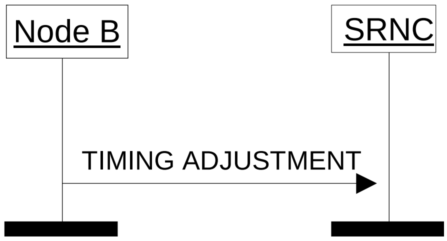

Figure 3: Timing Adjustment procedure

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 [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.

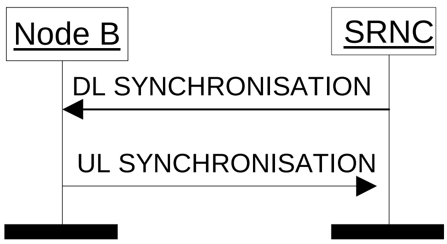

Figure 4: DCH Synchronisation procedure

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.]

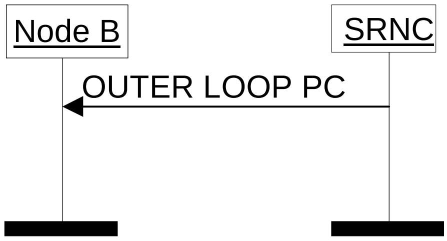

Figure 5: Outer Loop Power Control Information Transfer procedure

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 [2].

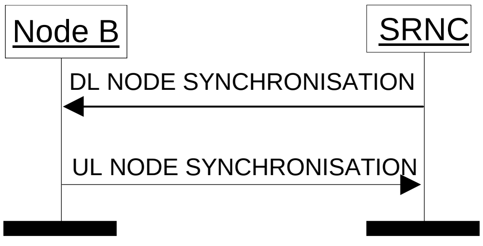

Figure 6: Node Synchronisation procedure

5.6 Rx Timing Deviation Measurement [3.84 Mcps TDD]

In case the *Timing Advance Applied* IE indicates "Yes" (see [4]) in a cell, the Node B shall, for all UEs using DCHs, monitor the receiving time of the uplink DPCH bursts arriving over the radio interface, and shall calculate the Rx timing deviation. 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.

If the *Timing Advance Applied* IE indicates "No" (see [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.

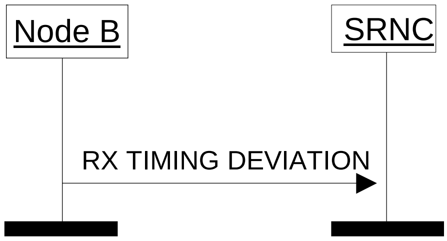

Figure 7: Rx Timing Deviation Measurement procedure

5.7 DSCH TFCI Signalling [FDD]

This procedure is used in order to signal to the Node B the TFCI (field 2). This allows the Node B to build the TFCI word(s) which have to be transmitted on the DPCCH. A transport bearer of any DCH directed to this same UE may be employed for transport over the I_{ub}/I_{ur}.

The procedure consists in sending the DSCH TFCI SIGNALLING control frame from the SRNC to the Node B. The frame contains the TFCI (field 2) and the correspondent CFN. The DSCH TFCI SIGNALLING control frame is sent once every Uu frame interval (10 ms) for as long as there is DSCH data for that UE to be transmitted in the associated PDSCH Uu frame. In the event that the Node B does not receive a DSCH TFCI SIGNALLING control frame then the Node B shall infer that no DSCH data is to be transmitted to the UE on the associated PDSCH Uu frame and will build the TFCI word(s) accordingly.

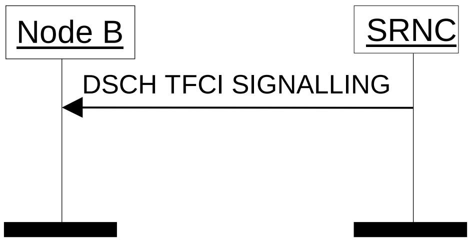

Figure 8: DSCH TFCI Signalling procedure

5.8 Radio Interface Parameter Update [FDD]

This procedure is used to update radio interface parameters which are applicable to all RL's 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.

