3G CHANGE REQUEST

Please see embedded help file at the bottom of this page for instructions on how to fill in this form correctly.

25.321	CR	**001 r1**	Current Version:	3.0.0

3G specification number ↑   *↑ CR number as allocated by 3G support team*

For submision to TSG   RAN #5   for approval **X**   *(only one box should*
list TSG meeting no. here ↑   for information   *be marked with an X)*

Form: 3G CR cover sheet, version 1.0   The latest version of this form is available from: ftp://ftp.3gpp.org/Information/3GCRF-xx.rtf

Proposed change affects: USIM ☐   ME **X**   UTRAN **X**   Core Network ☐
(at least one should be marked with an X)

Source:	Ericsson		**Date:**	1999-08-18

Subject: Modified MAC handling of PCH and FACH

3G Work item:

Category: F   Correction
(only one category shall be marked with an X)

- A   Corresponds to a correction in a 2G specification
- B   Addition of feature
- C   Functional modification of feature   **X**
- D   Editorial modification

Reason for change: It is proposed that PCH and FACH are to be handled by the same MAC entity (MAC-c) instead of two separate entities (MAC-p and MAC-c). Transport format combination (TFC) selection for FACH and PCH (joint selection over both channels) is proposed to be included in MAC-c. The proposed changes are in line with the possibility to multiplex PCH and FACH onto the same physical channel where the TFCI is shared between FACH and PCH (adopted by TSG-RAN WG1).
It is further proposed that TFC selection over more than one FACH can be performed in MAC-c. The possibility allows for scheduling of transport blocks of different sizes in the same transmission time interval (one size per FACH).

Clauses affected: 4.2.1 - 4.2.4

Other specs affected:
Other 3G core specifications	☐	→ List of CRs:	
Other 2G core specifications	☐	→ List of CRs:	
MS test specifications	☐	→ List of CRs:	
BSS test specifications	☐	→ List of CRs:	
O&M specifications	☐	→ List of CRs:	

Other comments:

help.doc

<---------- double-click here for help and instructions on how to create a CR.

4. General

4.1 Objective

4.2 Overview on MAC architecture

The following provides an overview of a common MAC architecture that encompasses both UMTS-FDD and UMTS-TDD. There are differences of detail between the two systems but their architectures are sufficiently similar for a common overview to be adopted. Followed by section 4.2.1 MAC entities, where the different MAC entities are summarised, the sections 4.2.2-4 contain a more detailed description of the MAC architecture.

Note: The contents have to be reviewed, changes depend on further contributions

4.2.1 MAC Entities

The diagrams that describe the MAC architecture are constructed from MAC entities. The entities are assigned the following names. The functions completed by the entities are different in the UE from those completed in the UTRAN:

- MAC-b, which identifies the MAC entity that handles the broadcast channel (BCH). There is one MAC-b entity in each UE and one MAC-b in the UTRAN for each cell.

    Note: The separation in two different BCCH is ffs, the control SAP may be split accordingly

    ~~MAC-p, which identifies the MAC entity that handles the paging channel (PCH). There is one MAC-p entity in each UE and one MAC-p in the UTRAN for each cell.~~

- MAC-c, which identifies the MAC entity that handles the paging channel (PCH), the forward access channel (FACH), the random access channel (RACH) and the Common Packet Channel (UL CPCH) for FDD. There is one MAC-c entity in each UE and one in the UTRAN for each cell.

- MAC-d, denotes the MAC entity that is responsible for handling of dedicated logical channels and dedicated transport channels (DCH) allocated to a UE. There is one MAC-d entity in the UE and one MAC-d entity in the UTRAN for each UE. Note: *When a UE is allocated resources for exclusive use by the bearers that it supports the MAC-d entities dynamically share the resources between the bearers and are responsible for selecting the TFI/ TFCI that is to be used in each transmission time interval.*

- MAC-sh, denotes the MAC entity that handles downlink shared channels (DSCH) for both FDD and TDD and uplink shared channels (USCH) for TDD . There is one MAC-sh entity in each UE that is using a DSCH and a USCH for TDD operation and one MAC-sh entity in the UTRAN for each cell that contains a DSCH and a USCH for TDD operation.

