TSG-RAN Meeting #26
Athen, Greece, 08-10 December 2004

RP-040486
Agenda item 7.3.2

Source: **TSG-RAN WG2.**

Title: **CRs on TR 25.309 (on Enhanced Uplink)**

The following CRs are in RP-040486:

Spec	CR	Rev	Phase	Subject	Cat	Version-Current	Version-New	Doc-2nd-Level	Workitem	Status-2nd-Level
25.309	001	3	Rel-6	Inclusion of e.g. physical layer model, MAC architecture, detail Node B scheduler mechanism and QoS Control principles	F	6.0.0	6.1.0	R2-042730	EDCH-Stage2	**agreed**
25.309	003	1	Rel-6	Proposed rewording on scheduler sections compared to CR 001r3	F	6.0.0	6.1.0	R2-042728	EDCH-Stage2	**agreed**

3GPP TSG-RAN2 Meeting #45
Shin-Yokohama, Japan, November 15th-19th, 2004

Tdoc ⌘R2-042730

CR-Form-v7.1

CHANGE REQUEST

⌘ **25.309** **CR** **001** ⌘**rev** **3** ⌘ Current version: **6.0.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ [ ] ME [X] Radio Access Network [X] Core Network [ ]

Title:	⌘	Inclusion of e.g. physical layer model, MAC architecture, detail Node B scheduler mechanism and QoS Control principles
Source:	⌘	RAN WG2
Work item code:	⌘	EDCH-Stage2
Date:	⌘	29 November 2004
Category:	⌘	**F**
Release:	⌘	Rel-6

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:

Ph2	*(GSM Phase 2)*
R96	*(Release 1996)*
R97	*(Release 1997)*
R98	*(Release 1998)*
R99	*(Release 1999)*
Rel-4	*(Release 4)*
Rel-5	*(Release 5)*
Rel-6	*(Release 6)*
Rel-7	*(Release 7)*

Reason for change: ⌘	25.309 should be updated to reflect the decisions taken during RAN2#44 and RAN2#45. In particular the physical layer model, MAC architecture, detail on the Node B scheduler mechanism and the QoS control principles have to be included in the TS.

Summary of change:	The following changes have been done: 1. Section 3.1: Addition to the definition of the E-DCH active set, HARQ profile, Power offset attribute, Serving E-DCH cell, Serving E-DCH RLS and Non-serving E-DCH RLS. 2. Section 3.2: Additon of new abbreviations in particular corresponding to the new E-DCH physical channels. 3. Section 6.1: Modification of the architecture with addition of a new MAC entity in the SRNC (MAC-es). 4. Section 6.3.1 and 6.3.2: Inclusion of the UL and DL Physical layer models. 5. Section 7.1.1: Modification of the existing text to reflect the fact that multiplexing of different MAC-d flows in the same MAC-e PDU is supported and that the allowed combinations are under control of the RNC. 6. Section 7.1.2: Inclusion of more detail regarding the reordering entity.

⌘

7. Section 7.2.1 to 7.2.5: Inclusion of the UE side MAC architecture.
8. Section 7.3.1 to 7.3.6 (new): Inclusion of the UTRAN side MAC architecture.
9. Section 8.1: Inclusion of how the UE decides on a maximum number of transmissions for a MAC-e PDU.
10. Section 9.1: Modification of the existing text, addition of text regarding the Relative Grants meaning and non-serving Node B operations.
11. Section 9.2 (new): New section on UE scheduling operation
12. Section 9.3.2: Exitsing text modified with further detail.
13. Section 10.1(new) and 10.1.1 (new): New sections on the general principles of the QoS control and QoS configuration principles.
14. Section 10.2: Modification of the existing text regarding TFC and E-TFC selection mainly linked to power control.
15. Section 10.3 (new): New section on the setting of power offset attributes of MAC-d flows.
16. Section 11.2: Addition of text on the downlink signalling parameters introducing the E-TFC tables, power offset attribute per MAC-d flow and Beta factor for the reference E-TFC.

Update from R2-042546:

- Section 3.2: Addition of 3 abbreviations. AG (Absolute Grant), RG (Relative Grant) and SG (Serving Grant).
- Section 6.3.1: Inclusion of the DPCCH content.
- Section 6.3.2: Inclusion of the fact that it is optional for the Serving RLS to send RGs.
- Section 7.1.1: Small clean up that was forgotten from Rev4.
- Section 7.1.2: Inclusion of the fact that there is a one to one mapping between logical channel and reordering queue.
- Section 7.2.1: Update of the figure showing the simplified architecture showing MAC inter-working in UE.
- Section 7.2.2: Inclusion of the fact that the support of E-DCH a new connection to MAC-es is added.
- Section 7.3.1: Update of the figure showing the simplified architecture showing MAC inter-working in UTRAN.
- Section 7.3.2: Removal of the FFS: The support of E-DCH implies no further changes to the UTRAN MAC-d entity.
- Section 7.3.5: Inclusion of the fact that there is a one to one mapping between logical channel and reordering queue.
- Section 8.1:
    - Inclusion of the fact that no pre-emption shall be done by the UE.
- Section 9.1:
    - Removal of the FFS regarding what is controlled by the Absolute Grant. The Absolute Grant contains the maximum allowed in terms of E-DPDCH+DPDCH/DPCCH power ratio.
    - Introduction of the fact that only one E-RNTI is allocated at a time.
    - Intoduction of more detail added on the Non-serving Node-B

operation.

- Section 9.2:
  - Section completely rewritten according to the decision taken of having two UE behaviors from Serving RLS point of view.
- Section 9.3.1:
  - Addition of text on the Scheduling Request.
- Section 10.2:
  - Modification of the power offset selection criteria in case of E-DCH multiplexing according to R2-042514
- Section 11.2: small correction

Update from R2-042664:

- Section 2:
  - RAN1 aspect: Addition of TS 25.212 in References.
- Section 6.3.1: Clarification of the fact that the DPCCH carries 10 bits of information.
- Section 6.3.2:
  - Further clarification of the text.
  - RAN1 aspect: Modulation added as ACK/NACK may have different modulation depending on who is sending it
- Section 7.2.1:
  - Addition of the DDI, N and TSN field sizes.
  - Clarification of the special value of the DDI field (it indicates that no more data is contained in the remaining part of the MAC-e PDU). Figure 7.2.1-1 updated.
- Section 7.2.5:
  - RAN1 aspect: Correction of the text on HARQ RV.
- Section 7.3.1:
  - Addition of the fact that mapping of the MAC-d flow into its Iub bearer is defined by the SRNC.
  - Addition of the DDI size.
  - Clarification of the special value of the DDI field (it indicates that no more data is contained in the remaining part of the MAC-e PDU). Figure 7.3.1-2 updated.
- Section 8.1:
  - Clarification of the text on pre-emption.
  - RAN1 aspect: Correction of the text on HARQ RV.
- Section 9.1:
  - Generalisation of the text as it has not been agreed that the quality was based on the DPCCH.
- Section 9.2.1:
  - Removal on the texts linked to the sending of Scheduling Request as this area is FFS.
- Section 9.3.1:
  - Removal on the fact that in the case where the UE had no grant,

the Scheduling Request should not contain data.

- Correction of a typo.

- Section 11.2:
  - Inclusion of text proposal of R2-042381 updated according to the latest discussion and RAN1 agreements.

Rev1 - Update from R2-042716:

- Section 2:
  - Removal of TS 25.212 in References.
- Section 3.2:
  - Bullet point on E-DCH detleted.
- Section 6.3.2:
  - Further text clarification on the Serving E-DCH RLS.
  - Further text clarification on ACK/NACK combining.
- Section 7.2.1:
  - Further clarification regarding to the MAC-d Flow ID.
- Section 7.2.2:
  - Correction of the title of the Figure.
- Section 7.2.5:
  - Update of the text to reflect the fact that there is one reordering queue per logical channel.
- Section 8.1:
  - Modification of the text on HARQ RV.
- Section 9.1:
  - Removal to the original text on was is controlled by the Scheduling Grants (in fact Absolute Grannts here). This point is handled separatly in CR002.
  - Removal of most of the text on Non-serving NodeB operation.
- Section 9.2.1:
  - Addition of a Note to clarify the usage wording "maximum allowed rate".
  - Last sentence of the section rewritten.
- Section 9.2.2:
  - First sentence of the section rewritten.
- Section 9.3.1:
  - Removal to the sentence on the condition on which the UE decide whether it has got or not a scheduling grant.
- Section 11.2:
  - Further clarification regarding to the MAC-d flow ID mapping to DDI.
  - “Signature sequence” is used instead of "Hadamard sequence”.
  - Additional parameters included in the E-DPDCH configuration.

Rev2 - Update from R2-042719:

- Section 3.1:

- Small rewording;

- Section 6.3.2:
  - Small text correction in the last paragraphe;
- Section 7.2.5:
  - Correction to Figure 7.2.5-1 to clarify that setting of TSN is done at the same time than multiplexing;
- Section 7.2.1:
  - Addition of a Note on the possibility to bypass the C/T multiplexing box;
  - Correction to Figure 7.2.1-2 to clarify that setting of TSN is done at the same time than multiplexing;
- Section 7.3.1:
  - Addition of a Note on the possibility to bypass the C/T multiplexing box;
  - Removal of the statement on the C/T field;
- Section 8.1:
  - Rewritting of the text on HARQ RV.
  - Rewording of the sentence on the non support of pre-emption by E-DCH.
- Section 9.1:
  - Removal of the FFS regarding what is controlled by the Scheduling Grants. Scheduling Grants control the maximum allowed power ratio. It remains FFS whether the Scheduling Grants control the maximum allowed (E-DPDCH+DPDCH)/DPCCH power ratio or E-DPDCH/DPCCH power ratio. This point is handled separatly.
- Section 11.2:
  - Correction of a typo;
- Some reformatting done accross the document.

Rev3 - Update from R2-042725:

- Creation of a “clean version” as a delta between CR001rev2 and 25.309 v6.0.0.
- No change to the text.

Consequences if not approved:	⌘	TS 25.309 will not reflect the decisions made during RAN2#44 and RAN2#45.

Clauses affected:	⌘	3.1, 3.2, 6.1, 6.3.1, 6.3.2, 7.1.1, 7.1.2, 7.2.1 to 7.2.5, 7.3.1 to 7.3.6 (new), 8.1, 9.1, 9.2 (new), 9.3, 9.3.1, 9.3.2, 10, 10.1 (new), 10.1.1 (new), 10.2, 10.3 (new)and 11.2

		Y	N			
Other specs affected:	⌘	X		Other core specifications	⌘	25.301, 25.302, 25.321, 25.331
			X	Test specifications		
			X	O&M Specifications		

Other comments:	⌘	

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Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

1 Scope

The present document is a technical specification of the overall support of FDD Enhanced Uplink in UTRA.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 25.896: "Feasibility Study for Enhanced Uplink for UTRA FDD".