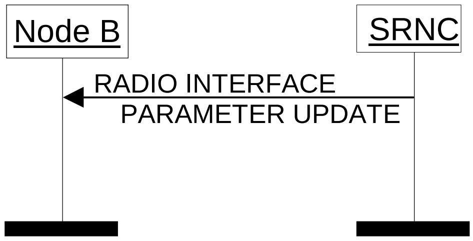

Figure 9: Radio Interface Parameter Update procedure

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 frame contains a valid DPC mode value, the Node B shall apply the newly provided value in DL power control. If the frame contains valid TFCI PO_primary parameter and cell is decided to be primary, the Node B shall apply the newly provided value in DL TFCI power control. If the frame contains valid TFCI PO parameter, the Node B shall apply the newly provided value in DL TFCI 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 [12].

5.9 Timing Advance [3.84 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 [4] and RNSAP [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.
- 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 [4]).

In both cases, starting from this CFN the Node-B shall support all applicable DCH Frame Protocol procedures on the new transport bearer and no requirements exist regarding support of 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 [4] and RNSAP [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 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.

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.

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.

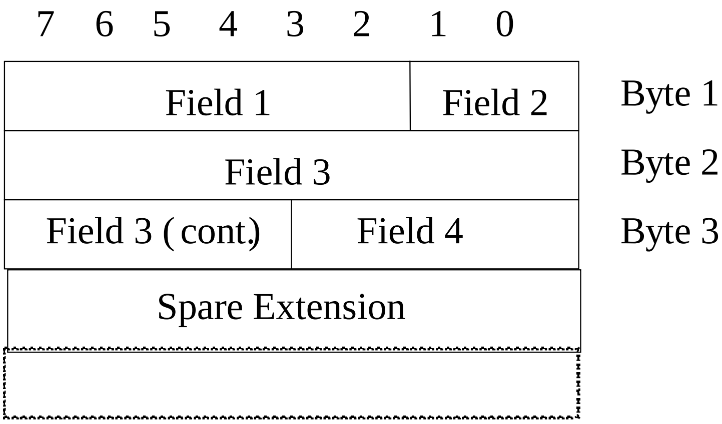

Figure 10: Example of notation used for the definition of the frame structure

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

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

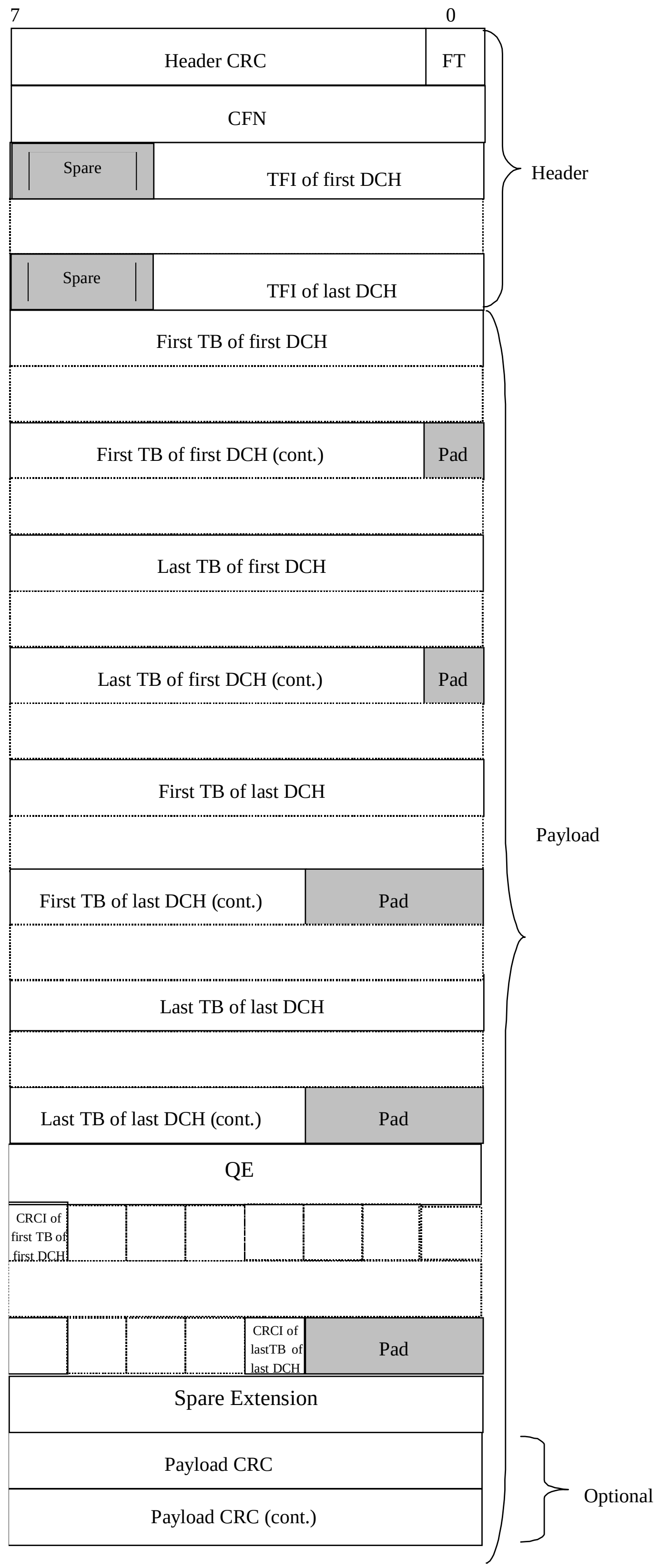

Figure 11: UL DATA FRAME structure

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).