- MAC-sy, identifies the MAC entity used in TDD operation to handle the information received on the synchronisation channel SCH

According to the RRC functions the RRC is generally in control of the internal configuration of the MAC.

4.2.2 MAC-b ~~, MAC-p~~ and MAC-sy

The following diagram illustrates the connectivity of the MAC-b ~~, MAC-p~~ and MAC-sy entities in a UE and in each cell of the UTRAN:
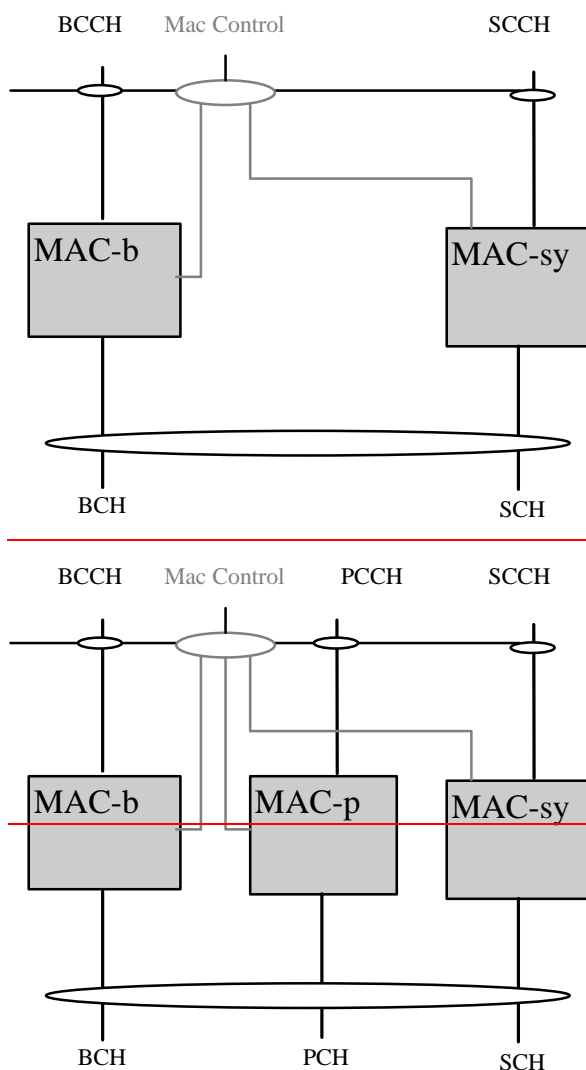
Figure 4.2.2.1 UE side and UTRAN side architecture (BCCH ,PCCH and SCCH)

MAC-b, ~~MAC-p~~ and MAC-sy represent~~s~~ SCH, and BCH ~~and PCH~~ control entities, which are cell-specific MAC entities in the UTRAN. In the UE side there is one SCH, and BCH ~~and PCH~~ control entity per UE. The SCH control entity handles synchronisation channels for the TDD mode. The details of this entity are left for further study. The MAC Control SAP is used to transfer Control information to each MAC entity.