[2] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in 3GPP TR 21.905 [2] and the following apply:

E-DCH: Enhanced DCH, a new dedicated transport channel type or enhancements to an existing dedicated transport channel type.

E-DCH active set: The set of cells which carry the E-DCH for one UE.

HARQ profile: One HARQ profile consists of a power offset attribute and maximum number of transmissions.

Power offset attribute: Represents the power offset between E-DPDCH(s) and reference E-DPDCH power level for a given E-TFC. This power offset attribute is set to achieve the required QoS in this MAC-d flow when carried alone in a MAC-e PDU and subsequently in the corresponding CCTrCh of E-DCH type. Details on the mapping on Beta factors can be found in RAN WG1 specifications. The reference E-DPDCH power level for a given E-TFC is derived from the beta factor signaled to the UE for a reference E-TFC (see details in section 10.1).

Serving E-DCH cell: Cell from which the UE receives Absolute Grants from the Node-B scheduler. A UE has one Serving E-DCH cell.

Serving E-DCH RLS or Serving RLS: Set of cells which contains at least the Serving E-DCH cell and from which the UE can receive and combine one Relative Grant. The UE has only one Serving E-DCH RLS.

Non-serving E-DCH RLS or Non-serving RLS: Set of cells which does not contain the Serving E-DCH cell and from which the UE can receive and combine one Relative Grant. The UE can have zero, one or several Non-serving E-DCH RLS.

3.2 Abbreviations

For the purposes of the present document, the abbreviations given in 3GPP TR 21.905 [2] and the following apply:

AG Absolute Grant

E-AGCH	E-DCH Absolute Grant Channel
E-DPCCH	E-DCH Dedicated Physical Control Channel
E-DPDCH	E-DCH Dedicated Physical Data Channel
E-HICH	E-DCH HARQ Acknowledgement Indicator Channel
E-RGCH	E-DCH Relative Grant Channel
E-RNTI	E-DCH Radio Network Temporary Identifier
E-TFC~~TF~~	E-DCH Transport Format Combination
HARQ	Hybrid Automatic Repeat Request
HSDPA	High Speed Downlink Packet Access
RG	Relative Grant
RLS	Radio Link Set
RSN	Retransmission Sequence Number
SG	Serving Grant
TSN	Transmission Sequence Number

4 Background and Introduction

The technical objective of the FDD Enhanced Uplink work item is to improve the performance of uplink dedicated transport channels, i.e. to increase capacity and throughput and reduce delay. This work item is applicable for UTRA FDD only.

Among the techniques considered in [1], the following techniques are part of the work item:

- Node B controlled scheduling: possibility for the Node B to control, within the limits set by the RNC, the set of TFCs from which the UE may choose a suitable TFC,
- Hybrid ARQ: rapid retransmissions of erroneously received data packets between UE and Node B,
- Shorter TTI: possibility of introducing a 2 ms TTI.

5 Requirements

- The Enhanced Uplink feature shall aim at providing significant enhancements in terms of user experience (throughput and delay) and/or capacity. The coverage is an important aspect of the user experience and that it is desirable to allow an operator to provide for consistency of performance across the whole cell area.
- The focus shall be on urban, sub-urban and rural deployment scenarios.
- Full mobility shall be supported, i.e., mobility should be supported for high-speed cases also, but optimisation should be for low-speed to medium-speed scenarios.
- The study shall investigate the possibilities to enhance the uplink performance on the dedicated transport channels in general, with priority to streaming, interactive and background services. Relevant QoS mechanisms shall allow the support of streaming, interactive and background PS services.
- It is highly desirable to keep the Enhanced Uplink as simple as possible. New techniques or group of techniques shall therefore provide significant incremental gain for an acceptable complexity. The value added per feature/technique should be considered in the evaluation. It is also desirable to avoid unnecessary options in the specification of the feature.
- The UE and network complexity shall be minimised for a given level of system performance.
- The impact on current releases in terms of both protocol and hardware perspectives shall be taken into account.
- It shall be possible to introduce the Enhanced Uplink feature in a network which has terminals from Release'99, Release 4 and Release 5. The Enhanced Uplink feature shall enable to achieve significant improvements in overall system performance when operated together with HSDPA. Emphasis shall be given on the potential impact the new feature may have on the downlink capacity. Likewise it shall be possible to deploy the Enhanced Uplink feature without any dependency on the deployment of the HSDPA feature.

6 Overall architecture of enhanced uplink DCH

6.1 Protocol architecture

The following modifications to the existing nodes are needed to support enhanced uplink DCH:

UE

A new MAC entity (MAC-es/MAC-e) is added in the UE located below MAC-d. MAC-es/MAC-e in the UE handles HARQ retransmissions, scheduling and MAC-e multiplexing, E-DCH~~.~~ TFC selection. ~~is part of MAC-d. It is FFS if MAC-e also includes TFC selection functionality.~~

Node B

A new MAC entity (MAC-e) is added in Node B which handles HARQ retransmissions, scheduling and MAC-e demultiplexing.

S-RNC

A new ~~functionality is added in~~ MAC entity (MAC-es) is added in the SRNC to provide in-sequence delivery (reordering) and to handle combining of data from different Node Bs in case of soft handover.

The resulting protocol architecture is shown in Figure 6.1-1:

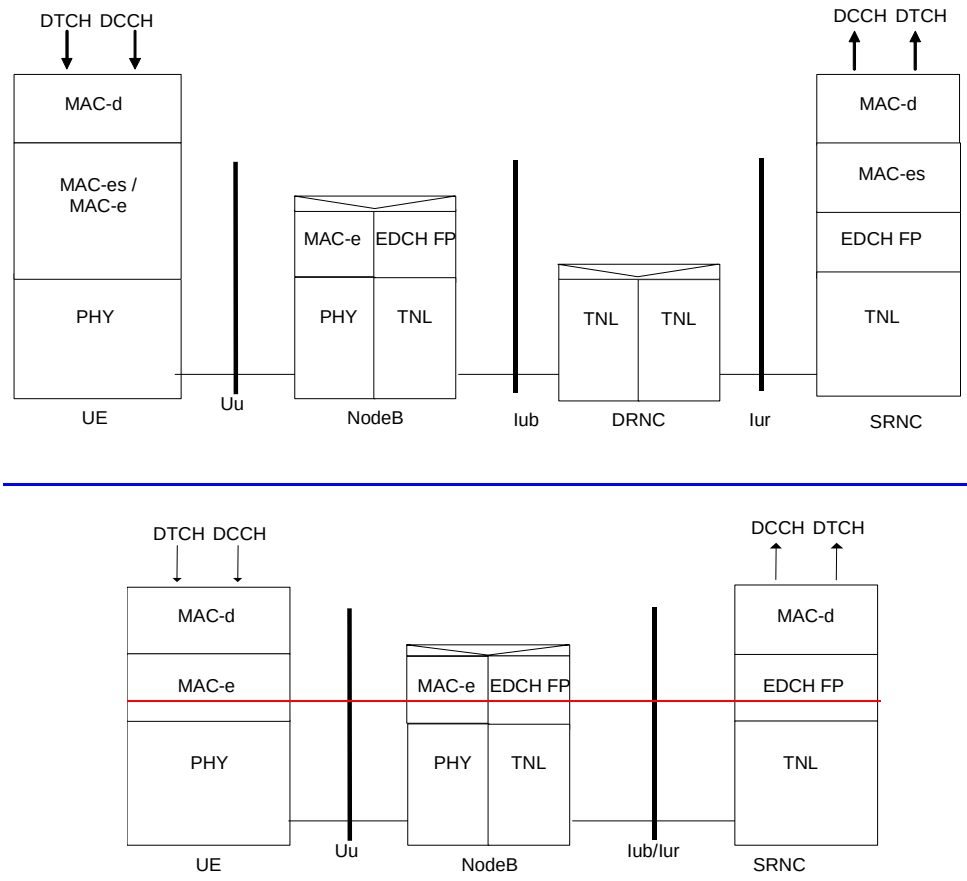

Figure 6.1-1: Protocol Architecture of E-DCH

The need for an E-DCH FP in the DRNC has to be discussed (this is under the scope of RAN WG3).

6.2 Transport channel attributes

The E-DCH transport channel has the following characteristics:

- E-DCH and DCH are using separate CCTrCHs
- There is only one CCTrCH of E-DCH type per UE;
- There is only one E-DCH per CCTrCH of E-DCH type;
- There is only one transport block per TTI;
- Both 2 ms TTI and 10 ms TTI are supported by the E-DCH. The support of 10 ms TTI is mandatory for all UEs. The support of 2 ms by the UEs is FFS (always optional or mandatory for high UE categories).

6.3 Basic physical structure

6.3.1 UL Physical layer model

E-DCH model with DCH and HS-DSCH

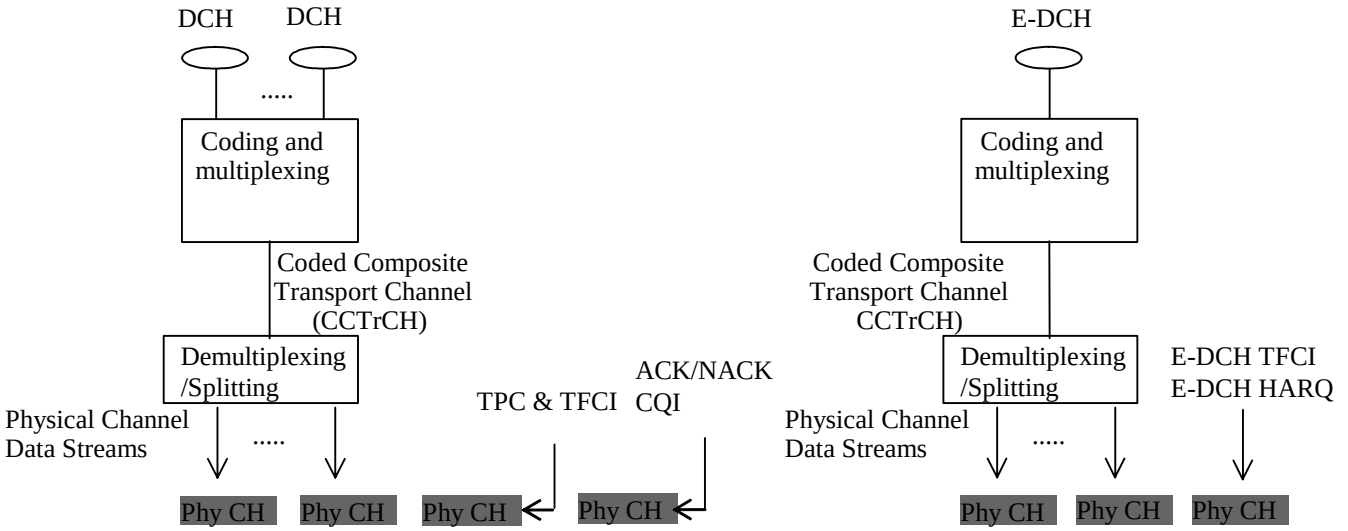

Figure 6.3.1-1: Model of the UE's Uplink physical layer

There is only one E-DCH per CCTrCh of E-DCH type.