6.2.3 DL DATA FRAME

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

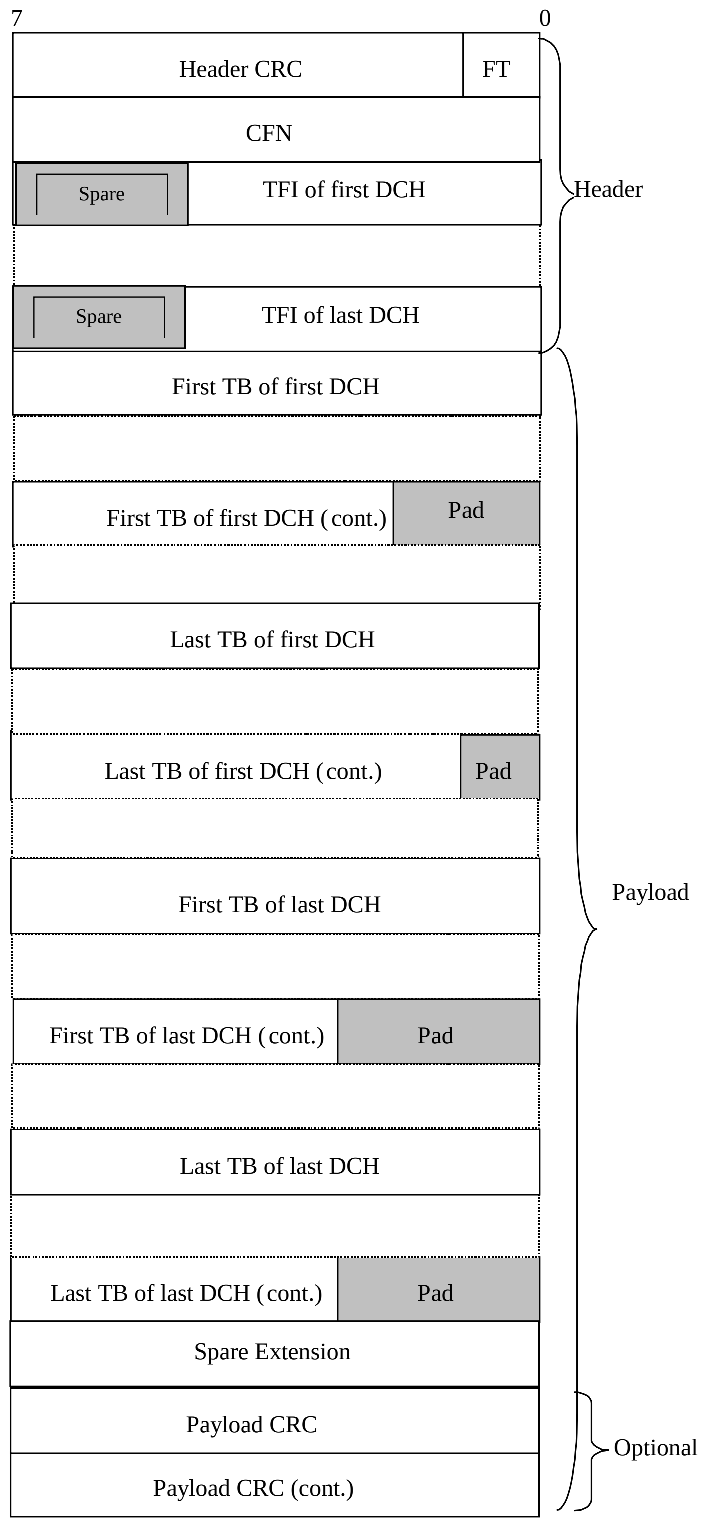

Figure 12: DL DATA FRAME structure

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) with the corresponding generator polynomial: $G(D) = D^7+D^6+D^2+1$. See subclause 7.2.

Field Length: 7 bits.

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 [2].

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 [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 [4] [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 [7] and [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 [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.

6.3 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.

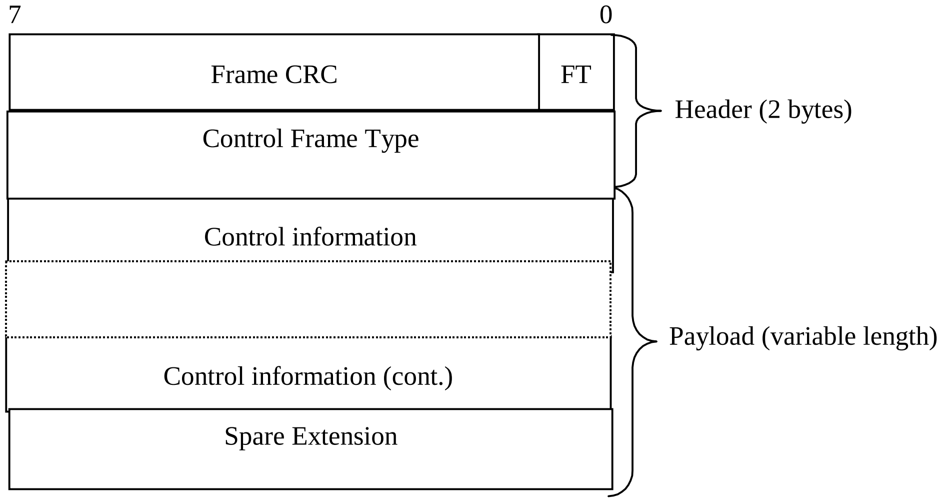

Figure 13: General structure of the control frames

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
DSCH TFCI SIGNALLING	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

Field length: 8 bits.