4.2.3 Traffic Related Architecture - UE Side

Figure 4.2.3.1 illustrates the connectivity of MAC entities. The figure shows a MAC-d servicing the needs of several DTCH mapping them to a number of DCH. A MAC-sh controls access to a common transport channel. It is noted that because the MAC-sh provides additional capacity then it communicates only with the MAC-d rather than the DTCH directly. The MAC-c, which interfaces with the PCH, FACH and RACH common transport~~signalling~~ channels, is connected with the MAC-d for transfer of data and RNTI. The MAC Control SAP is used to transfer Control information to each MAC entity. In the TDD implementation the MAC-sh transfers data from the DSCH to the MAC-d and from the MAC-d to the USCH under control of the FACH. In the FDD implementation, the MAC-c may transfer data from the MAC-d to the CPCH.
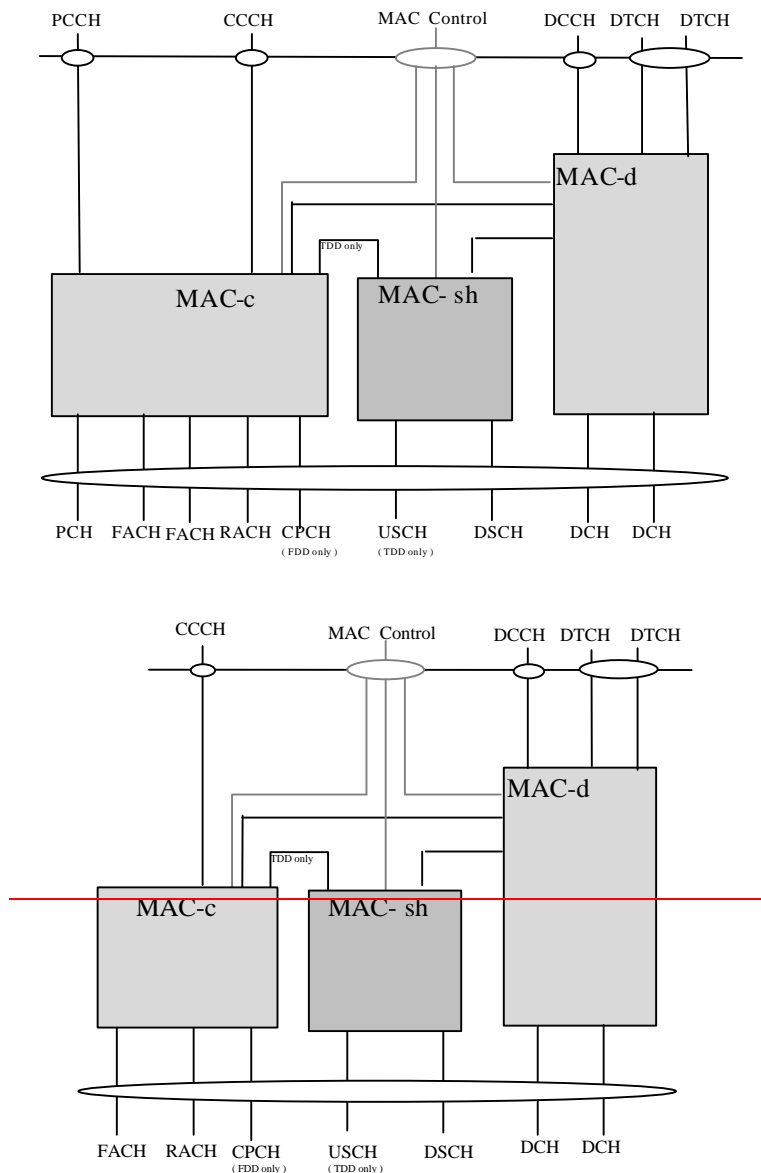
Figure 4.2.3.1 UE side MAC architecture

Figure 4.2.3.2 shows the UE side MAC-c entity. The following functionality is covered:

- The C/D MUX box represents the insertion and detection of the field in the MAC header, indicating whether a common or dedicated logical channel is used.
- The c-RNTI field in the MAC header is used to distinguish between UEs.
- In the uplink, the possibility of transport format selection exists.
- Selection of Access Service Classes (ASC) for RACH, details on definition of ASC and the relation to the RACH retransmission algorithm are ffs.

- Multiplexing/scheduling /priority handling is used to transmit the received information on RACH and CPCH.