For both 2 ms and 10 ms TTI, the information carried on the E-DPCCH consists of 10 bits in total: the E-TFI (7 bits) and the RSN (2 bits). And it is FFS, whether the last bit should be used for a scheduling request or something else.

The E-DPCCH is sent with a power offset relative to the DPCCH. The power offset is signalled by RRC.

6.3.2 —DL Physical layer model

E-DCH model with DCH and HS-DSCH

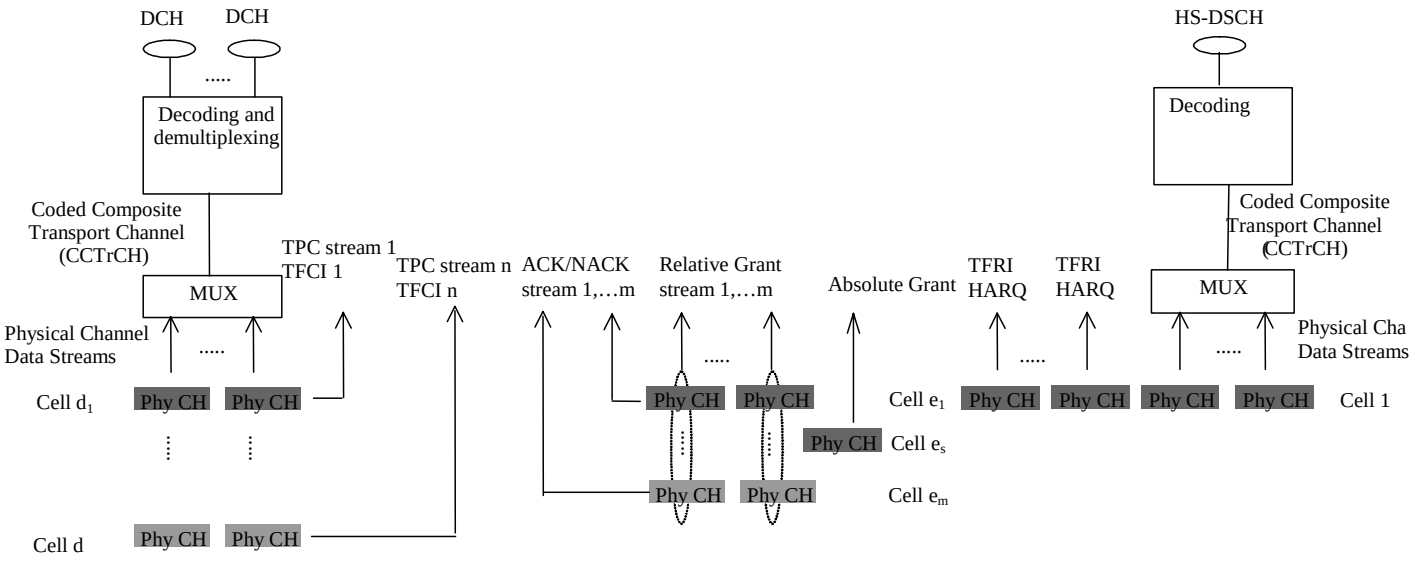

Figure 6.3.2-1: Model of the UE's Downlink physical layer. HS-DSCH serving cell is cell 1 in this figure

The DPCH active set contains cells d_1, …d_n.

The E-DCH active set can be identical or a subset of the DCH active set. The E-DCH active set is decided by the SRNC.

The E-DCH ACK/NACKs are transmitted by each cell of the E-DCH active set on a physical channel called E-HICH. The E-HICHs of the cells belonging to the same RLS (same MAC-e entity i.e. same Node B) shall have the same content and modulation and be combined by the UE.

Note: The set of cells transmitting identical ACK/NACK information is the same as the set of cells sending identical TPC bits (excluding the cells which are not in the E-DCH active set).

The E-DCH Absolute Grant is transmitted by a single cell, the Serving E-DCH cell (Cell e_s on figure 6.3.2-1) on a physical channel called E-AGCH.

Note: The relationship between the Serving E-DCH cell and the HS-DSCH Serving cell is FFS. The RRC signalling will however be independent and allow for both to be separate.

The E-DCH Relative Grants can be transmitted by each cell of the E-DCH active set on a physical channel called E-RGCH. The E-RGCHs of the cells belonging to the same RLS shall have the same content and be combined by the UE. These RLS are signalled from the SRNC to the UE in RRC: optionally (see section 9.2.1 where E-RGCH physical channels are allocated or not) one Serving E-DCH RLS (containing the Serving E-DCH cell) and optionally one or several Non-serving E-DCH RLS.

The ACK/NACKs received from UTRAN after combining (see Note above), the Absolute Grant information received from UTRAN (from the Serving E-DCH cell), and the Relative Grants received from UTRAN after combining (optionally one from the Serving E-DCH RLS, and optionally one from each Non-serving RLS(s)), are all sent to MAC by L1.

7 MAC architecture

7.1 General Principle

7.1.1 MAC multiplexing

The E-DCH MAC multiplexing has the following characteristics:

- MAC-d multiplexing is supported;
- Multiple MAC-d flows can be configured for one UE;
- The multiplexing of different MAC-d flows within the same MAC-e PDU is supported. But not all the combinations may be allowed for one UE. The allowed combinations are under the control of the SRNC. (See in Section 10)
- There can be up to 8 MAC-d flows for a UE.

~~- Different QoS characteristics can be associated to the MAC-d flows. Based on them, the MAC-e entity in the UE decides on the HARQ operation parameters (Beta factors, etc). For each transmission, the MAC-e entity gives the HARQ operation parameters to the L1 in addition to the TFRC;~~

~~- The design goal is to allow and define rules for the multiplexing of data from different MAC-d flows within the same MAC-e PDU. Details are FFS.~~

7.1.2 Reordering entity

The re-ordering entity is part of ~~in~~ a separate MAC sub-layer, MAC-es, in the ~~UE and the~~ SRNC. Data coming from different MAC-d flows are reordered in different reordering queues. There is one reordering queue~~The assumption is that the re-ordering is done per priority (re-ordering) queues and that the entity is located just below MAC-d. It is FFS, if it is found that the additional overhead is acceptable, to do the re-ordering~~ per logical channel.~~s. In that case, the re-ordering entity would be located just above MAC-d.~~

The reordering is based on a specific TSN included in the MAC-e PDU and on Node-B tagging with a (CFN, subframe number). For each MAC-es PDU, the SRNC receives the TSN originating from the UE, as well as the (CFN, subframe number) originating from the Node-B to perform the re-ordering. Additional mechanisms (e.g. timer-based and/or window-based) are up to SRNC implementation and will not be standardised.

7.2 MAC architecture – UE side

7.2.1 Overall architecture

The overall UE MAC architecture, which is shown in Figure 7.2.1-1, includes a new MAC-es/MAC-e entity which controls access to the E-DCH. A new connection from MAC-d to MAC-es/MAC-e is added to the architecture, as well as a connection between MAC-es/MAC-e and the MAC Control SAP.

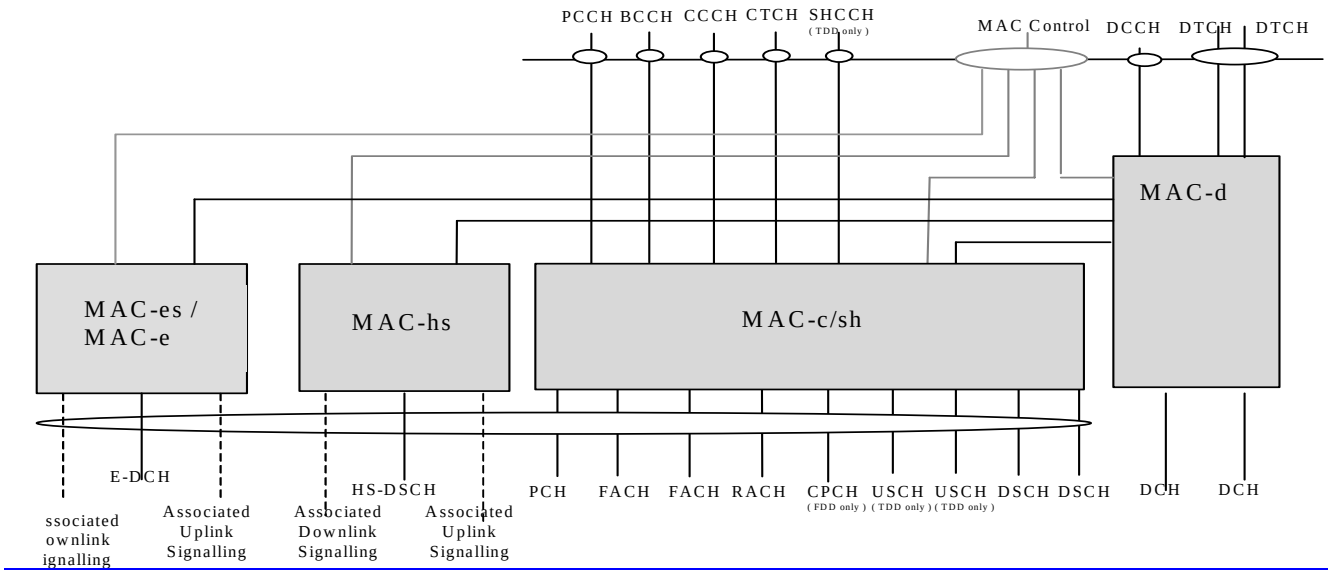

Figure 7.2.1-1: UE side MAC architecture

As shown in Figure 7.2.1-2, a RLC PDU enters MAC-d on a logical channel. RLC PDUs from one or more logical channels are C/T multiplexed on a MAC-e PDU. In the MAC-e header, the DDI (Data Description Indicator) field (6 bits) identifies logical channel, MAC-d flow and MAC-d PDU size. A mapping table is signalled over RRC, to allow the UE to set DDI values. The N field (fixed size of 6 bits) indicates the number of consecutive MAC-d PDUs corresponding to the same DDI value. A special value of the DDI field indicates that no more data is contained in the remaining part of the MAC-e PDU.The TSN field (6 bits) provides the transmission sequence number on the E-DCH. The MAC-e PDU is forwarded to a Hybrid ARQ entity, which then forwards the MAC-e PDU to layer 1 for transmission in one TTI.

