3GPP TSG-RAN meeting #5 ***RP-99463***
Kyongju, Korea, 6-8 October 1999

Title: Approved Change Requests on TS 25.321
Agenda item: 6.3.3

DOC	TSG_STA	SPEC	CR	REV	SUBJECT	CAT	CURRE	NEW
R2-99948	approved	25.321	001	1	Modified MAC handling of PCH and FACH	C	3.0.0	3.1.0
R2-99891	approved	25.321	002		Modifications of MAC primitives	C	3.0.0	3.1.0
R2-99B97	approved	25.321	003	2	RACH/FACH MAC header – Channel type identification	B	3.0.0	3.1.0
R2-99979	approved	25.321	004		Support for USCH/DSCH singling in TDD	B	3.0.0	3.1.0
R2-99997	approved	25.321	005		Restructuring of Annex B (removing redundant information regarding	F	3.0.0	3.1.0
R2-99996	approved	25.321	006		Clarification on RACH partitioning and prioritization via access service class	C	3.0.0	3.1.0
R2-99b42	approved	25.321	010	1	Modifications on UE-Id formats	C	3.0.0	3.1.0
R2-99936	approved	25.321	011		CPCH primitives	C	3.0.0	3.1.0
R2-99940	approved	25.321	012		Timing advance for TDD	B	3.0.0	3.1.0
R2-99916	approved	25.321	013		Traffic volume measurement report procedure	B	3.0.0	3.1.0
R2-99b38	approved	25.321	014		Mapping of BCCH logical channel onto FACH transport channel	C	3.0.0	3.1.0
R2-99c51	approved	25.321	015	1	MAC PDU formats for DCCH/DTCH on DSCH and for PCCH	C	3.0.0	3.1.0
R2-99c88	approved	25.321	016	1	Informative parts that shall not specify or constrain implementations	D	3.0.0	3.1.0
R2-99d00	approved	25.321	017	1	Modification of RACH transmission control procedure	C	3.0.0	3.1.0
R2-99c47	approved	25.321	018		Removal of MAC function for system information and paging scheduling	D	3.0.0	3.1.0
R2-99c99	approved	25.321	019	1	RACH transmission control procedure on MAC for TDD mod	C	3.0.0	3.1.0
R2-99d02	approved	25.321	020	1	MAC procedure for control of CPCH transmission	C	3.0.0	3.1.0
R2-99d01	approved	25.321	021	1	Removal of Annex A and B of TS 25.321	D	3.0.0	3.1.0

3GPP TSG-RAN meeting #5 **Document R2-99948**

Kyongju, Korea, 6-8 October 1999

3G CHANGE REQUEST

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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 *list TSG meeting no. here ↑*

for approval [X]
for information [ ]

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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: *(at least one should be marked with an X)*

USIM [ ] ME [X] UTRAN [X] Core Network [ ]

Source: TSG-RAN WG2 **Date:** 1999-08-18

Subject: Modified MAC handling of PCH and FACH

3G Work item:

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

F	Correction	[ ]
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:

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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:

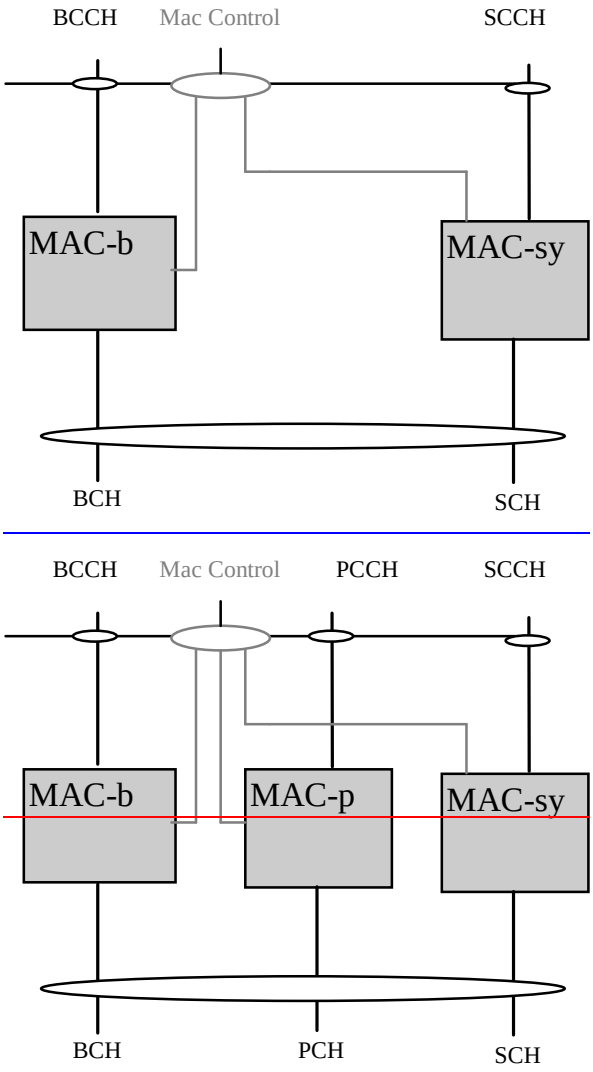


Figure 4.2.2.1 UE side and UTRAN side architecture (BCCH ,PCCH and SCCH)

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.

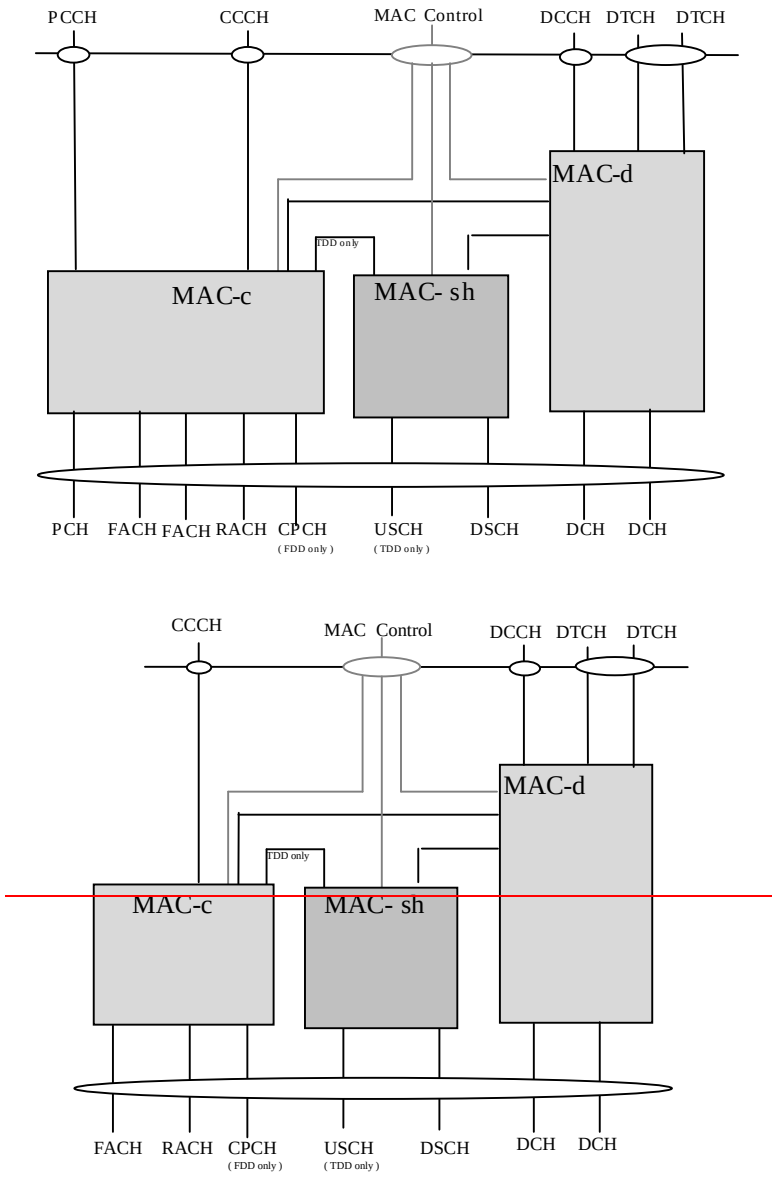


Figure 4.2.3.1 UE side MAC architecture

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).