- Channel selection is used to select an appropriately sized and available CPCH for transmission.
- Demultiplexing of received information inside MAC-c to CTCH is used to support Short Message Service Cell Broadcast (SMS CB).
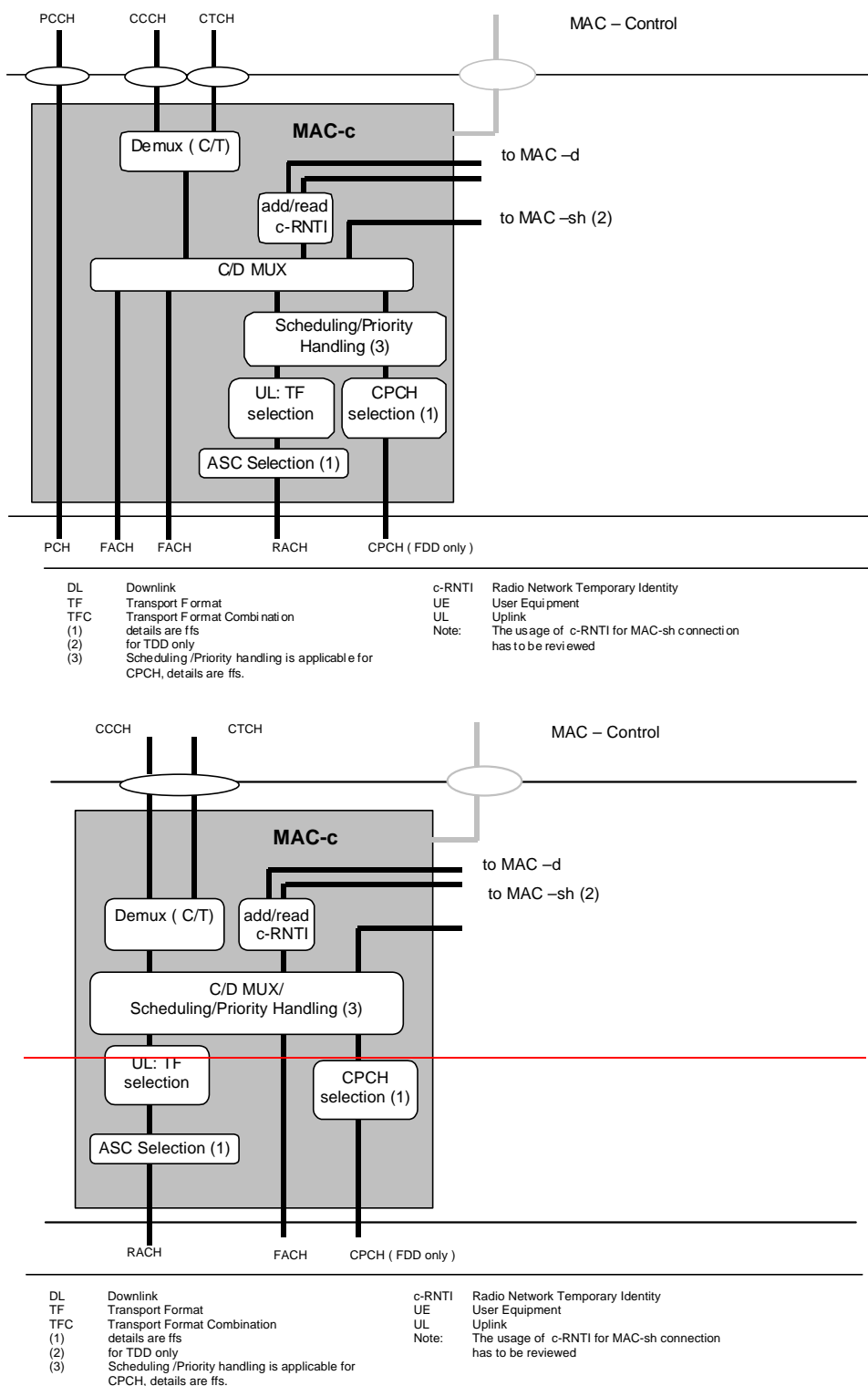
Figure 4.2.3.2. UE side MAC architecture / MAC-c details

Figure 4.2.3.3 shows the UE side MAC-d entity. The following functionality is covered:

- Dynamic transport channel type switching is performed by this entity, based on decision taken by RRC.
- The C/T MUX box is used when multiplexing of several dedicated logical channels onto one transport channel is used.
- The MAC-d entity using common channels is connected to a MAC-c entity that handles the scheduling of the common channels to which the UE is assigned.
- The MAC-d entity using downlink shared channel is connected to a MAC-sh entity that handles the reception of data received on the shared channels to which the UE is assigned.