Note: It is possible to bypass the MAC-d C/T multiplexing. The DDI field is then directly used to identify the logical channel(s) mapped on the same MAC-d flow. This is up to UE implementation.

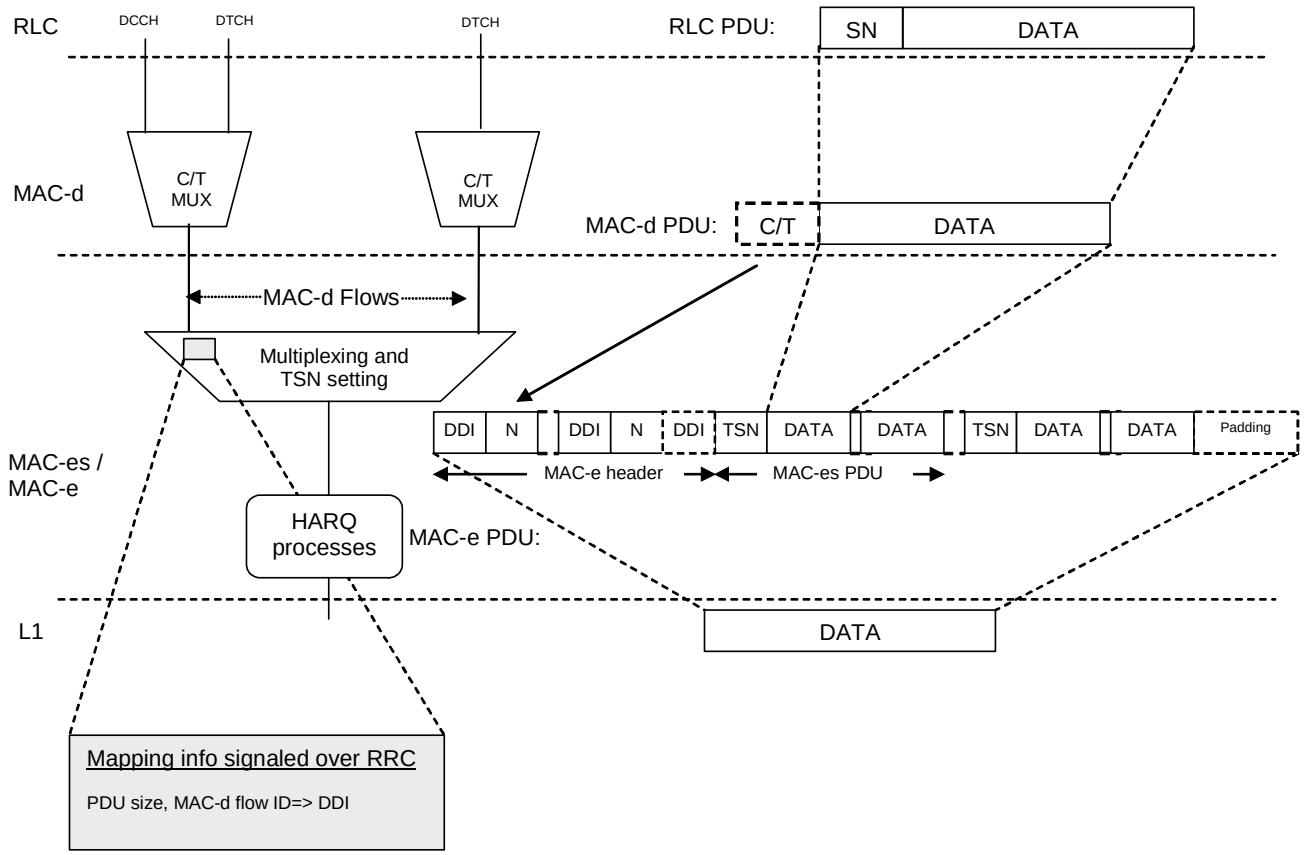

Figure 7.2.1-2: Simplified architecture showing MAC inter-working in UE. The left part shows the functional split while the right part shows PDU construction.

7.2.2 Details of MAC-d

For support of E-DCH a new connection to MAC-es is added.

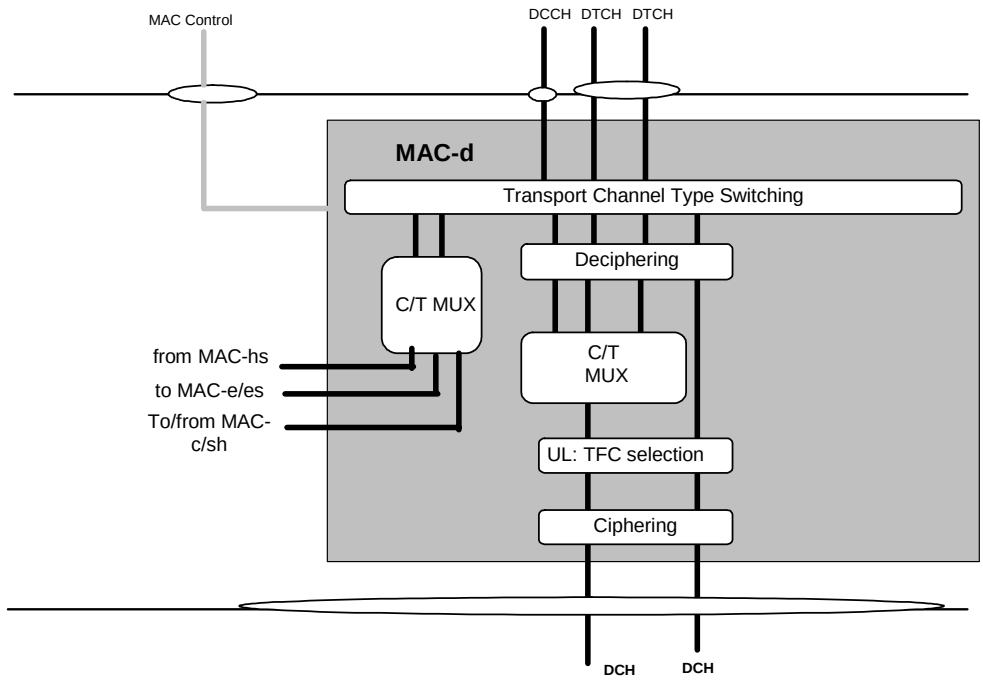

Figure 7.2.2-1: UE side MAC architecture/ MAC-d details

7.2.3 Details of MAC-c/sh

The support of E-DCH implies no change to the UE MAC-c/sh entity.

7.2.4 Details of MAC-hs

The support of E-DCH implies no change to the UE MAC-hs entity.

7.2.5 Details of MAC-es/MAC-e

The MAC-es/e handles the E-DCH specific functions. The split between MAC-e and MAC-es in the UE is not detailed. In the model below the MAC-e/es comprises the following entities:

- HARQ:
  The HARQ entity is responsible for handling the MAC functions relating to the HARQ protocol. It is responsible for storing MAC-e payloads and re-transmitting them. The detailed configuration of the hybrid ARQ protocol is provided by RRC over the MAC-Control SAP. The HARQ entity provides the E-TFC, the retransmission sequence number (RSN), and the power offset to be used by L1. Redundancy version (RV) of the HARQ transmission is derived by L1 from RSN, CFN and in case of 2 ms TTI from the sub-frame number. RRC signalling can also configure the HARQ entity to use RV=0 for every transmission.

- Multiplexing:
  The multiplexing entity is responsible for concatenating multiple MAC-d PDUs into MAC-es PDUs, and to multiplex one or multiple MAC-es PDUs into a single MAC-e PDU, to be transmitted at the next TTI, and as instructed by the E-TFC selection function. It is also responsible for managing and setting the TSN per logical channel for each MAC-es PDU.

- E-TFC selection:
  This entity is responsible for E-TFC selection according to the scheduling information (Relative Grants and Absolute Grants) received from UTRAN via L1, and for arbitration among the different flows mapped on the E-DCH. The detailed configuration of the E-TFC entity is provided by RRC over the MAC-Control SAP. The E-TFC selection function controls the multiplexing function.

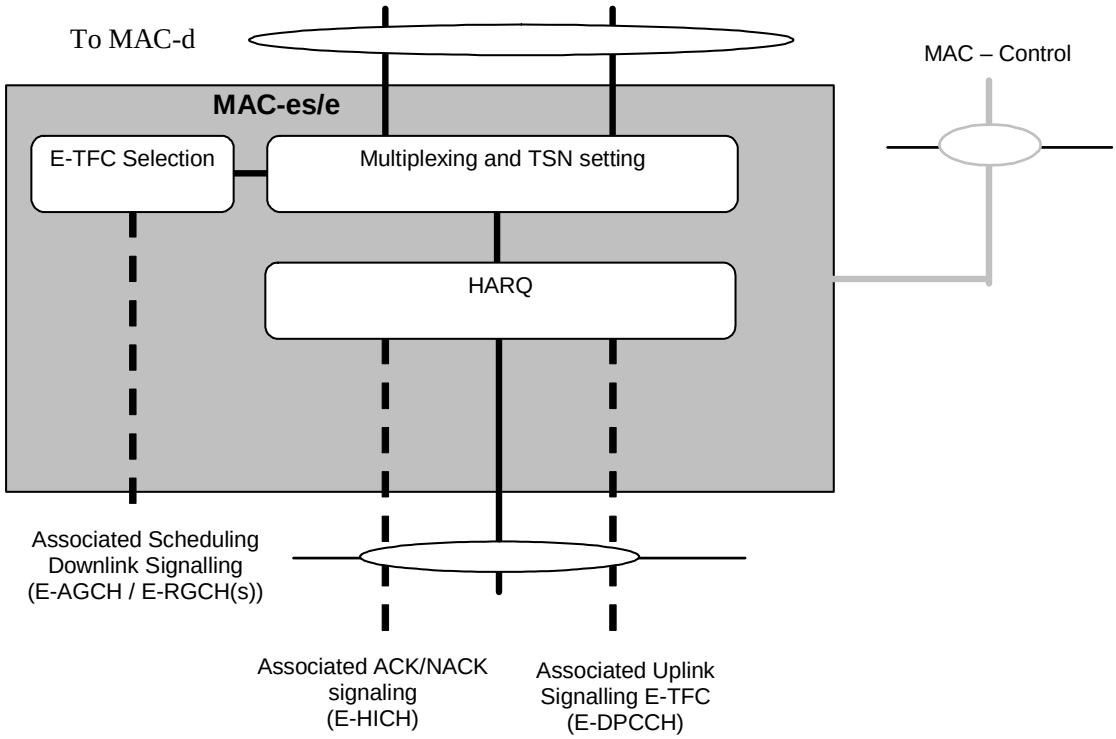

Figure 7.2.5-1: UE side MAC architecture / MAC-es/e details

7.3 MAC architecture – UTRAN side

7.3.1 Overall architecture

The overall UTRAN MAC architecture, which is shown in Figure 7.3.1-1, includes a new MAC-e entity and a new MAC-es entity. For each UE that uses E-DCH, one MAC-e entity per Node-B and one MAC-es entity in the SRNC are configured. MAC-e, located in the Node B, controls access to the E-DCH and is connected to MAC-es, located in the SRNC. MAC-es is further connected to MAC-d. For control information, new connections are defined between MAC-e and a MAC Control SAP in the Node B, and between MAC-es and the MAC Control SAP in the SRNC.