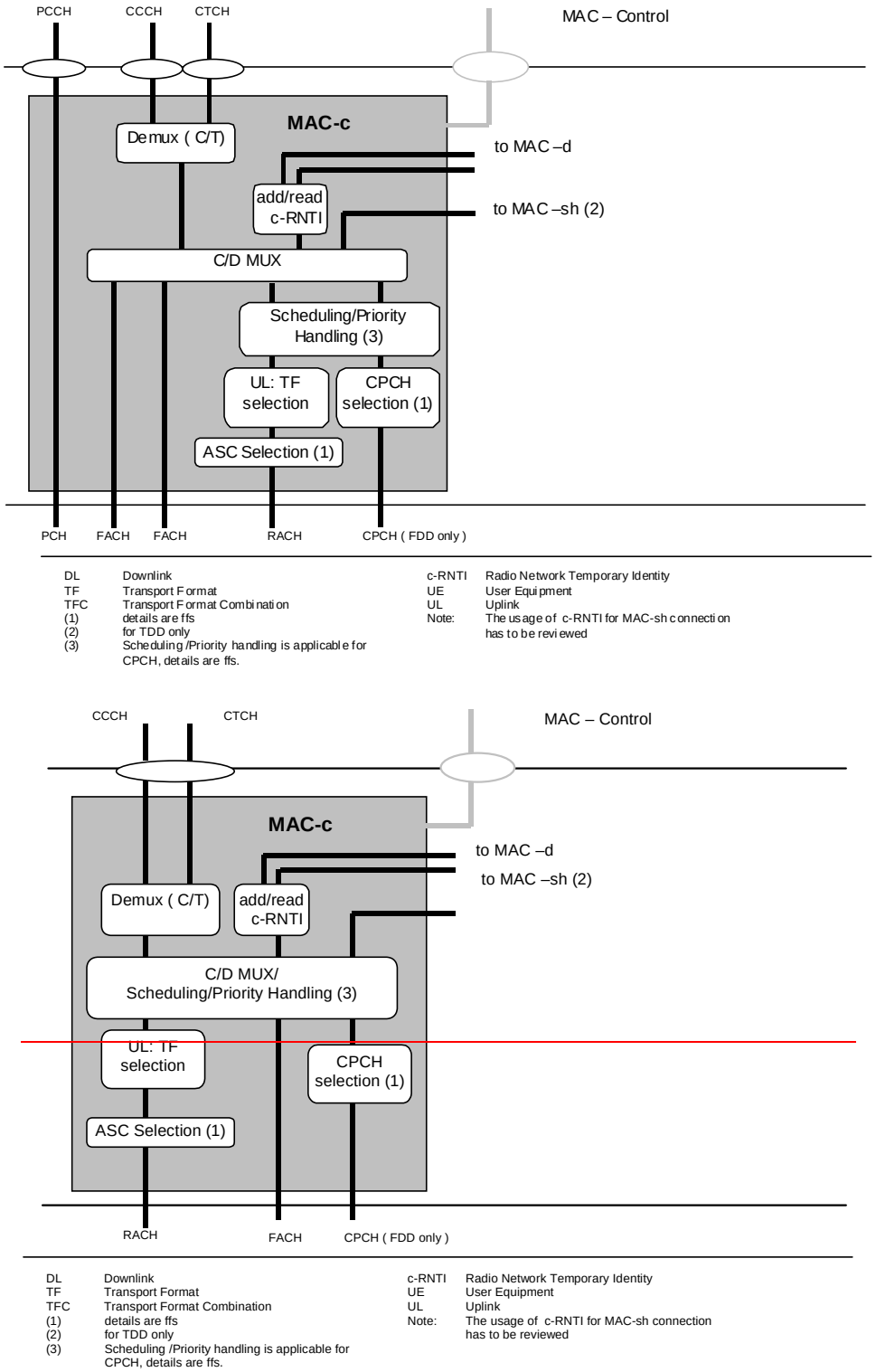


Figure 4.2.3.2. UE side MAC architecture / MAC-c details

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.

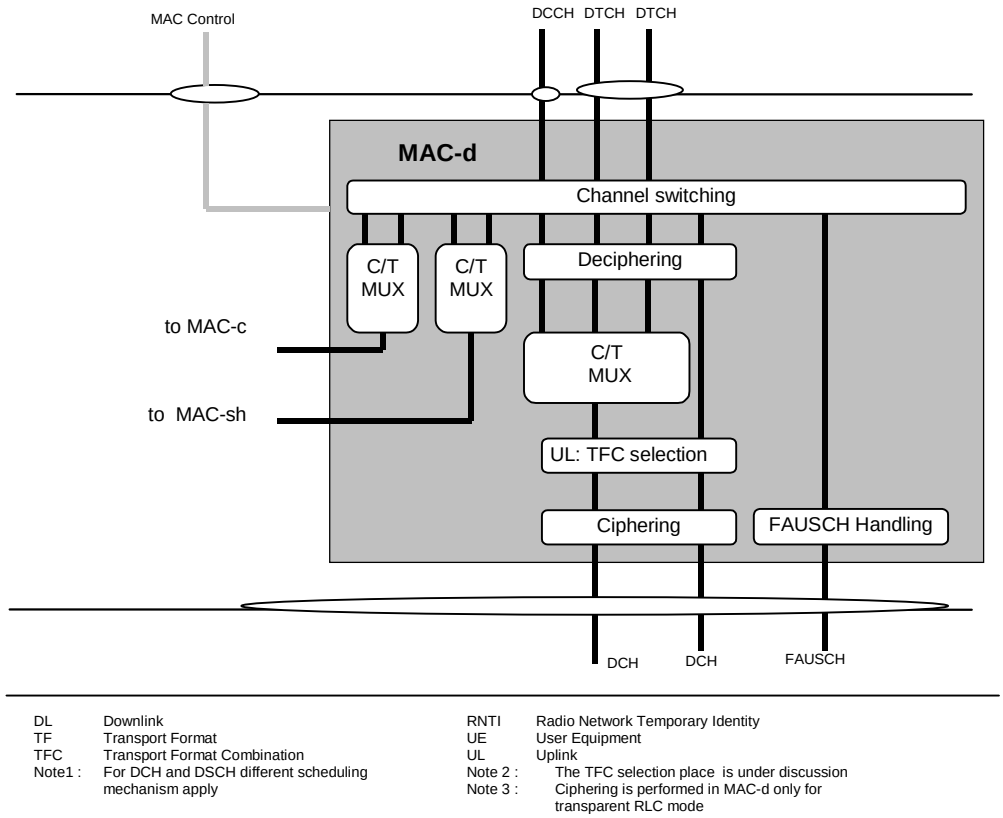


Figure 4.2.3.3. UE side MAC architecture / MAC-d details

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.

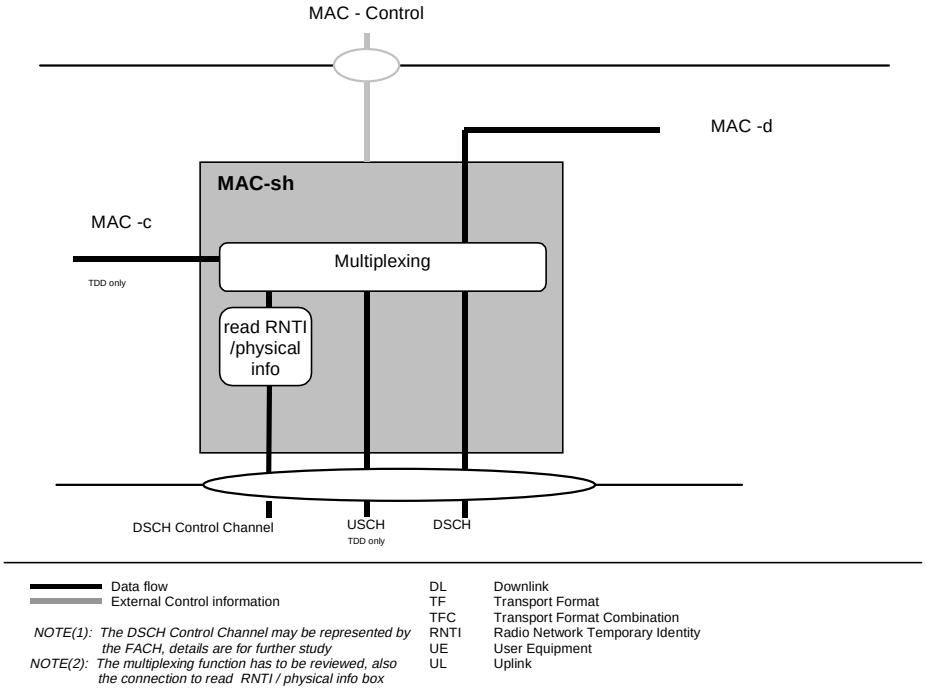
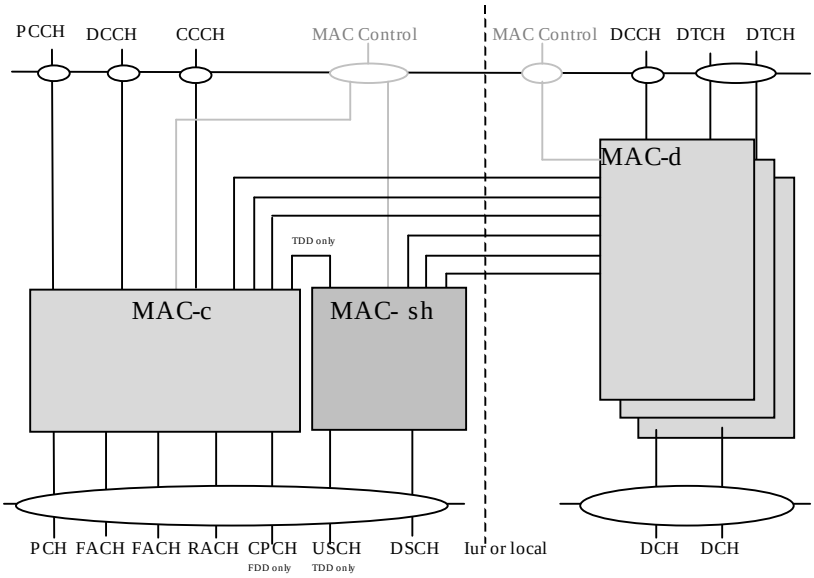


Figure 4.2.3.4. UE side MAC architecture / MAC-sh details

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.



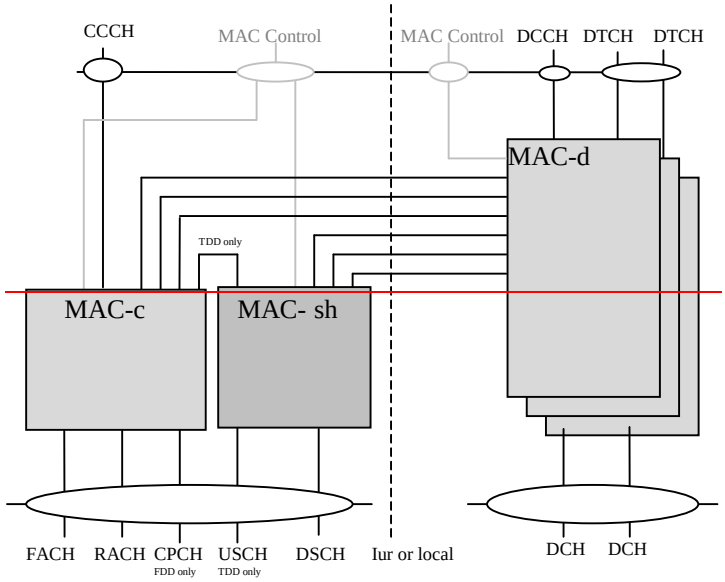


Figure 4.2.4.1: UTRAN side MAC architecture

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 UE's and between data flows 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 is~~might be~~ done for~~if~~ 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).