- In the uplink, transport format combination selection (out of the RRC assigned transport format combination set) is performed to prioritise transport channels.
- FAUSCH Handling indicates the function in the MAC-d supports the FAUSCH, details are ffs
- Support of Ciphering / Deciphering for transparent RLC operation in MAC , see [2] for details on the concept.

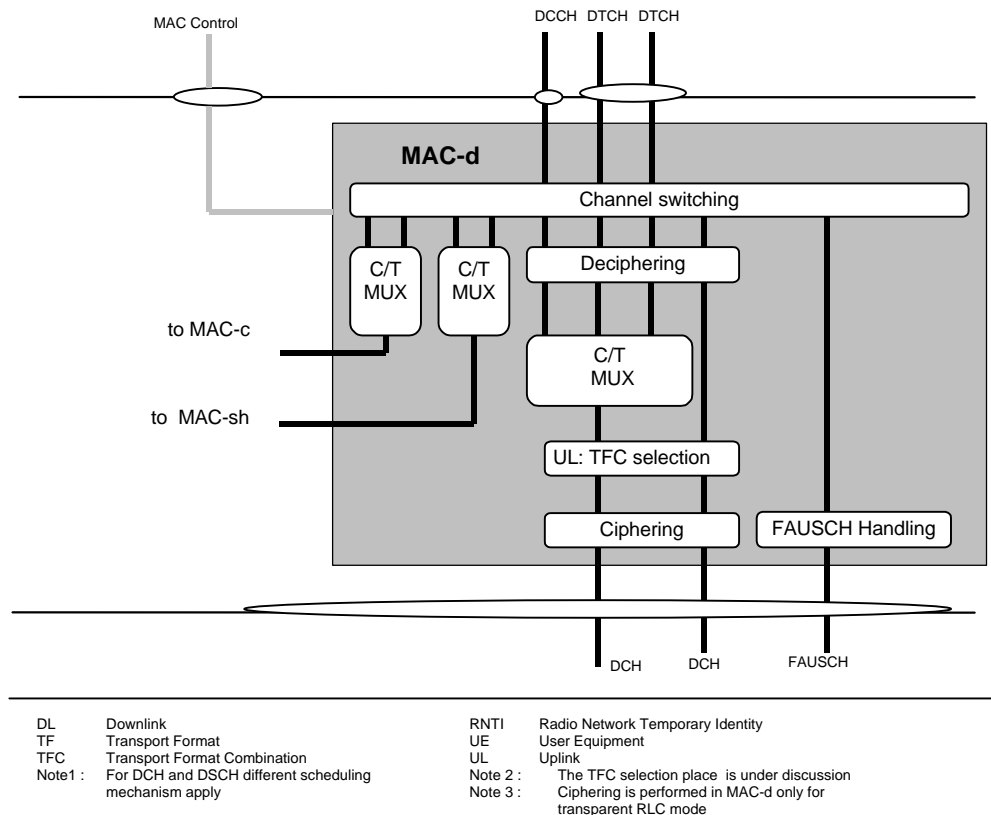| DL | Downlink | | RNTI | Radio Network Temporary Identity |
TF	Transport Format		UE	User Equipment
TFC	Transport Format Combination		UL	Uplink
Note1 :	For DCH and DSCH different scheduling mechanism apply		Note 2 :	The TFC selection place is under discussion
			Note 3 :	Ciphering is performed in MAC-d only for transparent RLC mode

Figure 4.2.3.3. UE side MAC architecture / MAC-d details

Figure 4.2.3.4 shows the UE side MAC-sh entity. The following functionality is covered:

- RNTI is used on the DSCH Control Channel to identify the UE. Additionally, some timing / physical information is needed to tell the UE when to listen to DSCH.
- Multiplexing is used to transmit the received information on DSCH and DSCH Control Channel to the Mac-d, for TDD the multiplexing is used to transfer data from MAC-d to USCH and receives control information for shared operation from MAC-c.