There is one Iub transport bearer per MAC-d flow (i.e. MAC-es PDUs carrying MAC-d PDUs from the same MAC-d flow).

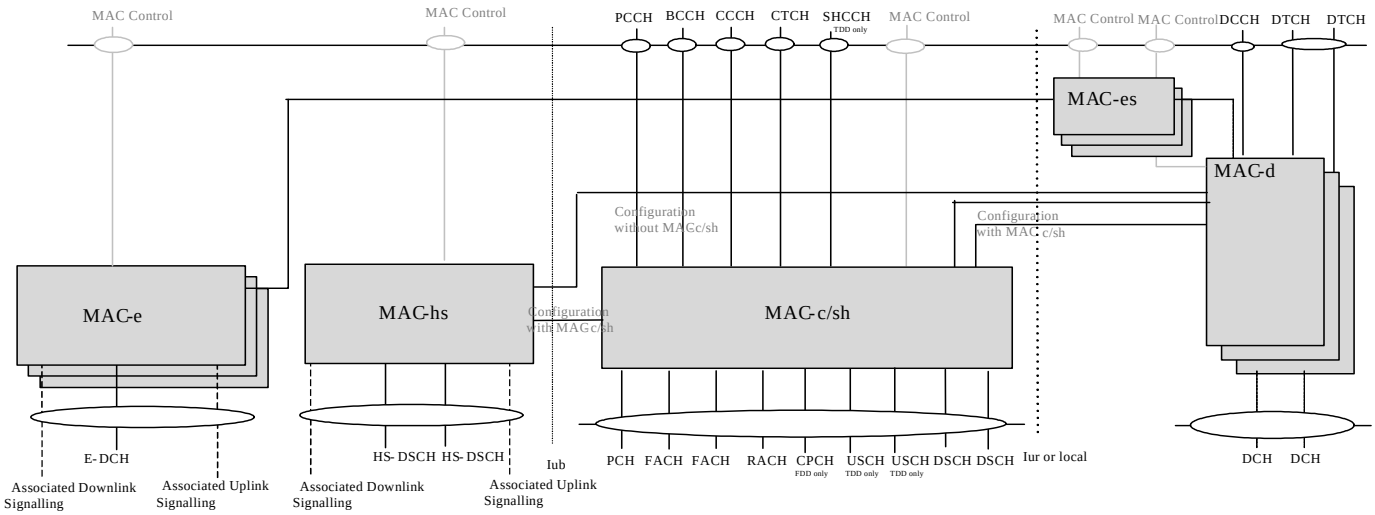

Figure 7.3.1-1: UTRAN side MAC architecture (SHO not shown)

As shown in Figure 7.3.1-2, a MAC-e PDU enters MAC from layer 1. After Hybrid ARQ handling, the MAC-e PDU is demultiplexed to form MAC-es PDUs aimed for one or more MAC-d flows. The mapping between the DDI (Data

Description Indicator) fields (6 bits) and the MAC-d flow and PDU size is provided to the Node B by the SRNC. The mapping of the MAC-d flow into its Iub bearer is defined by the SRNC. A special value of the DDI field indicates that no more data is contained in the remaining part of the MAC-e PDU. The MAC-es PDUs are sent over Iub to MAC-es, where they are distributed on the reordering queue of each logical channel. After re-ordering, the in-sequence data units are disassembled. The resulting MAC-d PDUs are forwarded to MAC-d. Finally, C/T demultiplexing enables delivery of each RLC PDU on the correct logical channel.

Note: It is possible to bypass the MAC-d C/T multiplexing. The DDI field is then directly used to identify the logical channel(s) mapped on the same MAC-d flow. This is up to UTRAN implementation.

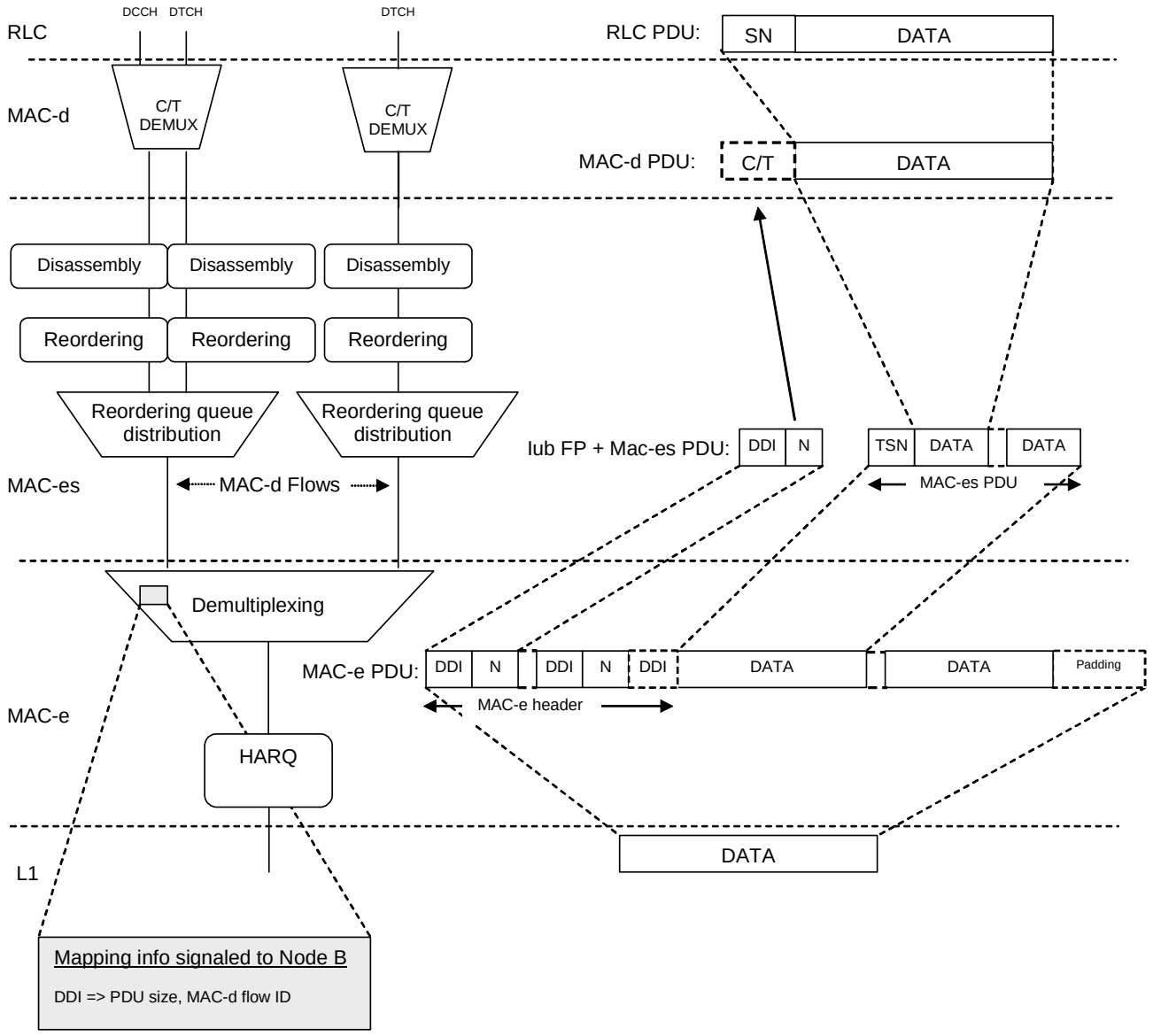

Figure 7.3.1-2: Simplified architecture showing MAC inter-working in UTRAN. The left part shows the functional split while the right part shows PDU decomposition.

7.3.2 Details of MAC-d

For support of E-DCH a new connection to MAC-es is added.

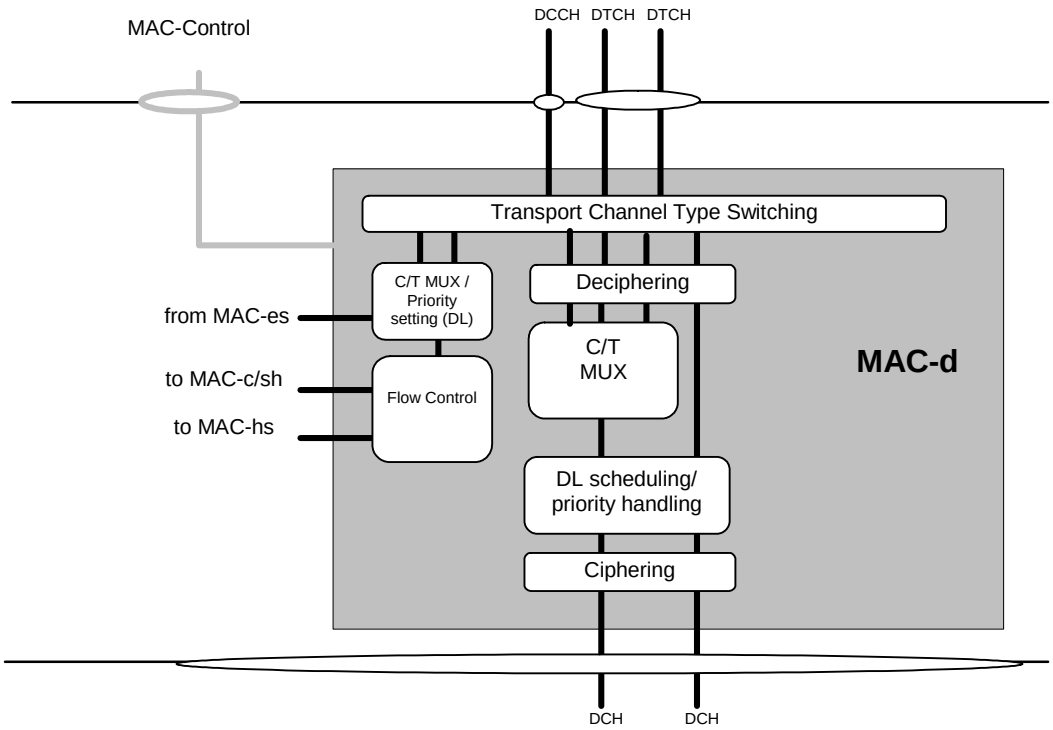

Figure 7.3.2-1: UTRAN side MAC architecture / MAC-d details

7.3.3 Details of MAC-c/sh

The support of E-DCH implies no change to the UTRAN MAC-c/sh entity

7.3.4 Details of MAC-hs

The support of E-DCH implies no change to the UTRAN MAC-hs entity

7.3.5 Details of MAC-es

For each UE, there is one MAC-es entity in the SRNC. The MAC-es sublayer handles E-DCH specific functionality, which is not covered in the MAC-e entity in Node B. In the model below, the MAC-e comprises the following entities:

- Reordering Queue Distribution:
  The reordering queue distribution function routes the MAC-es PDUs to the correct reordering buffer based the SRNC configuration.