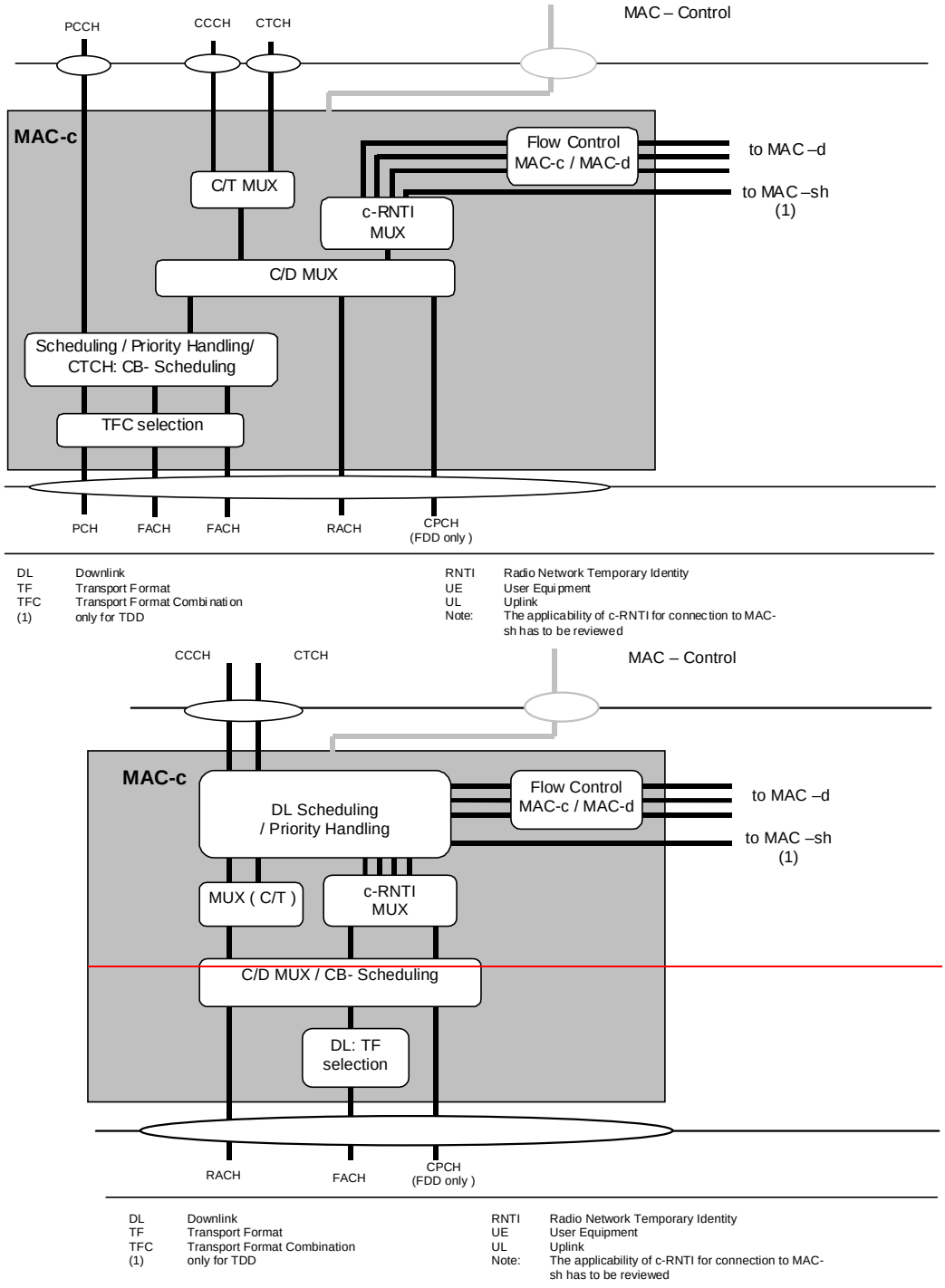


Figure 4.2.4.2 UTRAN side MAC architecture / MAC-c details

3GPP TSG-RAN meeting #5 **Document R2-99891**

Kyongju, Korea, 6-8 October 1999

3G CHANGE REQUEST

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25.321 **CR** **002** Current Version: 3.0.0

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

For submision to TSG RAN #5 *list TSG meeting no. here ↑*

for approval [X]
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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: *(at least one should be marked with an X)* USIM [ ] ME [X] UTRAN [X] Core Network [ ]

Source: TSG-RAN WG2 **Date:** 1999-08-17

Subject: Modification of MAC primitives

3G Work item:

Category: *(only one category Shall be marked With an X)*

F	Correction	[ ]
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:

Parameters taken from TS 25.331 have been added to CMAC-CONFIG-Req. In addition, parameters for ciphering and the RACH backoff algorithm have been added.
Primitive names are changed according to primitive naming convention in 25.301.
CMAC-ERROR, MAC-ERROR and CMAC-CONNECT primitives are removed, because no motivation for their existence has been found.
Editorial notes are removed because lack of relevance.
The parameters for CMAC-MEASUREMENT primitives are regarded as FFS, until the traffic volume measurement algorithm is decided upon.
"Number of transmitted RLC PDUs" is added as a new parameter to the MAC-DATA-Ind primitive. It is needed by the RLC EPC function.
Message Unit (MU) is changed to Data in the MAC-DATA primitives.

Clauses affected: 8

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:

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8. Elements for layer-to-layer communication

8.1 Primitives between layers 1 and 2

see TS25.302

8.2 Primitives between MAC and RLC

8.2.1 Primitives

The primitives between MAC layer and RLC layer are shown in Table 8.2.1.~~1~~

Generic Name	Type				Parameters
	Request	Indication	Response	Confirm	
MAC-DATA	X	X			~~MU~~ Data, Number of transmitted RLC PDUs
~~MAC-ERROR~~		~~X~~			~~[FFS]~~
MAC-STATUS		X	X		[FFS]

Table 8.2.1 Primitives between MAC layer and RLC layer

MAC-DATA-~~-~~Req~~uest~~/Ind~~ication~~

- MAC-DATA-~~-~~Req~~uest~~ primitive is used to request that an upper layer PDU be sent using the procedures for the information transfer service.
- MAC-DATA-~~-~~Ind~~ication~~ primitive indicates the arrival of ~~an~~ upper layer PDU~~s~~ received within one transmission time interval by means of the information transfer service.

~~MAC-ERROR Indication~~

~~• MAC-ERROR Indication primitive indicates to RLC that an error condition has occurred.~~

MAC-STATUS-~~-~~Ind~~ication~~/Resp~~onse~~

- MAC-STATUS-~~-~~Ind~~ication~~ primitive indicates to RLC about changes in the rules under which it may transfer data to MAC. Parameters of the primitive can indicate a transmission timer value, whether the RLC can transfer data and whether that data is restricted to supervisory frames only.
- MAC-STATUS-~~-~~Resp~~onse~~ enables RLC to acknowledge a MAC-STATUS-~~-~~Ind~~ication~~. It is possible that RLC would use this primitive to indicate that it has nothing to send or that it is in a suspended state.

8.2.2 Parameters

a) ~~Message Unit (MU)~~Data
It contains the RLC layer message (RLC-PDU) to be transmitted~~-~~, or the RLC layer messages that have been received by the MAC sub-layer.

b) Number of transmitted RLC PDUs (indication only)
Indicates the number of RLC PDUs transmitted within the transmission time interval, based on the TFI value.

~~*[Note (from Tdoc WG2 009/99): This description are based on L2 LAC specification drafted TTC/ARIB Joint meeting. Because SAP between LAC and MAC is defined in our structure of MAC, the name of Signal is changed*~~

~~*to Primitive. And format of explanation of primitives are changed to avoid verbose description. Request and Indication are combined to explain. Primitives for Activation/Deactivation or Establish/Release or Connect/Disconnect for MAC connection are FFS.]*~~

~~[Note (from Tdoc WG2 009/99*)*: The parameters for RLCMAC-ERROR and RLCMAC-STATUS are FFS.]~~

8.3 Primitives between -MAC and RRC

8.3.1 Primitives

The primitives between MAC and RRC are shown in Table 8.3.1

Generic Name	Type				Parameters
	Request	Indication	Response	Confirm	
CMAC-CONFIG	**X**				UE information elements RAB information elements TrCH information elements RACH transmission control elements Ciphering elements ~~CHI~~
~~**CMAC-CONNECT**~~	~~**X**~~			~~**X**~~	~~ffs~~
CMAC-MEASUREMENT	**X**	**X**			Measurement information elements ~~TRIG. TH, RESULT, PER~~
CMAC-STATUS		**X**			Status info.
~~**CMAC-ERROR**~~		~~**X**~~			~~Reason for error~~

Table 8.3.1 Primitives between MAC sub-layer and RRC

CMAC-CONFIG-Req~~uest~~

- CMAC-CONFIG Req~~uest~~ is used to request for setup, release and configuration of a logical channel, e.g. RNTI allocation, ~~the~~ switching the connection between logical channels and transport channels, TFCS update or scheduling priority of logical channel.

~~CMAC-CONNECT Request/Confirm~~

~~• CMAC-CONNECT Request is used initiate a RRC connection~~
~~• CMAC-CONNECT Confirm is used to confirm the establishment of a RRC connection.~~

CMAC-MEASUREMENT-Req~~uest~~/Ind~~ication~~

- CMAC-MEASUREMENT--Req~~uest~~ is used by RRC to request MAC to perform measurements, e.g. traffic volume measurements. ~~to measure something radio quality at both BS and MS sides. (for example : Transport Block Error)~~
- CMAC-MEASUREMENT--Ind~~ication~~ is used to notify RRC of the measurement~~ing~~ result.

CMAC-STATUS--Ind~~ication~~

- CMAC-STATUS-Ind~~ication~~ primitive notifies RRC~~the management entity~~ of status information.

~~CMAC-ERROR Indication~~

- ~~CMAC-ERROR Indication primitive notifies the management entity of an error detected in the operation of the MAC sub-layer protocol such as excessive number of transmission attempts for Ack-mode, and timer time out.~~

8.3.2 Parameters

See 25.331 for a detailed description of the UE, RAB and TrCH information elements.