The RLC has to provide RLC-PDU's to the MAC which fits into the available transport blocks on the transport channels respectively.
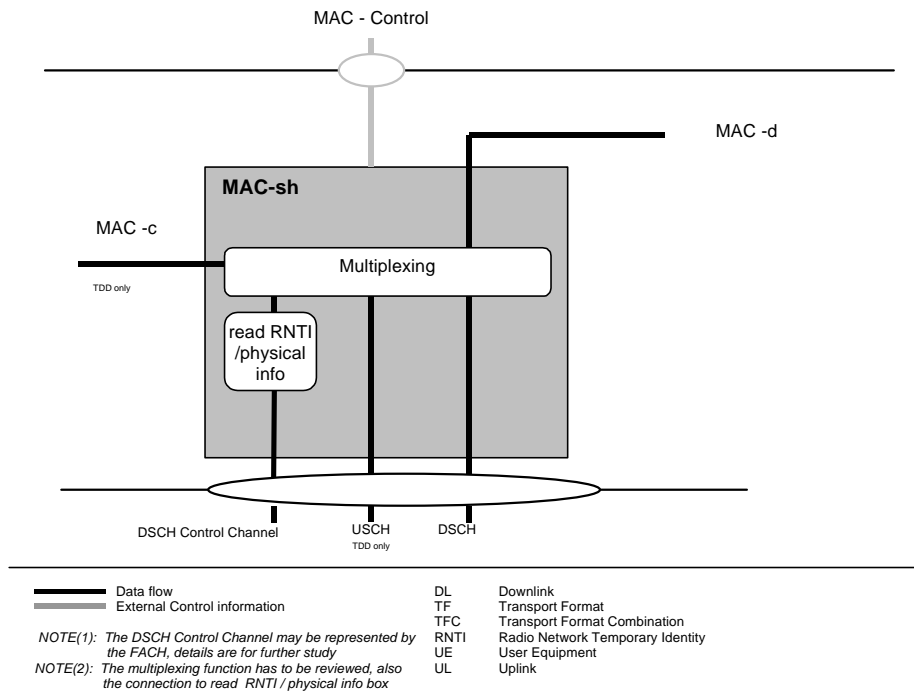
▬▬▬	Data flow	DL	Downlink
▬▬▬	External Control information	TF	Transport Format
		TFC	Transport Format Combination
NOTE(1): The DSCH Control Channel may be represented by		RNTI	Radio Network Temporary Identity
the FACH, details are for further study		UE	User Equipment
NOTE(2): The multiplexing function has to be reviewed, also		UL	Uplink
the connection to read RNTI / physical info box			