6.3.3 Payload structure and information elements

6.3.3.1 TIMING ADJUSTMENT

6.3.3.1.1 Payload structure

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

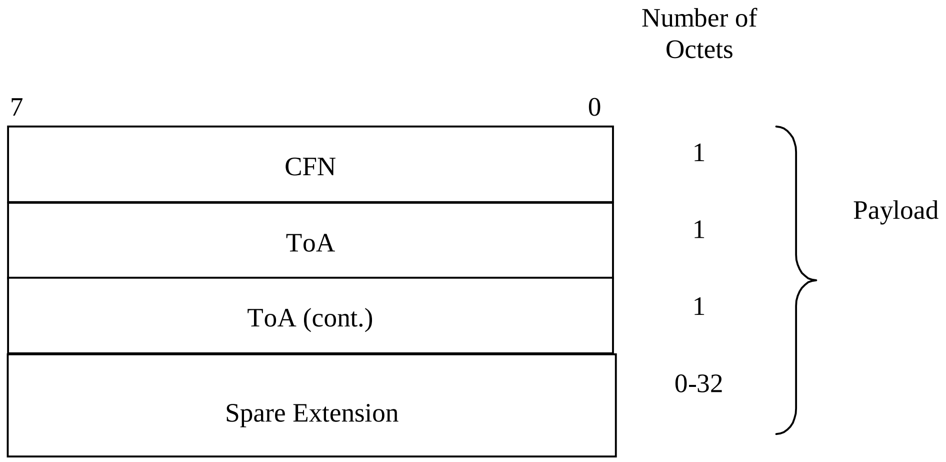

Figure 14: Structure of the payload for the TIMING ADJUSTMENT control frame

6.3.3.1.2 CFN

Description: The CFN value is extracted from the corresponding DL DATA FRAME or DSCH TFCI SIGNALLING control 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.

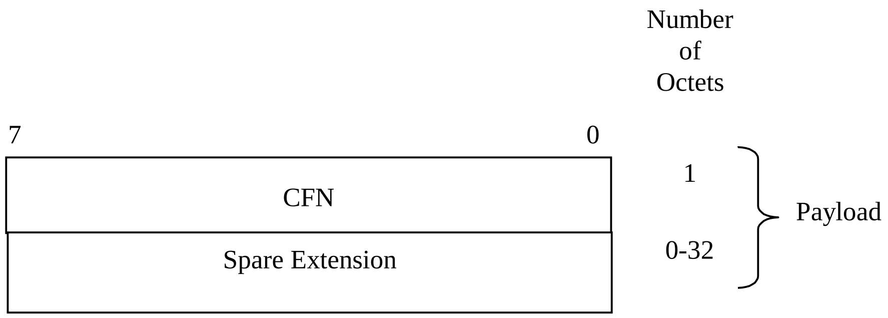

Figure 15: Structure of the payload for the DL SYNCHRONISATION control frame

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.

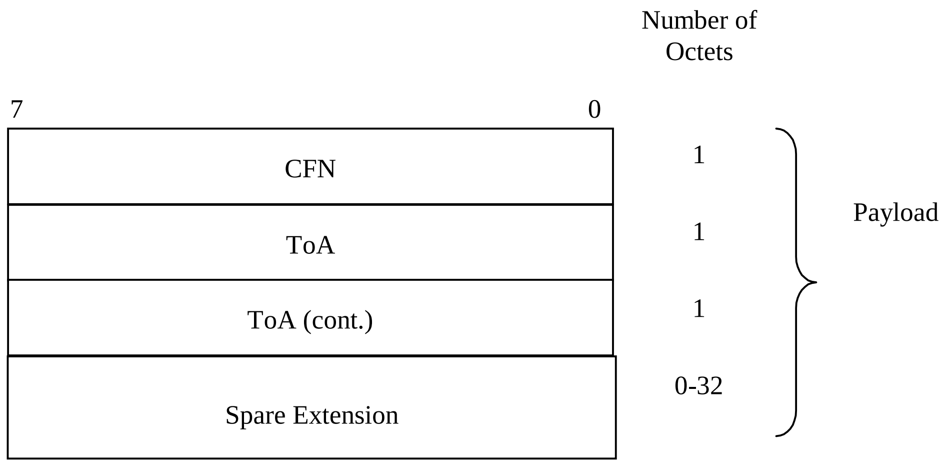

Figure 16: Structure of the UL SYNCHRONISATION control frame

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.

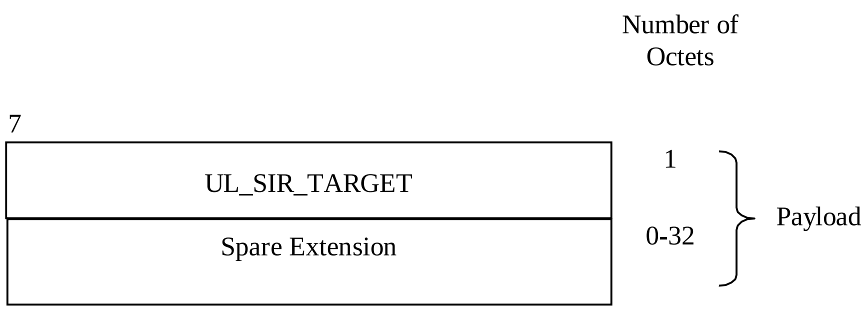

Figure 17: Structure of the payload for OUTER LOOP PC control frame

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.