~~a)Channel Information (CHI)~~

~~Channel information for active transport channel. For example, common channel or dedicated channel notification in user packet transmission.~~

a) UE information elements
S-RNTI
SRNC identity
C-RNTI
Activation time

b) RAB information elements
RAB multiplexing info (Transport channel identity, Logical channel identity, MAC logical channel priority)

c) TrCH information elements
Transport Format Combination Set

d) Measurement information elements
(Details are ffs)

~~b)TH~~
~~Threshold information for measurement. For example, traffic monitor or transmission quality. When an specific value is assigned, it means measuring should be reported with law data.~~

~~c)PER~~
~~Period information for measurement. When an specific value is assigned, it means measuring should be reported only when measuring result exceed the given threshold.~~

~~d)TRIG~~
~~Trigger information which request to start measuring.~~

~~e)RESULT~~
~~Measurement result~~.

~~f)~~e) Status info
Maximum number of preamble ramping cycles reached.
~~It is management entity of status information.~~

~~g)Reason for error~~
~~It contains the management entity of an error detected in the operation of the MAC sub layer protocol (e.g. excessive number of transmission attempts for Ack mode).~~

f) RACH transmission control elements
Persistence value P
Maximum number of preamble ramping cycles M_{max}
Others (ffs., e.g. minimum and maximum number of time units between two preamble ramping cycles)

g) Ciphering elements
Ciphering mode
Ciphering key
Ciphering sequence number

~~[Note(from Tdoc WG2 009/99): If used with a threshold information, the MEASURE primitive is same as an alarm indication or request for channel switching. When the condition that channel switching is needed is detected at UE side, appropriate RRC message will be sent to Network side.~~

3GPP TSG-RAN meeting #5 ***Document R2-99b97***

Kyongju, Korea, 6-8 October 1999

3G CHANGE REQUEST

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TS25.321 **CR** **003r2** Current Version: 3.0.0

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

For submision to TSG RAN#5 *list TSG meeting no. here ↑* for approval [X] for information [ ] *(only one box should 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: *(at least one should be marked with an X)* USIM [ ] ME [X] UTRAN [X] Core Network [ ]

Source: TSG RAN WG2 **Date:** 20/09/99

Subject: RACH/FACH MAC Header Channel Type and MAC Signalling in TDD for USCH/DSCH Identification and Operation

3G Work item:

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

F	Correction	[ ]
A	Corresponds to a correction in a 2G specification	[ ]
B	Addition of feature	[X]
C	Functional modification of feature	[ ]
D	Editorial modification	[ ]

Reason for change: Inclusion of necessary means to support USCH/DSCH introduction of SHCCH logical channel for direct communication between RRC in C-RNC and UE.

Clauses affected: 3.2, 4.2.3, 4.2.4, 4.3.3, 6.2.1, 6.2.2, 9.1.1, 9.2.1, 9.2.1.1, 9.2.1.2, 9.2.1.3, 9.2.1.4, Annex C

Other specs affected:

Other 3G core specifications	[X]	→ List of CRs:	25.321 CR004
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: Relative to revision01 the sentence concerning SHCCH was removed in section 4.2.3 (inline with CR004)

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3. Definitions, abbreviations and symbols

3.1 Definitions

See [9] for a definition of fundamental concepts and vocabulary.

3.2 Abbreviations

ARQ	Automatic Repeat Request
ASC	Access Service Class
BCCH	Broadcast Control Channel
BCH	Broadcast Channel
C-	Control-
CC	Call Control
CCCH	Common Control Channel
CCTrCH	Coded Composite Transport Channel
CPCH	Common Packet Channel (UL)
CN	Core Network
CRC	Cyclic Redundancy Check
DC	Dedicated Control (SAP)
DCA	Dynamic Channel Allocation
DCCH	Dedicated Control Channel
DCH	Dedicated Channel
DL	Downlink
DRNC	Drift Radio Network Controller
DSCH	Downlink Shared Channel
DTCH	Dedicated Traffic Channel
FACH	Forward Link Access Channel
FAUSCH	Fast Uplink Signalling Channel
FCS	Frame Check Sequence
FDD	Frequency Division Duplex
GC	General Control (SAP)
HO	Handover
ITU	International Telecommunication Union
kbps	kilo-bits per second
L1	Layer 1 (physical layer)
L2	Layer 2 (data link layer)
L3	Layer 3 (network layer)
LAC	Link Access Control
LAI	Location Area Identity
MAC	Medium Access Control
MM	Mobility Management
Nt	Notification (SAP)
OCCCH	ODMA Common Control Channel
ODCCH	ODMA Dedicated Control Channel
ODCH	ODMA Dedicated Channel
ODMA	Opportunity Driven Multiple Access
ORACH	ODMA Random Access Channel
ODTCH	ODMA Dedicated Traffic Channel
PCCH	Paging Control Channel
PCH	Paging Channel
PDU	Protocol Data Unit
PHY	Physical layer
PhyCH	Physical Channels
RACH	Random Access Channel
RLC	Radio Link Control

RNC	Radio Network Controller
RNS	Radio Network Subsystem
RNTI	Radio Network Temporary Identity
RRC	Radio Resource Control
SAP	Service Access Point
SCCH	Synchronization Control Channel
SCH	Synchronization Channel
SDU	Service Data Unit
SHCCH	Shared Channel Control Channel
SRNC	Serving Radio Network Controller
SRNS	Serving Radio Network Subsystem
TDD	Time Division Duplex
TFCI	Transport Format Combination Indicator
TFI	Transport Format Indicator
TMSI	Temporary Mobile Subscriber Identity
TPC	Transmit Power Control
U-	User-
UE	User Equipment
UE_R	User Equipment with ODMA relay operation enabled
UL	Uplink
UMTS	Universal Mobile Telecommunications System
URA	UTRAN Registration Area
USCH	Uplink Shared Channel
UTRA	UMTS Terrestrial Radio Access
UTRAN	UMTS Terrestrial Radio Access Network

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 FACH and RACH common 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~~ The MAC-sh transfers data from the DSCH to the MAC-d and from the MAC-d to the USCH (TDD only) under control of the ~~FACH~~RRC. In the FDD implementation, the MAC-c may transfer data from the MAC-d to the CPCH.

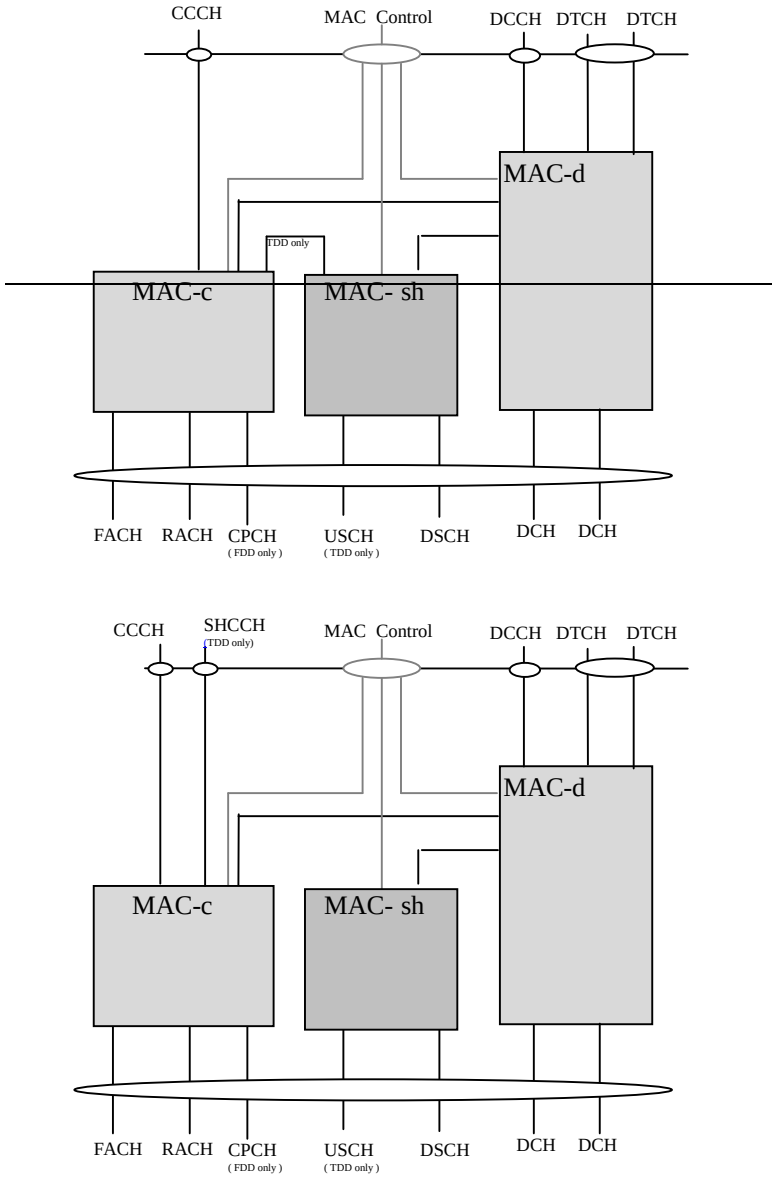
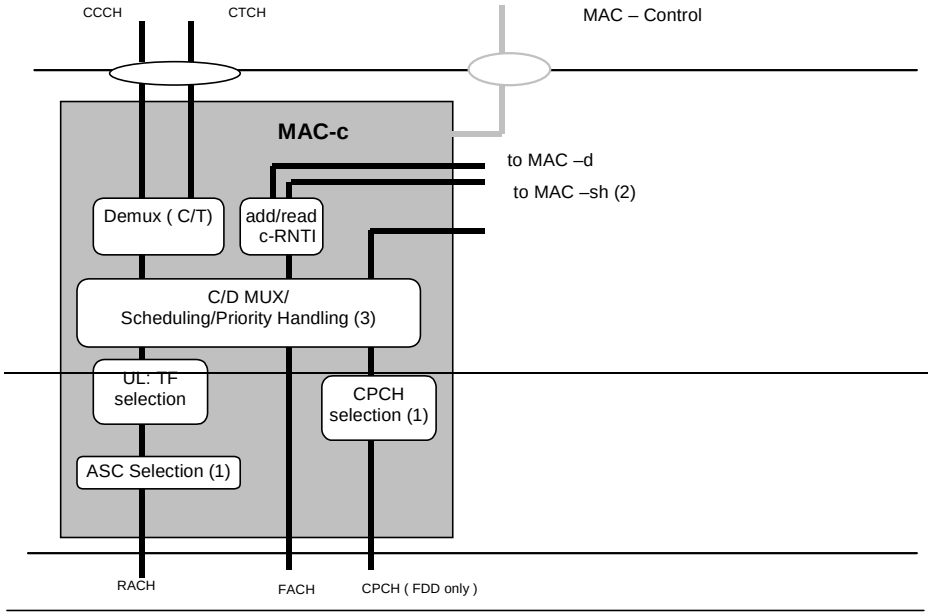


Figure 4.2.3.1 UE side MAC architecture

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 TCTF MUX box represents the insertion and detection of the TCTF field in the MAC header, indicating the common channel type or dedicated logical channel used or whether SHCCH 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).