Figure 4.2.3.4. UE side MAC architecture / MAC-sh details

4.2.4. Traffic Related Architecture - UTRAN Side

Figure 4.2.4.1 illustrates the connectivity between the MAC entities from the UTRAN side. It is similar to the UE case with the exception that there will be one MAC-d for each UE and each UE (MAC-d) that is associated with a particular cell may be associated with that cells MAC-sh. MAC-c receives the CPCH transport blocks. MAC-c and Mac-sh are located in the controlling RNC while MAC-d is located in the serving RNC.The MAC Control SAP is used to transfer Control information to each MAC entity belongs to one UE.
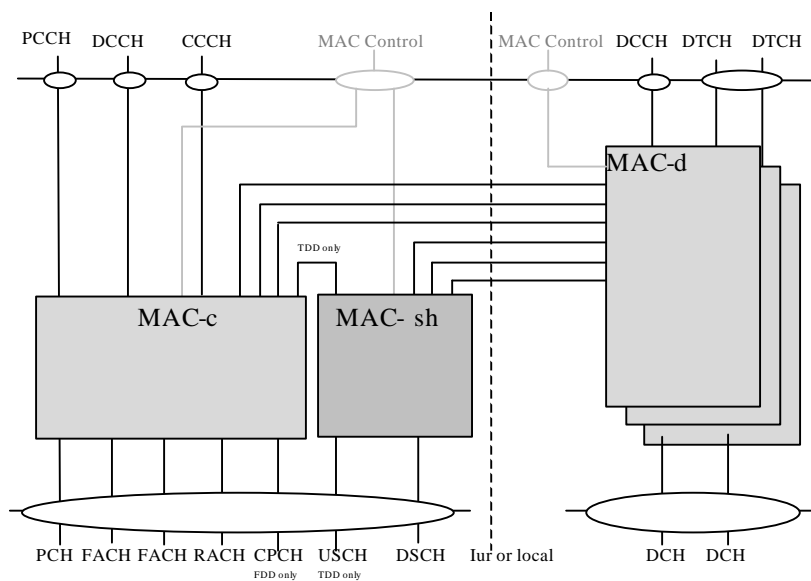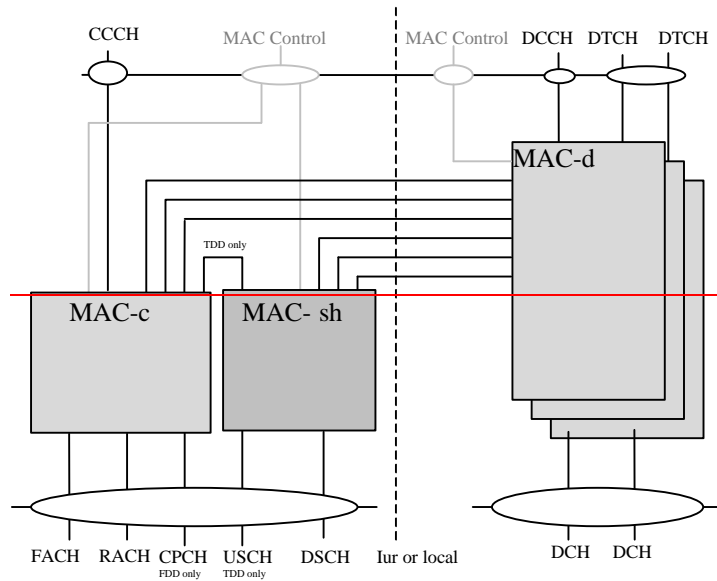
Figure 4.2.4.1: UTRAN side MAC architecture

Figure 4.2.4.2 shows the UTRAN side MAC-c entity. The following functionality is covered:

- The Scheduling – Priority Handling box manages FACH resources between the
  according to their priority. DL flow control is also provided to MAC-d.
- The C/D box represents the insertion and detection of the field in the MAC header, indicating whether a common or dedicated logical channel is used.
- For dedicated type logical channels, the c-RNTI field in the MAC header is used to distinguish between UEs.
- In the downlink, transport format combination selection ismight be done forif FACH is variable rate and PCH.
- The multiplexing of CTCH information and the CB-Scheduling function inside MAC-c supports the Short Message Service Cell Broadcast (SMS CB).

DL	Downlink		RNTI	Radio Network Temporary Identity
TF	Transport Format		UE	User Equipment
TFC	Transport Format Combination		UL	Uplink
(1)	only for TDD		Note:	The applicability of c-RNTI for connection to MAC-sh has to be reviewed