6.3.3.5 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.

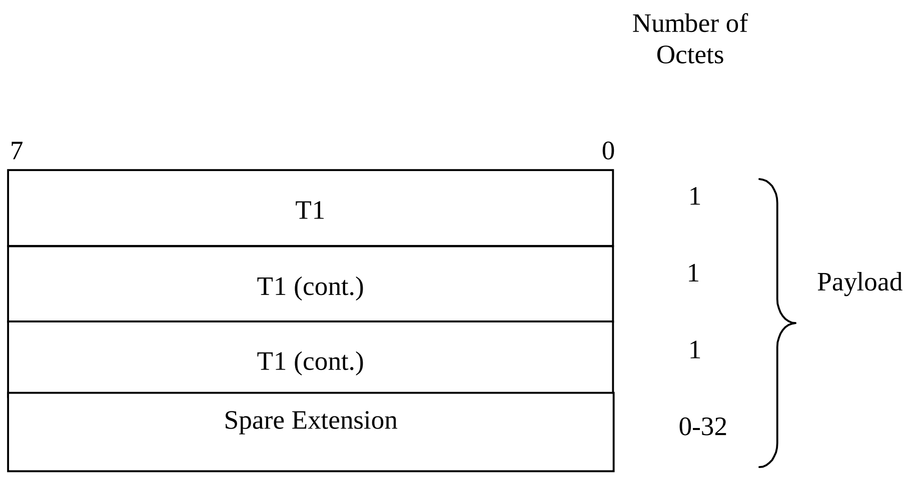

Figure 18: Structure of the payload for the DL NODE SYNCHRONISATION control frame

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.

7 … 0	Number of Octets	
T1	1	Payload
T1 (cont.)	1	
T1 (cont.)	1	
T2	1	
T2 (cont.)	1	
T2 (cont.)	1	
T3	1	
T3 (cont.)	1	
T3 (cont.)	1	
Spare Extension	0-32	

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 [3.84Mcps 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.

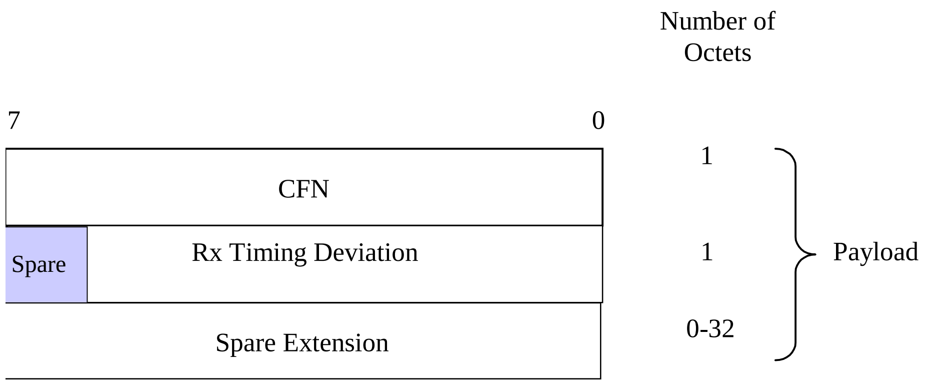

Figure 20: Structure of the payload for RX TIMING DEVIATION control frame

6.3.3.7.2 Rx Timing Deviation

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

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

{N x 4 –256}chips ≤ RxTiming Deviation < {(N+1) x 4 –256} chips

With N = 0,1, .. , 127

Granularity: 4 chips.

Field length: 7 bits.

6.3.3.7.3 Spare Extension

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

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.

6.3.3.8 DSCH TFCI SIGNALLING [FDD]

6.3.3.8.1 Payload structure

The figure 21 shows the structure of the payload when the control frame is used for signalling TFCI (field 2) bits.