DL	Downlink	c-RNTI	Radio Network Temporary Identity
TF	Transport Format	UE	User Equipment
TFC	Transport Format Combination	UL	Uplink
(1)	details are ffs	Note:	The usage of c-RNTI for MAC-sh connection has to be reviewed
(2)	for TDD only		
(3)	Scheduling /Priority handling is applicable for CPCH, details are ffs.		

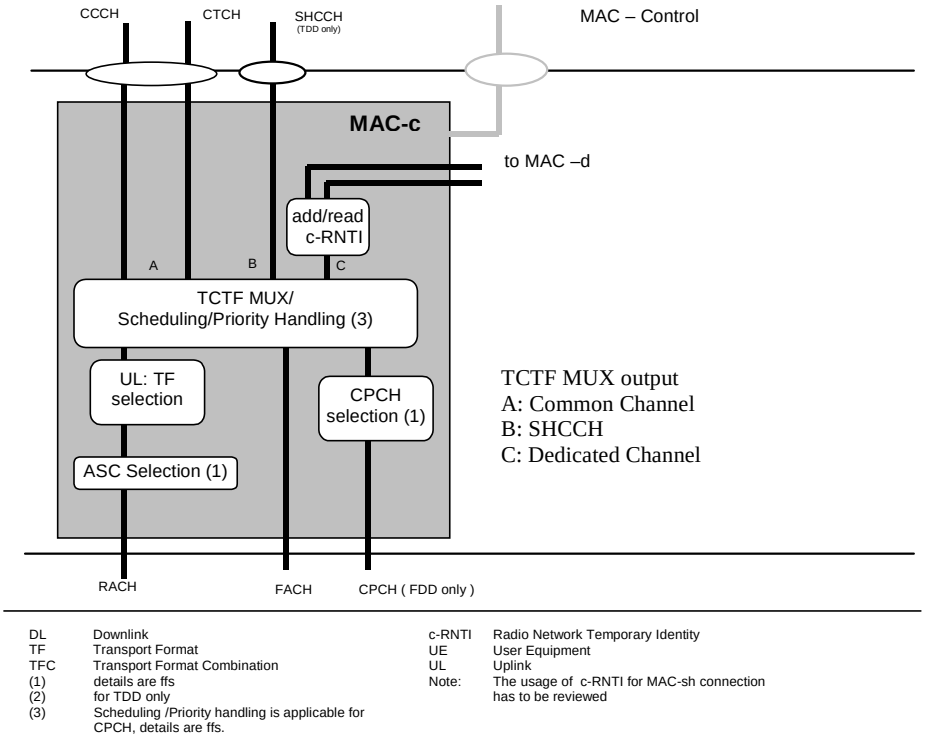


Figure 4.2.3.2. UE side MAC architecture / MAC-c details

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.

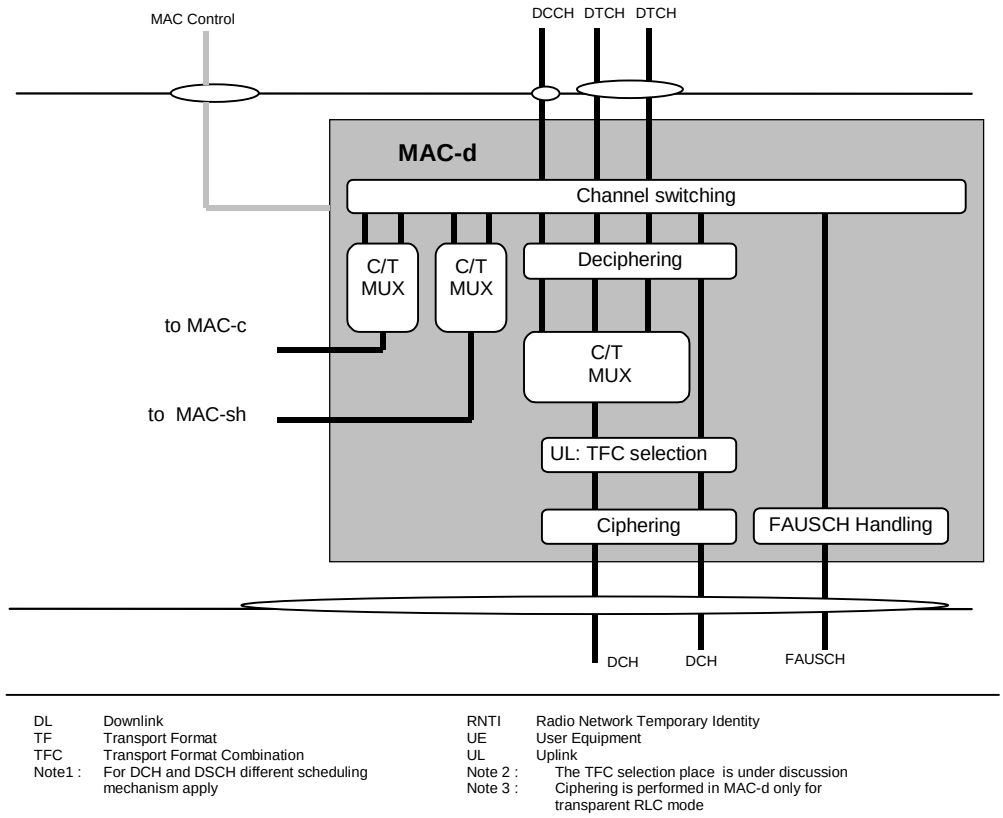


Figure 4.2.3.3. UE side MAC architecture / MAC-d details

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.

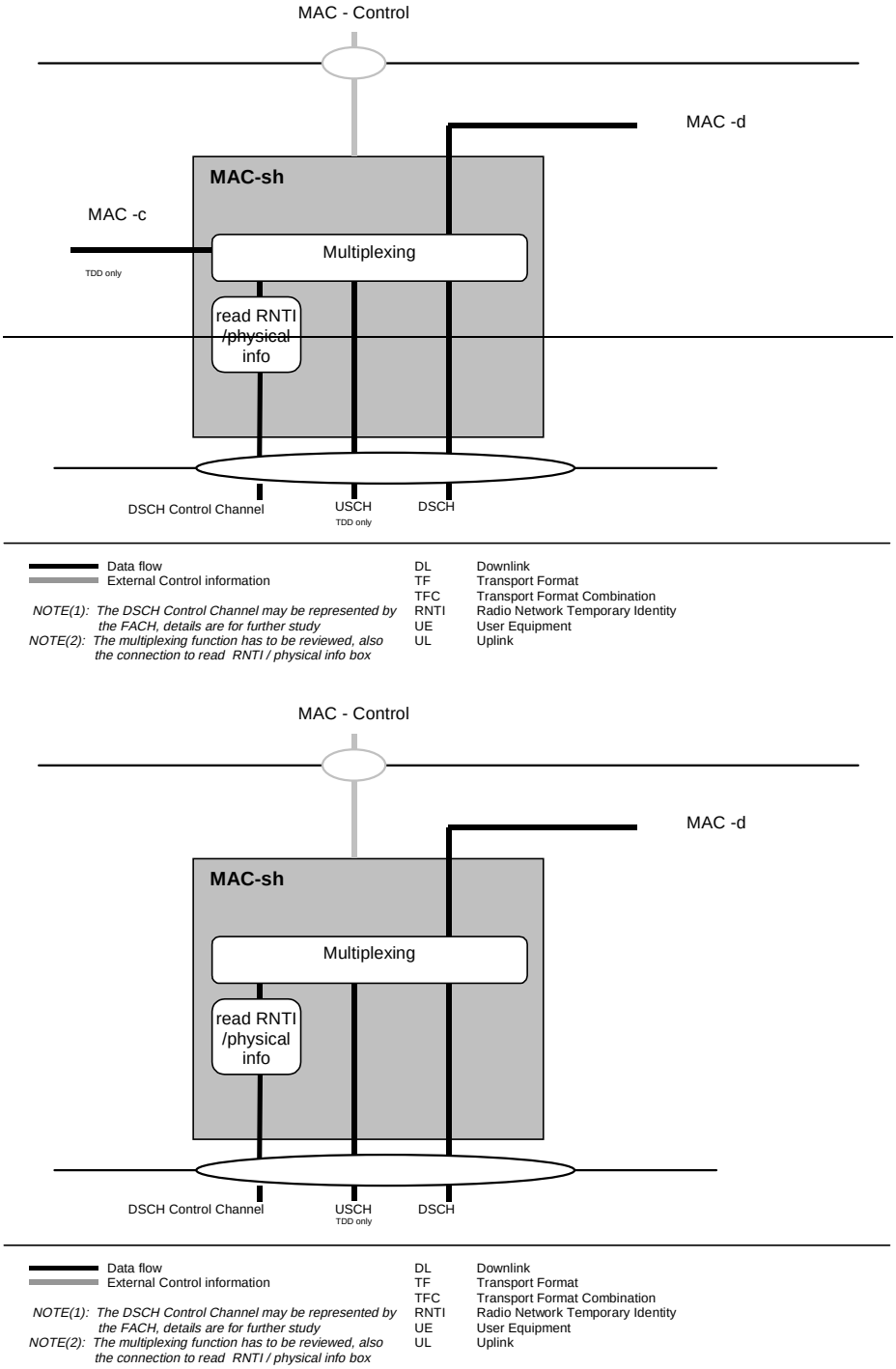


Figure 4.2.3.4. UE side MAC architecture / MAC-sh details

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.