- Reordering:
  This function reorders received MAC-es PDUs according to the received TSN and Node-B tagging i.e. (CFN, subframe number). MAC-es PDUs with consecutive TSNs are delivered to the disassembly function upon reception. PDUs are not delivered to the disassembly function if PDUs with a lower TSN are missing. The number of reordering entities is controlled by the SRNC. There is one Reordering Queue per logical channel.

- Macro diversity selection:
  The function is performed in the MAC-es, in case of soft handover with multiple Node-Bs (The soft combining for all the cells of a Node-B takes place in the Node-B). This means that the reordering function receives MAC-es PDUs from each Node-B in the E-DCH active set. The exact implementation is not specified. However the model below is based on one Reordering Queue Distribution entity receiving all the MAC-d flow from all the Node-Bs, and one MAC-es entity per UE.

- Disassembly:
  The disassembly function is responsible for disassembly of MAC-es PDUs. When a MAC-es PDU is disassembled the MAC-es header is removed, the MAC-d PDU's are extracted and delivered to MAC-d.

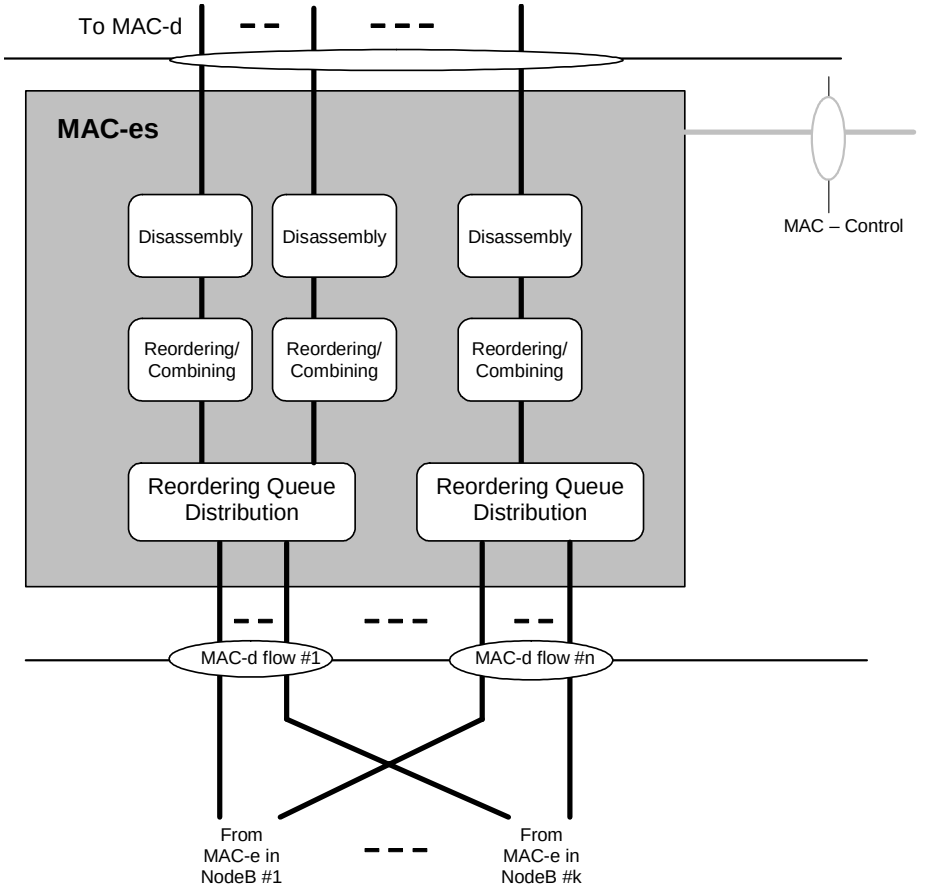

Figure 7.3.5-1: UTRAN side MAC architecture / MAC-es details (SHO case)

7.3.6 Details of MAC-e

There is one MAC-e entity in Node B for each UE and one E-DCH scheduler function in the Node-B. The MAC-e and E-DCH scheduler handle HSUPA specific functions in Node B. In the model below, the MAC-e and E-DCH scheduler comprises the following entities:

- E-DCH Scheduling :
  This function manages E-DCH cell resources between UEs. Based on scheduling requests, scheduling assignments are determined and transmitted. The general principles of the E-DCH scheduling are described in section 9.1 below. However implementation is not specified (i.e. depends on RRM strategy).

- E-DCH Control :
  The E-DCH control entity is responsible for reception of scheduling requests and transmission of scheduling assignments. The general principles of the E-DCH scheduling are described in section 9.1 below.

- De-multiplexing:
  This function provides de-multiplexing of MAC-e PDUs. MAC-es PDUs are forwarded to the associated MAC-d flow.

- HARQ:
  One HARQ entity is capable of supporting multiple instances (HARQ process) of stop and wait HARQ protocols. Each process is responsible for generating ACKs or NACKs indicating delivery status of E-DCH transmissions. The HARQ entity handles all tasks that are required for the HARQ protocol.

The associated signalling shown in the figure illustrates the exchange of information between layer 1 and layer 2 provided by primitives.

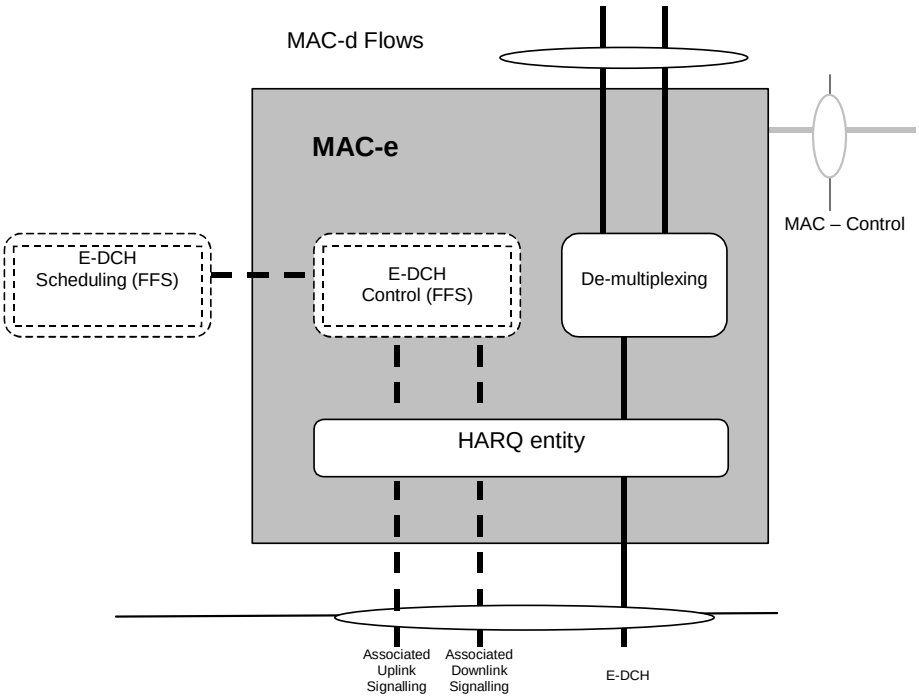

Figure 7.3.6-1: UTRAN side MAC architecture / MAC-e details

8 HARQ protocol

8.1 General Principle

The HARQ protocol has the following characteristics:

- Stop and wait HARQ is used;
- The HARQ is based on synchronous downlink ACK/NACKs;
- The HARQ is based on synchronous retransmissions in the uplink:
  - The number of process numbers depends on the TTI (i.e. 2ms or 10ms). The target is to have one value per TTI. The exact numbers are FFS;
  - There will be an upper limit to the number of retransmissions. The UE decides on a maximum number of transmissions for a MAC-e PDU based on the maximum number of transmissions attribute (see Section 10.1.1), according to the following principles:
    - The UE selects highest maximum number of transmissions among all the considered HARQ profiles associated to the MAC-d flows in the MAC-e PDU;
    - Further optimisations such as explicit rules set by the SRNC ~~(details~~ are FFS;
  - Pre-emption will not be supported by E-DCH~~)~~;
- Intra Node B macro-diversity and Inter Node B macro-diversity should be supported for the E-DCH with HARQ;
- Incremental redundancy shall be supported by the specifications with Chase combining as a subcase:
  - The first transmission shall be self decodable;

- The UTRAN configures the UE to either use the same incremental redundancy version (RV) for all transmissions, or to set the RV according to set of rules based on E-TF, Retransmission Sequence Number (RSN) and the transmission timing;

~~- The set of incremental redundancy versions to be applied by a UE for any E-TF (E-DCH Transport Format) is under the control of the UTRAN;~~

~~- The set of incremental redundancy versions may be E-TF dependent. For some E-TF, the incremental redundancy version may be linked to the CFN. For other E-TF, it may be explicitly signalled. When and how is FFS;~~

- There shall be no need, from the H-ARQ operation point of view, to reconfigure the Node B from upper layers when moving in or out soft handover situations. However, the Node-B may be aware of the soft handover status via a soft handover indicator.~~;~~

~~Details on how to cycle through the different incremental redundancy versions are FFS.~~

8.2 Error handling

8.3 Signalling

8.3.1 Uplink

8.3.2 Downlink

In the downlink, a report is used to indicate either ACK (positive acknowledgement) or NACK (negative acknowledgement).

9 Node B controlled scheduling

9.1 General Principle

The Node B controlled scheduling is based on uplink and downlink control together with a set of rules on how the UE shall behave with respect to this signaling.