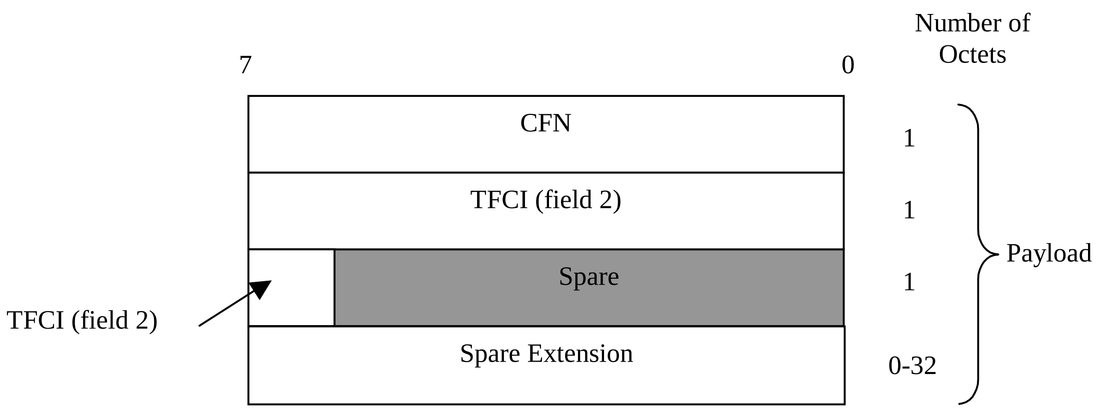

Figure 21: Structure of the payload for the DSCH TFCI SIGNALLING control frame

6.3.3.8.2 TFCI (field 2)

Description: TFCI (field 2) is as described in [4], it takes the same values as the TFCI(field 2) which is transmitted over the Uu interface.

Value range: {0-1023}

Field length: 10 bits

6.3.3.8.3 Spare Extension

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

6.3.3.8.4 CFN

Description: Indicator when TFCI(field 2) shall be transmitted on downlink.

Value range: As defined in subclause 6.2.4.3.

Field length: 8 bits.

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.