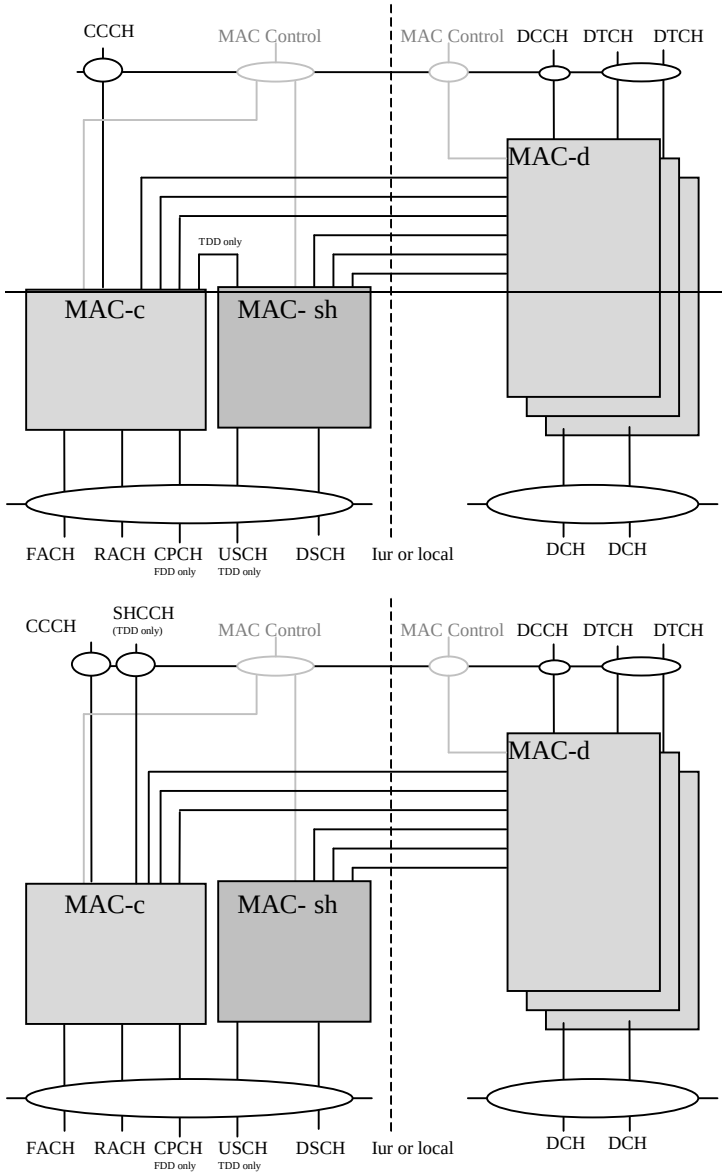
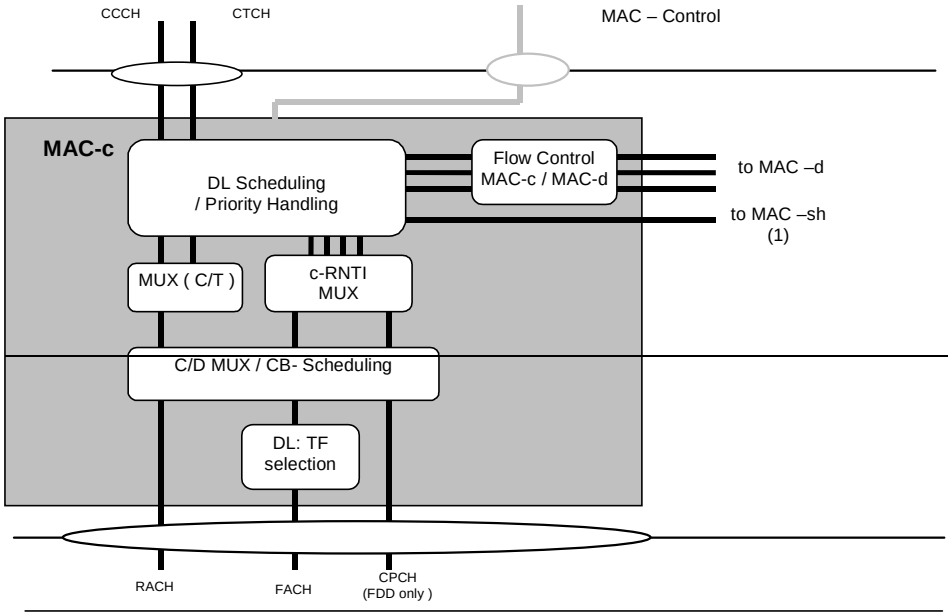


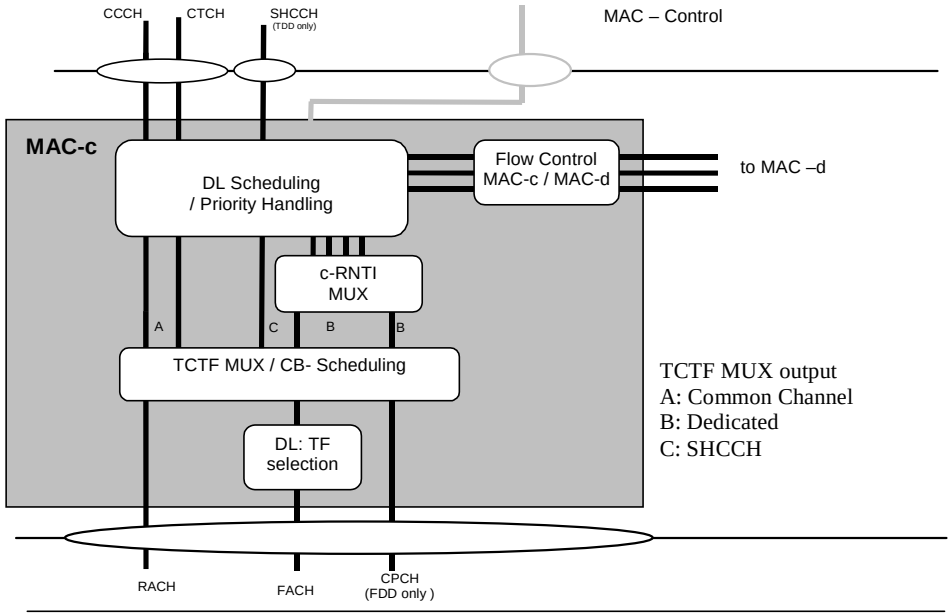
Figure 4.2.4.1: UTRAN side MAC architecture

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 UE's and between data flows 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.~~
- The TCTF MUX box represents the insertion and detection of the TCTF field in the MAC header, indicating the common channel type or dedicated logical channel used or whether SHCCH 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 selection might be done if FACH is variable rate.
- 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

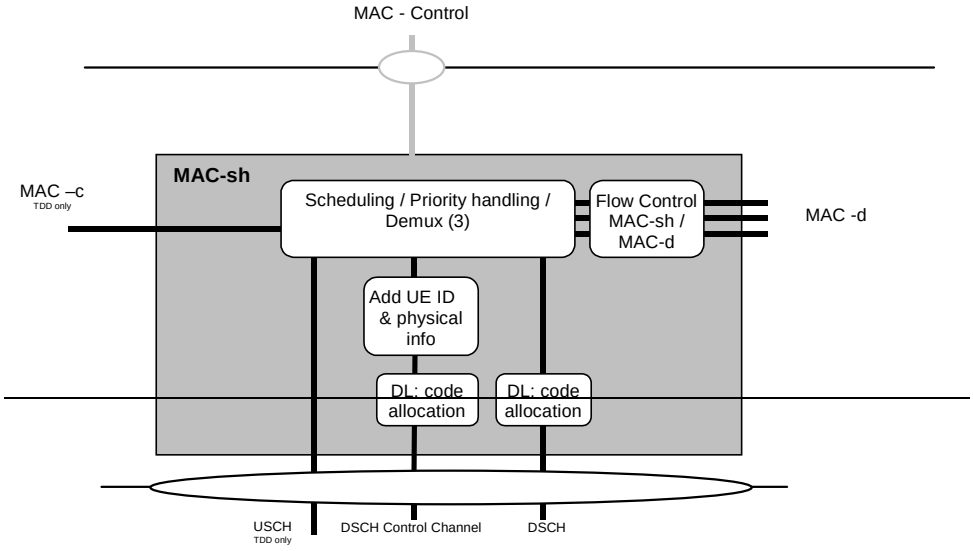
Figure 4.2.4.2 UTRAN side MAC architecture / MAC-c details

Figure 4.2.4.4 shows the UTRAN side MAC-sh entity. The following functionality is covered:

- A specific UE ID is needed when using the DSCH Control Channel to identify the UE on the DSCH. This specific UE ID may be optimised for DSCH and will be allocated when a RAB is mapped onto a DSCH. Additionally, some timing information is needed to tell the UE when to listen to DSCH.
- The scheduling /priority handling box in MAC-sh shares the DSCH resources between the UEs and between data flows according to their priority. For TDD operation the demultiplex function is used to support the USCH. ~~and the connection to the MAC c~~.
- The scheduling/priority handling box also prioritizes between UL & DL capacity allocation indications when the FACH is used for both DSCH and USCH control channels (FACH is used for TDD – FDD is FFS).
- DL code allocation is used to indicate the code used on the DSCH and the appropriate Transport format on the DSCH.
- Flow control is provided to MAC-d.

(Note: Capacity allocation synchronization related to the USCH/ DSCH transmission is ffs.)

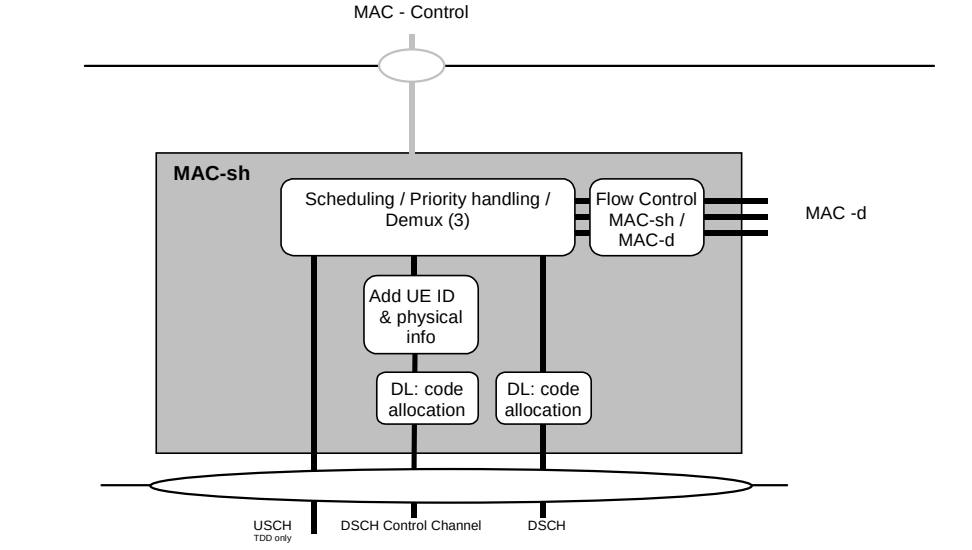
The RLC has to provide RLC-PDU's to the MAC which fits into the available transport blocks on the transport channels respectively.