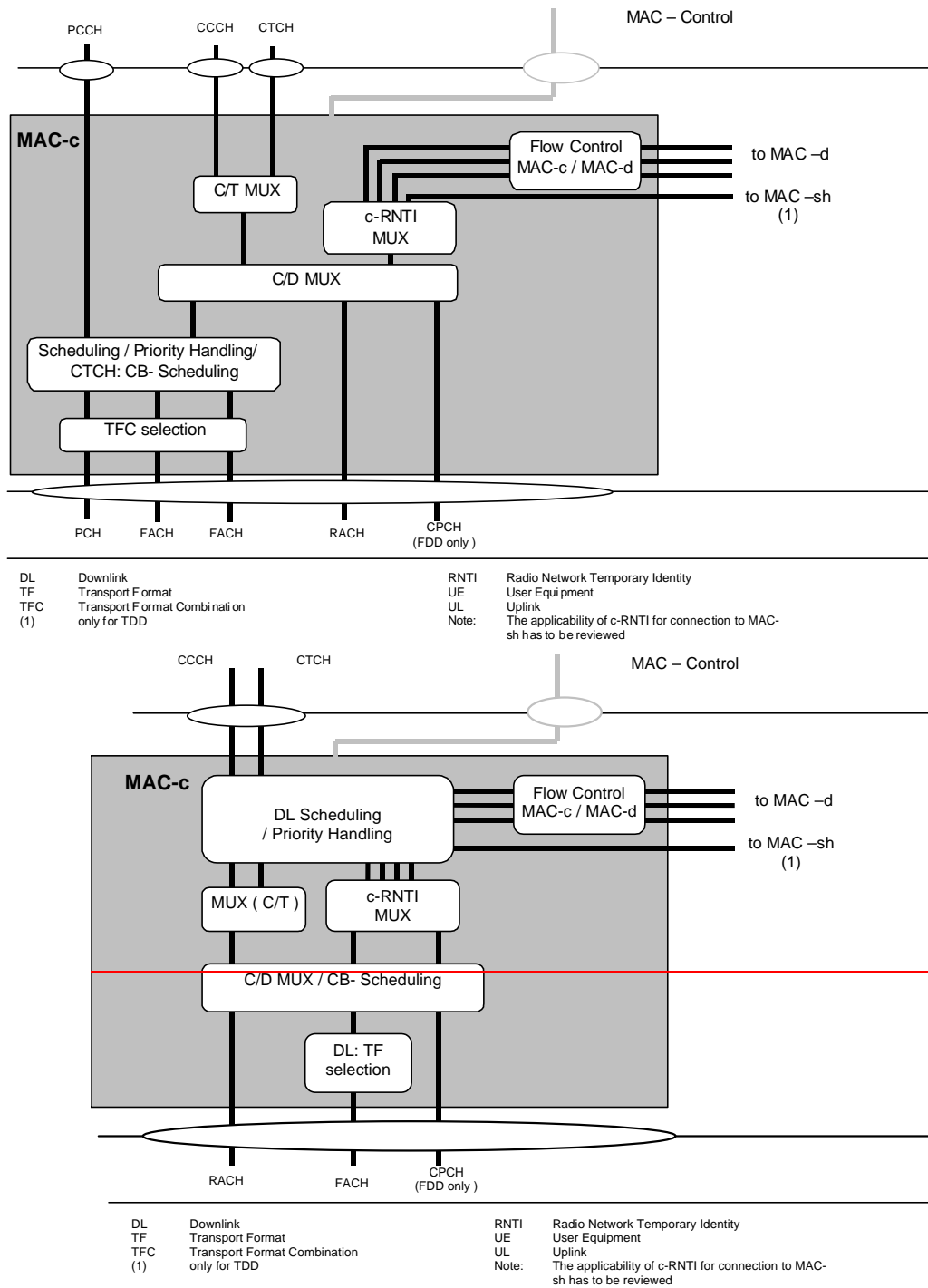| DL	Downlink		RNTI	Radio Network Temporary Identity
TF	Transport Format		UE	User Equipment
TFC	Transport Format Combination		UL	Uplink
(1)	only for TDD		Note:	The applicability of c-RNTI for connection to MAC-sh has to be reviewed

Figure 4.2.4.2 UTRAN side MAC architecture / MAC-c details