In the downlink, a resource indication (Scheduling Grant~~scheduling grant~~) is required to indicate to the UE the maximum amount of uplink resources it may use. When issuing Scheduling Grants, the Node B may use QoS-related information provided by the SRNC (see Section 10.1.1) and from the UE in a Scheduling Request (see Section 9.3.1)

The Scheduling Grants~~scheduling grants~~ have the following characteristics:

- Scheduling Grants~~grants~~ are only to be used for the E-DCH TFC selection algorithm (i.e. they do not to influence the TFC selection for the DCHs);

- The Scheduling Grants control~~ It is FFS whether the scheduling grant controls~~ the maximum allowed ~~in terms of E-DPDCH/DPCCH~~ power ratio. Its exact definition is FFS; ~~, E-DCH TF index, E-DPDCH+DPDCH/DPCCH power ratio, other…~~

- All grants are deterministic;

- Scheduling Grants~~grants~~ can be sent once per TTI or slower;

- There are two types of grants:

  - The Absolute Grants~~absolute grants~~ provide an absolute limitation of the maximum amount of UL resources the UE may use;

- The Relative Grants~~relative grants~~ increase or decrease the resource limitation compared to the previously used value;

- Absolute Grants~~scheduling grants~~ are sent by the Serving E-DCH cell~~supported~~:

  - They are valid for one UE, for a group of UEs or for all UEs;

  - They can have an associated duration;

  - The Absolute Grant ~~Except if sent to all UEs, the absolute scheduling grant~~ contains at least the identity (E-RNTI) of the UE (or group of UEs) for which the grant is intended and the maximum resources the UE(s) may use;

  - Group identities or dedicated identities are not distinguished by the UE. It is up to the UTRAN to allocate the same identity to a group of UEs;

  - One identity (E-RNTI) is allocated to a UE at a time. The allocation is done by the Node-B and sent by the SRNC in RRC.

  - The identity consists of 16 bits (16 bits CRC at layer 1);

- Relative Grants (updates) are sent by the Serving and Non-Serving Node-Bs as a complement to Absolute Grants:

  - The Relative Grant from the Serving E-DCH RLS can take one of the three values: “UP”, “HOLD” or “DOWN”;

  - The Relative Grant from the Non-serving E-DCH RLS can take one of the two values: “HOLD” or “DOWN”. The “HOLD” command is sent as DTX. The “DOWN” command corresponds to an “overload indicator”;

- For each UE, the non-serving Node-B operation is as follows:

  - If the Node-B could not decode the E-DPCCH/E-DPDCH for the last n_1 TTIs (where n_1 is TBD) because of processing issue, it shall notify the SRNC;

  - The non-serving Node-B is allowed to send a “DOWN” command only for RoT reasons (maximum allocated uplink RoT in the cell is exceeded) and not because of lack of internal processing resources.

9.2 UE scheduling operation

9.2.1 Grants from the Serving RLS

The UE shall be able to receive Absolute Grant from the Serving E-DCH cell and Relative Grant from the Serving E-DCH RLS.

Two UE scheduling mode of operation are defined (“RG” based and “Non RG” based).

Note: The description below is generic. It currently makes reference to the rate but it may have to be translated into the power dimension.

If E-RGCH physical channels are allocated for the cells of the Serving E-DCH RLS, the UE shall follow the “RG” based mode of operation and handle the grant from the Serving E-DCH RLS as follow:

- The UE maintains a “Serving Grant” (SG);

- The “Serving Grant” is used in the E-TFC selection algorithm as the maximum allowed rate;

- The “Serving Grant” is set equal to the “Absolute Grant” value when one is received from the Serving E-DCH cell:

- The SG is not modified when the UE receives a “HOLD” from the Serving E-DCH RLS;

- When the UE receives an “UP” from Serving E-DCH RLS:

- New SG = Last used bit rate + Delta;

- When the UE receives a “DOWN” from Serving E-DCH RLS:

  - New SG = Last used bit rate – Delta;

If no E-RGCH physical channels are allocated for the cells of the Serving E-DCH RLS, the UE shall follow the “Non RG” based mode of operation and handle the grant from the Serving E-DCH RLS as follow:

- The UE obeys last received AG on the group identity it belongs to;

- The UEs gradually increases its current bit rate, by configurable steps (autonomous ramp-up) until it reaches the last received AG;

- If the used UE rate was lower than a given bit rate during the last n TTIs (where n is a configurable parameter that can be set to infinite value), the UE has to perform the autonomous ramp-up mechanism to go above this bit rate.

9.2.2 Grants from the Non-serving RLS

Node-B from the Non-serving E-DCH RLS will only send Relative Grants to the UE. The UE shall handle the RG from the Non-serving E-DCH RLS as follow:

- If at least one Non-serving RLS indicates “DOWN”, the UE shall decrease the current used bit rate by a pre-defined offset. The offset may be dependant on the bit rate;

  - The option to use a calculated offset is FFS (e.g. the offset may be function of the measured CPICH power on the overloaded cells in relation to the measured CPICH power on the serving cell);

- When no more “DOWN” is received from any Non-serving RLS (all Non-serving RLS indicate “HOLD” i.e. DTX):

  - The UE shall follow the Serving RLS Grants.

9.3 Signalling

9.3.1 Uplink

For the UE to request resources from the Node B(s), Scheduling Requests will be transmitted in the uplink.

The Scheduling Request contains the following type of information:

- UE Buffer occupancy;

- Estimation of the available or needed power/rate;

- Further information needed and details are FFS;

In the case where the UE has no scheduling grant and has data to send, a Scheduling Request shall be sent to the Serving E-DCH RLS in a MAC-e PDU. The transmission shall be non-scheduled.

In the case where the UE has a scheduling grant, the Scheduling Request shall be sent to the Serving E-DCH RLS along with the data in the MAC-e PDU. The details on when and how Scheduling Requests are included in the MAC-e PDU are FFS. In addition, it is FFS whether an additional request bit will be sent in the E-DPCCH. This bit would indicate whether or not the UE is satisfied with the current granted power offset (details are FFS).

It is FFS if the Scheduling Request content and size depend on whether the UE simultaneously transmits data or not.

9.3.2 Downlink

For each UE, there is only one Absolute Grant transmitted by the serving E-DCH cell using the E-AGCH.

For each UE, there is in one Relative Grant transmitted per Serving and Non-serving RLS from the E-DCH active set cells. The channel(s) (one per cell) on which the Relative Grant is transmitted is(are) signalled separately to each UE (this allows for the same channel to be monitored by multiple UEs if it is UTRAN decision).

- ~~Relative grants (updates) are supported as a complement to absolute grants;~~
- ~~The combination of absolute and relative grants to get the total grant is FFS;~~
- ~~The operation in soft handover is FFS;~~
- ~~The interaction between HARQ and scheduling is FFS.~~

~~9.2 Signalling~~

~~9.2.1 Uplink~~

~~For the UE to request resources from the Node B(s), scheduling requests will be transmitted in the uplink (details are FFS).~~

~~9.2.2 Downlink~~

~~The absolute scheduling grants are transmitted using a shared channel.~~

~~The relative scheduling grants are transmitted using dedicated resources.~~

10 QoS control

10.1 General Principle

The QoS of ongoing flows mapped on E-DCH for a UE is maintained by the serving Node B and by the UE. The Node B controls the resources allocated to a UE versus other UEs by means of scheduling as specified in Section 9. The UE controls the QoS of all its logical channels mapped on E-DCH by means of E-TFC selection as specified in Section 10.2, and by HARQ operation, specified in Section 8.

In addition to these mechanisms, guaranteed bit rate services for MAC-d flows / logical channels (FFS) are also supported through non-scheduled transmission. A flow using non-scheduled transmission is defined by the SRNC and provided in the UE and in the Node B. The UE can transmit data belonging to such flow without first receiving any scheduling grant.

10.1.1 QoS configuration principles

RAB attributes are available in the SRNC according to R99 principles. To enable QoS control for the E-DCH, QoS-related information is made available in the UE and in the Node B as outlined below.

To the UE, the following QoS-related information is provided from the SRNC to enable QoS-based E-TFC selection, multiplexing of logical channels in MAC-e PDUs, and HARQ operation:

- Logical channel priority for each logical channel (as in R5);
- Mapping between logical channel(s) and MAC-d flow(s) (as in R5);
- Allowed MAC-d flow combinations in one MAC-e PDU;
- Reference power offset for a pre-defined E-TFC. The UE then calculates reference power offsets for its other E-TFCs [FFS, RAN WG1 confirmation needed] so that the quality (protection of MAC-e PDU) when using any of the E-TFCs is identical to that of the reference E-TFC;
- HARQ profile per MAC-d flow. One HARQ profile consists of a power offset attribute and a maximum number of transmissions attribute. The power offset attribute is used in E-TFC selection to regulate the

BLER operating point for the transmission. The maximum number of transmissions attribute is used in the HARQ operation to regulate maximal latency and residual BLER of MAC-d flows.

- Number of bits per TTI corresponding to the guaranteed bit rate (only for MAC-d flows /logical channels (FFS) that carry non-scheduled guaranteed bit rate services).

To the Node B, the following QoS-related parameters are provided by the SRNC to enable scheduling and resource reservation:

- Power offset or E-TFC (FFS) that corresponds to the guaranteed bit rate (only for MAC-d flows /logical channels that carry guaranteed bit rate services). For scheduled transmission, it is used to allocate grants to UEs. For non-scheduled transmission, it is used for the Node B to reserve sufficient amount of resources. The need for additional mechanisms to optimize the Node-B hardware is FFS (e.g. the UE may tell the Node-B ahead that an non-scheduled transmission is coming);

10.2 TFC and E-TFC selection

Logical channels mapped on the DCHs are always prioritised over those mapped on E-DCHs.

The principle of the TFC selection across E-DCH and DCH is the following:

- The UE maintains a list of allowed TFCs for the CCTrCH of DCH type;
- The UE performs the TFC selection for the DCHs;
- Every E-DCH TTI, the UE shall estimate the remaining power;
- Then it performs the TFC selection for the E-DCH, with the estimated remaining power, taking into account the following rules:
  - The E-TFC selection is based on logical channel priorities like in the Release 99, i.e. the UE shall maximise the transmission of higher priority data;~~R99;~~
  - The UE shall respect the allowed combinations of MAC-d flows in the same MAC-e PDU;
  - The power offset of E-DPDCH(s) relative to DPCCH associated to a MAC-e PDU including MAC-d PDUs coming from one or several MAC-d flows is set as follows;
    - The UE selects the power offset of the HARQ profile associated to the MAC-d flows with the highest priority logical channel in the MAC-e PDU;
  - The UE adds the resulting power offset for the MAC-e PDU to the previously calculated reference power offsets for different E-TFCs. It then selects the E-TFC, taking into account the obtained power offsets, the UE's remaining power and the amount of data to be transmitted.
  - For each transmission, the MAC-e entity gives the selected power offset of E-DPDCH(s) relative to DPCCH to the L1 in addition to the E-TFC;
    - What should be done when this exceeds the L1 maximum transmission power is FFS.
- In addition, the UE may need not to go below a minimum rate for the E-DCH. In some case, this means that the UE may have to power scale down all physical channels present;
- An~~In order to be backward compatible, some~~ E-DCH minimum set because of power limitation~~support~~ is needed. Details are FFS.