Data flow
External Control information

DL	Downlink
TF	Transport Format
TFC	Transport Format Combination
RNTI	Radio Network Temporary Identity
UE	User Equipment
UL	Uplink

NOTE(1): The DSCH Control Channel may be represented by the FACH, details are for further study, If supported by the FACH the data will be transferred to MAC-c via priority/flow boxes.
NOTE(2): The relation between the scheduling and the adding of RNTI & physical info has to be reviewed
NOTE(3): The Demux functionality is used in TDD
NOTE(4): For the USCH(TDD only) the control channel is represented by the FACH.



Data flow
External Control information

DL	Downlink
TF	Transport Format
TFC	Transport Format Combination
RNTI	Radio Network Temporary Identity
UE	User Equipment
UL	Uplink

NOTE(1): The DSCH Control Channel may be represented by the FACH, details are for further study, If supported by the FACH the data will be transferred to MAC-c via priority/flow boxes.
NOTE(2): The relation between the scheduling and the adding of RNTI & physical info has to be reviewed
NOTE(3): The Demux functionality is used in TDD
NOTE(4): For the USCH(TDD only) the control channel is represented by the FACH.

Figure 4.2.4.4 UTRAN side MAC architecture / MAC-sh details

4.3.2 Logical Channels

The MAC layer provides data transfer services on logical channels. A set of logical channel types is defined for different kinds of data transfer services as offered by MAC. Each logical channel type is defined by what type of information is transferred.

4.3.2.1 Logical channel structure

The configuration of logical channel types is depicted in Figure 4.3.2.1:

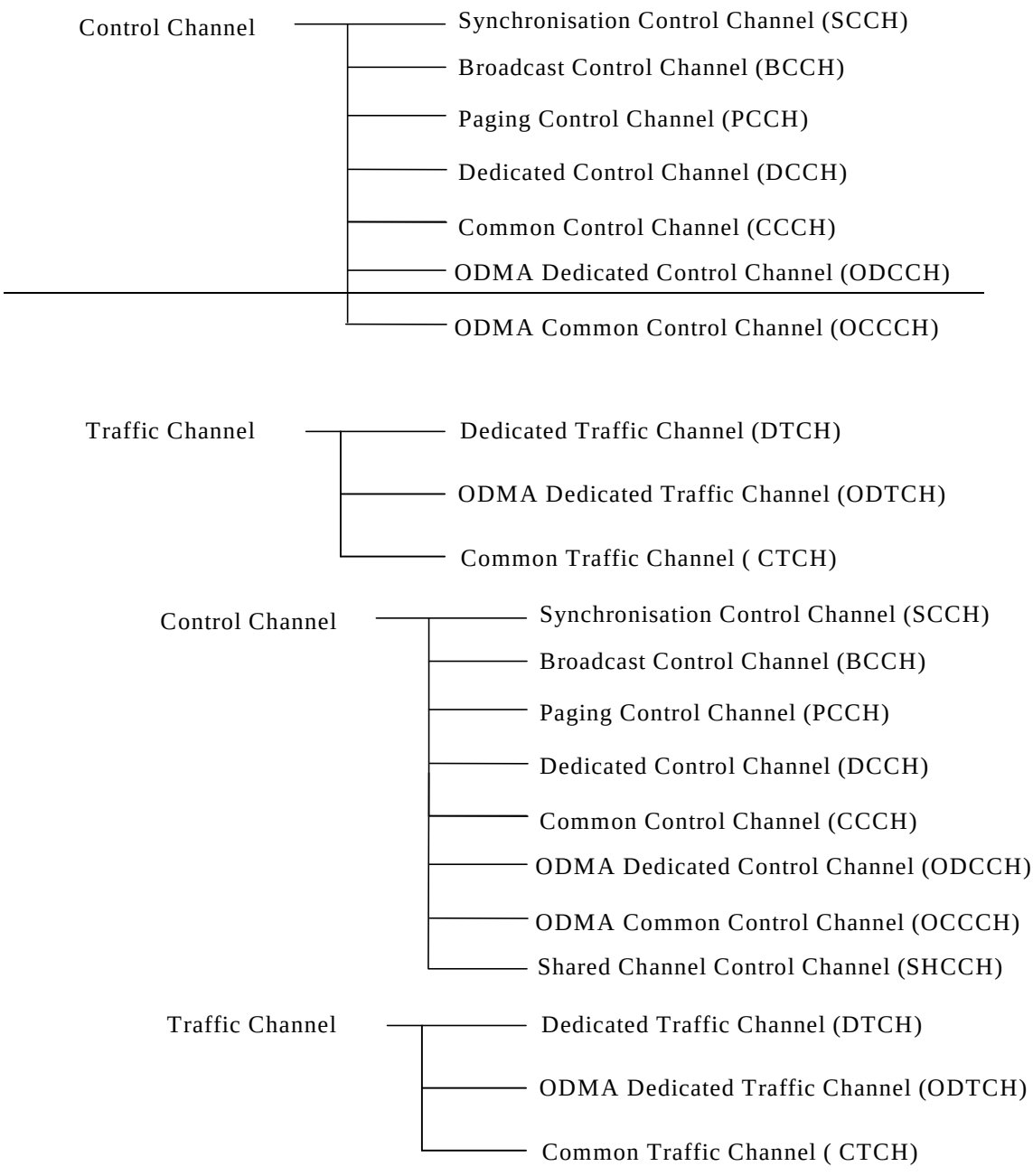


Figure 4.3.2.1 : Logical channel structure

4.3.2.2 Control Channels

Following control channels are used for transfer of control plane information only:

- Synchronisation Control Channel (SCCH)
- Broadcast Control Channel (BCCH)
- Paging Control Channel (PCCH)
- Common Control Channel (CCCH)
- Dedicated Control Channel (DCCH)
- ODMA Common Control Channel (OCCCH)
- ODMA Dedicated Control Channel (ODCCH)
- Shared Channel Control Channel (SHCCH)

4.3.3 Mapping between logical channels and transport channels

The following connections between logical channels and transport channels exist:

- SCCH is connected to SCH
- BCCH is connected to BCH
- PCCH is connected to PCH
- CCCH is connected to RACH and FACH
- DCCH and DTCH can be connected to either RACH and FACH, to CPCH and FACH, to RACH and DSCH, to DCH and DSCH, or to a DCH, the DCCH can be connected to FAUSCH.
- ODCCH, OCCCH and ODTCH can be connected to ORACH, ODCCH and ODTCH can be connected to ODCH.
- CTCH may be mapped to FACH and DSCH or BCH, the mapping is ffs
- DCCH and DTCH can be mapped to the USCH (TDD only).
- SHCCH is connected to RACH and FACH.

6.2 Relation between MAC Functions / Transport Channels and UE

6.2.1 Relation between MAC Functions and Transport Channels

Associated MAC Functions	Logical Ch	Transport Ch	TF Selection	Priority handling between users	Priority handling (one user)	Scheduling	Identification of UEs	Mux/Demux on common transport CH	Mux/ Demux on dedicated transport CH	Dynamic transport CH switching
Uplink (Rx)	CCCH	RACH						X		
	DCCH	RACH					X	X		
	DCCH	CPCH					X	X		X
	DCCH	DCH							X	
	DTCH	RACH					X	X		
	DTCH	CPCH					X	X		X
	DTCH	DCH							X	
Downlink (Tx)	SCCH	SCH								
	BCCH	BCH				X				
	PCCH	PCH				X				
	CCCH	FACH		X				X		
	DCCH	FACH		X			X	X		
	DCCH	DSCH		X				X		
	DCCH	DCH	X		X				X	
	DTCH	FACH	X(note1)	X			X	X		X
	DTCH	DSCH	X(note2)	X				X		X
	DTCH	DCH	X		X				X	X
	SHCCH	FACH		X				X		

Table 1 UTRAN MAC functions corresponding to the transport channel (note3)

(Note1) On FACH channel, the transport format set is limited.
(Note2) Whether DSCH has the transport format set is under discussion.
(Note3) The functions not included in the table are listed below.

- Mapping between logical channels and transport channels.
- Traffic volume monitoring
- Constrained execution of open loop power control algorithms

Further, the following additional functions are not included yet in the table :

- Routing of higher layer signalling
- Maintenance of a MAC signalling connection between peer MAC entities
- Monitoring the links of the assigned resources
- Processing of messages received at common control channels

Note (this table has to be reviewed)

6.2.2 Relation of UE MAC functions corresponding to the Transport Channel MAC Functions and Transport Channels

Functions	Logical Ch	Transport Ch	TF Selection	Priority handling data of one user	Identification	Mux/Demux on common transport channels	Mux/Demux on dedicated transport channels	Dynamic transport channel type switching
Uplink (Tx)	CCCH	RACH				X		
	DCCH	RACH	X(note1)		X	X		
	DCCH	CPCH	X	X	X	X		X
	DCCH	DCH	X	X			X	
	DTCH	RACH	X(note1)		X	X		X
	DTCH	CPCH	X	X	X	X		X
	DTCH	DCH	X	X			X	X
Downlink (Rx)	SCCH	SCH						
	BCCH	BCH						
	PCCH	PCH						
	CCCH	FACH				X		
	DCCH	FACH			X	X		
	DCCH	DSCH				X		
	DCCH	DCH					X	
	DTCH	FACH			X	X		
	DTCH	DSCH				X		
	DTCH	DCH					X	
	SHCCH	FACH				X		

Table 2 UE MAC functions corresponding to the transport channel

(Note1) The RACH channel has the limited transport format set.