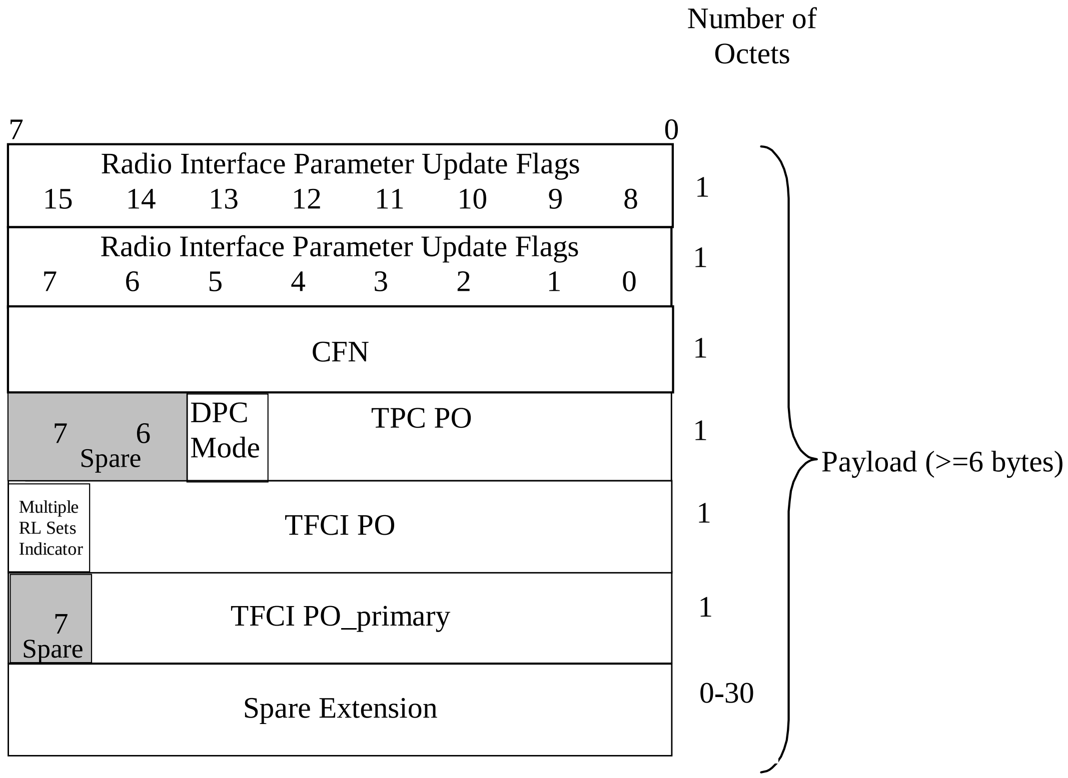

Figure 22: Structure of the payload for the RADIO INTERFACE PARAMETER UPDATE control frame

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: Indicates if the 5th byte (bit 0-6) of the control frame payload contains a valid TFCI PO (1) or not (0);

Bit 4: Indicates if the 6th byte (bit 0-6) of the control frame payload contains a valid TFCI PO_primary (1) or not (0);

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 6-15: Set to (0): reserved in this user plane revision. Any indicated flags shall be ignored by the receiver.

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 [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 [12].

Field length: 1 bit.

6.3.3.9.6 TFCI Power Offset (TFCI PO)

Description: Power offset to be applied in the DL between the DPDCH information and the TFCI bits on the DPCCH.

Value range: {0-31.75 dB}.

Granularity: 0.25 dB.

Field length: 7 bits.

6.3.3.9.7 TFCI Power Offset for primary cell (TFCI PO_primary)

Description: Power offset to be applied in the DL between the DPDCH information and the TFCI bits on the DPCCH when cell is decided to be primary. The primary status shall be determined as specified in [4].

Value range: {0-31.75 dB}.

Granularity: 0.25 dB.

Field length: 7 bits.

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.

6.3.3.10 TIMING ADVANCE [3.84Mcps 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.

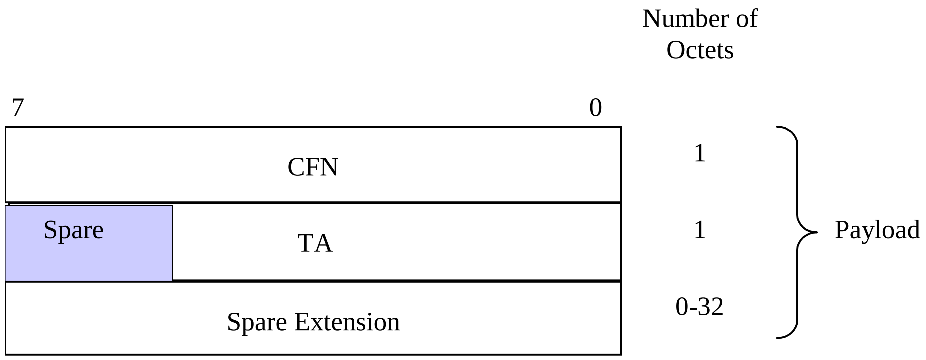

Figure 23: Structure of the TIMING ADVANCE control frame

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

Description: UE applied UL timing advance adjustment.

Value range: {0-252 chips}.

Granularity: 4 chips.

Field length: 6 bits.

6.3.3.10.4 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 [9]] [TDD - 4.2.12 of [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 and for the frame header and control frames it is 7 bits.

7.2.1 CRC Calculation

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

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

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

Denote the bits in a frame by $a_1, a_2, a_3, \ldots, a_{A_i}$, and the parity bits by $p_1, p_2, p_3, \ldots, p_{L_i}$. A_i is the length of a protected data and L_i is 16 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

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

yields a remainder equal to 0 when divided by $g_{CRC16}(D)$ and the polynomial for the header and control frame

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

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

7.2.1.1 Relation between input and output of the Cyclic Redundancy Check

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

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

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

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

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

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

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

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 Iub_Iur 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

History

Document history		
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V5.1.0	December 2002	Publication
V5.2.0	September 2003	Publication
V5.3.0	December 2003	Publication