10.3 Setting of Power offset attributes of MAC-d flows

Power offset attributes of MAC-d flows are part of the HARQ profiles of the MAC-d flow. They are provided by the UTRAN to the UE according to the following principles:

- The DPCCH transmission power is controlled the same way as in Release 99;

- In case where there is no need for a DCH (i.e. the SRBs are mapped on the E-DCH), a size 0 TrBlck may be required (FFS);

- With each MAC-es PDU transmitted to the SRNC, the Node-B includes the number of transmissions that have been required to correctly decode the PDU;

- Using the information provided by the Node B, the SRNC may maintain up to date power offsets;

- The SRNC may decide to signal to the UE new values for the power offset attributes for one (or several) MAC-d flows.

- No other power management/control mechanism is needed for E-DCH.

11 Signalling parameters

11.1 Uplink signalling parameters

11.2 Downlink signalling parameters

With RRC signalling, the UE will in addition be informed about:

- The E-HICH configuration
  - Including signature sequence number and channelisation code;
- The E-RGCH configuration
  - Including signature sequence number, channelisation code and Serving/Non-serving E-DCH RLS ID;
- The E-AGCH configuration
  - Including E-RNTI and channelisation code;
- The E-DPCCH configuration
  - Including E-DPCCH/DPCCH Power Offset;
- The E-DPDCH configuration:
  - A number (how many is TBD) of tables are defined by the standard, each defining a set of E-TFC (or E-TFCS). A UE is allocated one and only one E-TFCS table by RRC.
  - For each E-TFC a (nominal) beta factor is calculated based on reference power offset signalled for reference E-TFCs by RRC (number of reference E-TFCs is FFS);
  - HARQ Incemental Redundancy Version configuration. Always use RV=0 or use the RV table;
  - Maximum number of E-DPDCH channelisation code;
  - Minimum SF;
  - It is FFS whether in addition puncturing limits will need to be signalled by RRC or not.

RRC will signal the mapping between logical channel, MAC-d PDU size, MAC-d flow ID and Data Description Indicator (see section 7).

RRC will signal for each MACd-flow, the MAC-d flow specific power offset, the maximum number of transmissions, and the multiplexing list (indicating with which other MAC-d flows, MAC-d PDU's of this flow can be multiplexed in the same MAC-e PDU).

12 Mobility procedures

3GPP TSG-RAN2 Meeting #45
Shin-Yokohama, Japan, November 15th-19th, 2004

Tdoc ⌘R2-042728

CR-Form-v7.1

CHANGE REQUEST

⌘ **25.309** **CR** **003** ⌘ **rev** **1** ⌘ Current version: **6.0.0** ⌘

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ⌘ symbols.*

Proposed change affects: UICC apps⌘ ☐ ME ☒ Radio Access Network ☒ Core Network ☐

Title:	⌘	Proposed rewording on scheduler sections compared to CR 001r3
Source:	⌘	RAN WG2
Work item code:	⌘	EDCH-Stage2
Date:	⌘	25 November 2004
Category:	⌘	**F**
Release:	⌘	Rel-6

Use one of the following categories:
F *(correction)*
A *(corresponds to a correction in an earlier release)*
B *(addition of feature),*
C *(functional modification of feature)*
D *(editorial modification)*
Detailed explanations of the above categories can be found in 3GPP TR 21.900.

Use one of the following releases:
Ph2 *(GSM Phase 2)*
R96 *(Release 1996)*
R97 *(Release 1997)*
R98 *(Release 1998)*
R99 *(Release 1999)*
Rel-4 *(Release 4)*
Rel-5 *(Release 5)*
Rel-6 *(Release 6)*
Rel-7 *(Release 7)*

Reason for change:	⌘	The text captured in CR 001, although correct, was built during the meeting and can be improved on several parts because external readers may be confused on some sections.
Summary of change:	⌘	1. Re-writing on the parts in yellow in the text below, the basis from the CR being CR 001r3 -
Consequences if not approved:	⌘	TS 25.309 may be difficult to interpret for readers not deeply involved in the discussions.

Clauses affected:	⌘	9.2 and 9.3			
Other specs affected:	⌘	Y / N	Other core specifications	⌘	
		☐ / ☒	Other core specifications		
		☐ / ☒	Test specifications		
		☐ / ☒	O&M Specifications		
Other comments:	⌘				

How to create CRs using this form:
Comprehensive information and tips about how to create CRs can be found at http://www.3gpp.org/specs/CR.htm.
Below is a brief summary:

1) Fill out the above form. The symbols above marked ⌘ contain pop-up help information about the field that they are closest to.
2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://ftp.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2001-03 contains the specifications resulting from the March 2001 TSG meetings.
3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

9.2 UE scheduling operation

9.2.1 Grants from the Serving RLS

The UE shall be able to receive Absolute Grant from the Serving E-DCH cell and Relative Grant from the Serving E-DCH RLS.

Two UE scheduling mode of operation are defined ("RG" based and "Non RG" based).

Note: The description below is generic. It currently makes reference to the rate but it may have to be translated into the power dimension.

If E-RGCH physical channels are allocated for the cells of the Serving E-DCH RLS, the UE shall follow the "RG" based mode of operation and handle the grant from the Serving E-DCH RLS as follow:

- The UE maintains a "Serving Grant" (SG);
- The SG~~"Serving Grant"~~ is used in the E-TFC selection algorithm as the maximum allowed rate;
- The SG~~"Serving Grant"~~ is set equal to the "Absolute Grant" value when one is received from the Serving E-DCH cell:
- If no "Absolute Grant" is received by the UE, then the UE will follow the "Relative Grant" of the Serving E-DCH RLS:
- The SG is not modified when the UE receives a "HOLD" from the Serving E-DCH RLS;
- When the UE receives an "UP" from Serving E-DCH RLS:
  - New SG = Last used bit rate + Delta;
- When the UE receives a "DOWN" from Serving E-DCH RLS:
  - New SG = Last used bit rate – Delta;

If no E-RGCH physical channels are allocated for the cells of the Serving E-DCH RLS, the UE shall follow the "Non RG" based mode of operation and handle the grant from the Serving E-DCH RLS as follow:

- ~~The UE obeys last received AG on the group identity it belongs to;~~
- ~~The UEs gradually increases its current bit rate, by configurable steps (autonomous ramp-up) until it reaches the last received AG;~~
- The UE maintains a "Serving Grant" (SG);
- The SG is used in the E-TFC selection algorithm as the maximum allowed rate;
- The UE sets the "MAX Serving Grant" (MAX SG) to the last received "Absolute Grant" (AG);
- If the UE has data to transmit and the SG is below the MAX SG, the SG is increased over time by configurable steps (autonomous ramp-up) until SG is equal to MAX SG;
- If the SG is above the MAX SG (due to reception of a new AG lowering the MAX SG), then the SG is immediately set equal to MAX SG;
- ~~If the used UE rate was lower than a given bit rate during the last n TTIs (where n is a configurable parameter that can be set to infinite value), the UE has to perform the autonomous ramp-up mechanism to go above this bit rate.~~
- If the UE transmitted at a given rate below the current SG for more than n TTIs (where n is a configurable parameter that can be set to an infinite value), then the SG is set equal to this given rate. This in effect forces the UE to use autonomous ramp-up after some continuous activity below SG.

9.2.2 Grants from the Non-serving RLS

Node-B from the Non-serving E-DCH RLS will only send Relative Grants to the UE. The UE shall handle the RG from the Non-serving E-DCH RLS as follows:

- When the UE receives a "DOWN" from at least one Non-serving E-DCH RLS;
  - New SG = Last used bit rate – Delta;
    - ~~If at least one Non-serving RLS indicates "DOWN", the UE shall decrease the current used bit rate by a pre-defined offset.~~ The Delta~~offset~~ may be dependant on the bit rate;
      - The option to use a calculated offset is FFS (e.g. the offset may be function of the measured CPICH power on the overloaded cells in relation to the measured CPICH power on the serving cell);
- When ~~no more "DOWN" is received from any Non-serving RLS (all Non-serving RLS indicate "HOLD" i.e. DTX);~~the UE does not receive a "DOWN" from any Non-serving E-DCH RLSs;
  - The UE shall follow the Serving E-DCH RLS's Scheduling Grants.

9.3 Signalling

9.3.1 Uplink

For the UE to request resources from the Node B(s), Scheduling Requests will be transmitted in the uplink.

The Scheduling Request contains the following type of information:

- UE Buffer occupancy;
- Estimation of the available or needed power/rate;
- Further information needed and details are FFS;

In the case where the UE's "Serving Grant" (SG) equals to zero and it ~~has no scheduling grant and~~ has data to send, a Scheduling Request shall be sent to the Serving E-DCH RLS in a MAC-e PDU. The transmission shall be non-scheduled.

In the case where the UE's "Serving Grant" (SG) is above zero, it shall send ~~has a scheduling grant,~~ the Scheduling Request ~~shall be sent~~ to the Serving E-DCH RLS along with the data in the MAC-e PDU. The details on when and how Scheduling Requests are included in the MAC-e PDU are FFS. In addition, it is FFS whether an additional request bit will be sent in the E-DPCCH. This bit would indicate whether or not the UE is satisfied with the current SG~~granted power offset~~ (details are FFS).

It is FFS if the Scheduling Request content and size depend on whether the UE simultaneously transmits data or not.

9.3.2 Downlink

For each UE, there is only one Absolute Grant transmitted by the serving E-DCH cell using the E-AGCH.

For each UE, there is in one Relative Grant transmitted per Serving and Non-serving RLS from the E-DCH active set cells. The channel(s) (one per cell) on which the Relative Grant is transmitted is(are) signalled separately to each UE (this allows for the same channel to be monitored by multiple UEs if it is UTRAN decision).

- ~~Relative grants (updates) are supported as a complement to absolute grants;~~
- ~~The combination of absolute and relative grants to get the total grant is FFS;~~
- ~~The operation in soft handover is FFS;~~
- ~~The interaction between HARQ and scheduling is FFS.~~