Note: This table has to be reviewed

9 Elements for peer-to-peer communication

9.1 Protocol data units

9.1.1 MAC Data PDU

MAC PDU consists of an optional MAC header and a MAC Service Data Unit (MAC SDU), see figure 9.1.1. Both the MAC header and the MAC SDU are of variable size.

The content and the size of the MAC header depends on the type of the logical channel, and in some cases none of the parameters in the MAC header are needed.

The size of the MAC-SDU depends on the size of the RLC-PDU, which is defined during the setup procedure.

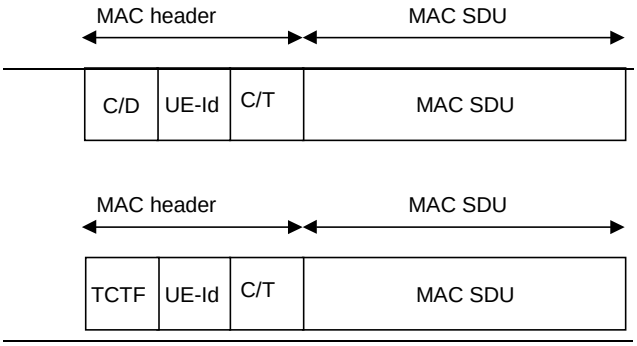


Figure 9.1.1.1 MAC data PDU

9.1.2 MAC Control PDU

MAC Control PDU consist elements for the control of the operation. The details are ffs.

9.2 Formats and parameters

9.2.1 MAC Data PDU: Parameters of the MAC header

The following fields are defined for the MAC header:

~~• C/D field~~

~~The C/D field is a single-bit flag that provides identification of the logical channel class on FACH and RACH transport channels, i.e. whether it carries CCCH or dedicated logical channel information.~~

~~C/D field~~	~~Designation~~
~~1~~	~~CCCH~~
~~0~~	~~DCCH or DTCH~~

~~Table 9.2.1.1: Coding of the C/D Field~~

- Target Channel Type Field

  The TCTF field is a triple-bit flag that provides identification of the logical channel class on FACH and RACH transport channels, i.e. whether it carries CCCH or CTCH or dedicated channel information or shared channel control information over SHCCH.

TCTF	Designation
000	CCCH
001	CTCH
010	DCCH or DTCH over RACH/FACH
011	SHCCH (TDD only); the usage for FDD is ffs
100	For future use
101	For future use
110	For future use
111	For future use

Table 9.2.1.1: Coding of the Target Channel Type Field

- C/T field

  The C/T field provides identification of the logical channel instance when multiple logical channels are carried on the same transport channel. The C/T field is used also to provide identification of the logical channel type on dedicated transport channels and on FACH and RACH when used for user data transmission. The size of the C/T field may be variable.

C/T field (e.g. 4 bits)	Designation
0000	Logical channel 1
0001	Logical channel 2
...	...
1111	Logical channel 16

Table 9.2.1.2: Structure of the C/T field

- UE-Id
  The UE-Id field provides an identifier of the UE . The following types of UE-Id are currently defined:

s-RNTI , this UE Id is related to the serving RNC
c-RNTI, this UE Id is related to the controlling RNC.

In addition for UE's having a RRC connection the S-RNC identifier exist.

s-RNTI together with S-RNC identifier is used for URA update RRC connection reestablishment and UTRAN originated paging messages and there associated responses.

c-RNTI is used as a UE identifier in all other DCCH/DTCH common channel messages on the air interface.

Note: Whether or not other UE-Id types are needed is ffs.

9.2.1.1 MAC header for DTCH and DCCH

a) DTCH or DCCH mapped to DCH, no multiplexing of dedicated channels on MAC:
No MAC header is required.

b) DTCH or DCCH mapped to DCH, with multiplexing of dedicated channels on MAC:
C/T field is included in MAC header.

c) DTCH or DCCH mapped to RACH/FACH:
~~C/D~~ TCTF field and UE-Id are included in the MAC header. C/T field is included if multiplexing on MAC is applied.

~~d)DTCH or DCCH mapped to RACH/FACH, where DTCH or DCCH are the only channels (ffs).~~
~~UE-Id field is included in MAC header. C/T field is included if multiplexing on MAC is applied.~~

~~e)~~d) DTCH or DCCH mapped to DSCH:
The MAC-PDU format for DSCH is left for further study.

e) DTCH or DCCH mapped to USCH:
The MAC-PDU format for USCH is left for further study.

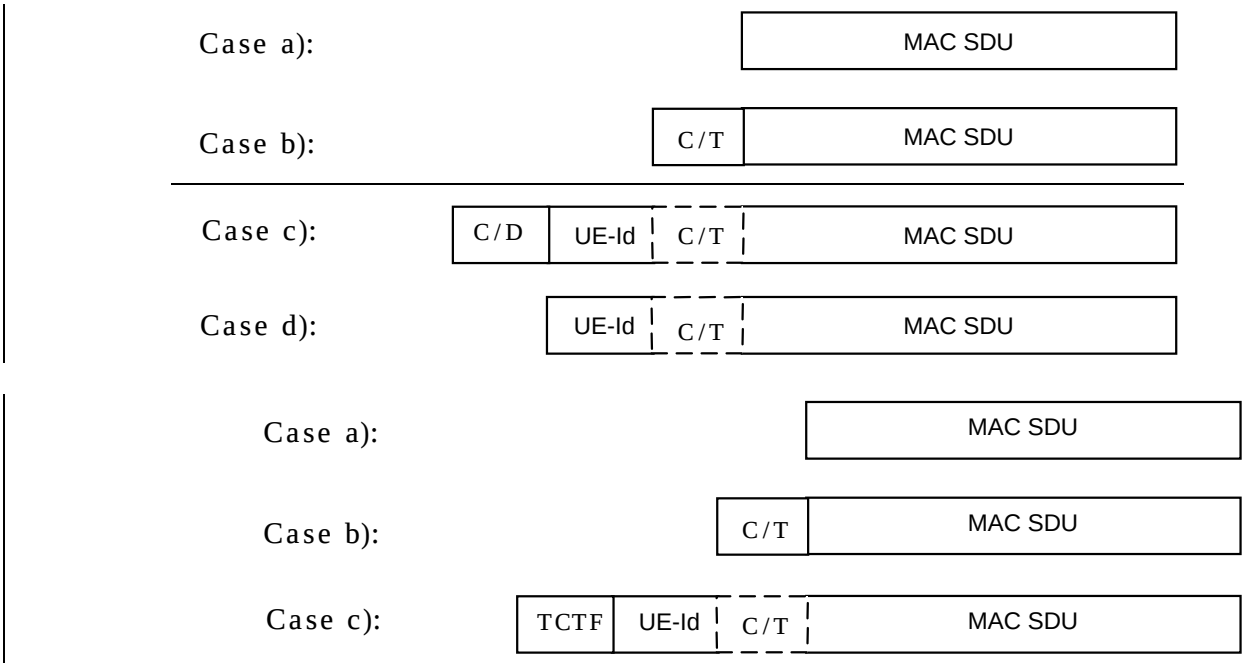


Figure 9.2.2.1: MAC Data PDU formats for DTCH and DCCH

9.2.1.2 MAC header for CCCH

Note: The concept for using UE Id on CCCH has to be reviewed

a) CCCH mapped to RACH/FACH:
~~C/D~~TCTF has to be included and UE-id field may be included in MAC header. Details of usage the UE-id field is ffs.

b) CCCH mapped to RACH/FACH, where CCCH is the only channel (ffs):
UE-id field may be included in the MAC header.

-Note: The usage of the MAC header for BCCH and PCCH is ffs.
The address used for initial addressing is ffs, a possible solution may be to use a Random or CN related Identifier.

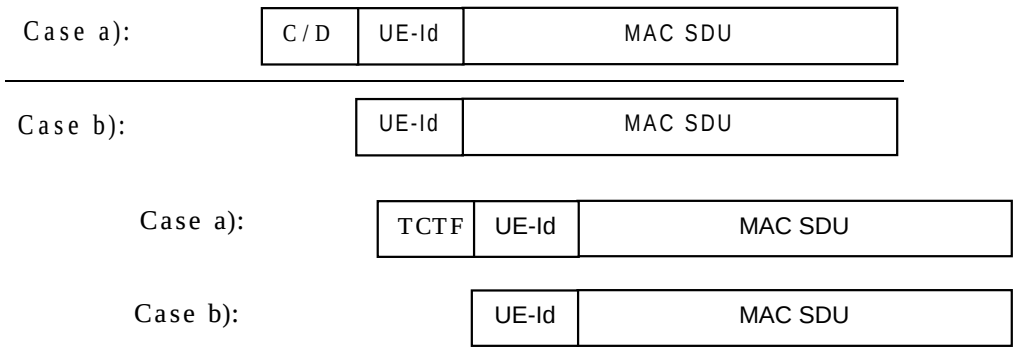


Figure 9.2.1.2.1 : MAC Data PDU formats for CCCH

9.2.1.3 MAC Header for CTCH

The MAC header for CTCH mapped to FACH is as shown in figure 9.2.1.3.1

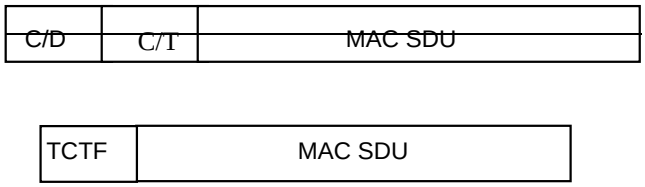


Figure 9.2.1.3.1 : MAC Data PDU format for CTCH

~~C/D field indicates whether data is mapped to the common or dedicated logical channel.~~

~~C/T field indicates whether it belongs to CCCH or CTCH.~~ The TCTF field indicates whether data is mapped to common or dedicated channels and whether it belongs to CCCH or CTCH. In case of CTCH, it identifies whether the message is SMS CB message or Schedule message

9.2.1.4 MAC Header for SHCCH

The MAC header for SHCCH is as shown in figure 9.2.1.3.2

a) SHCCH mapped to RACH/FACH:
TCTF has to be included.

b) SHCCH mapped to RACH/FACH, where SHCCH is the only channel:

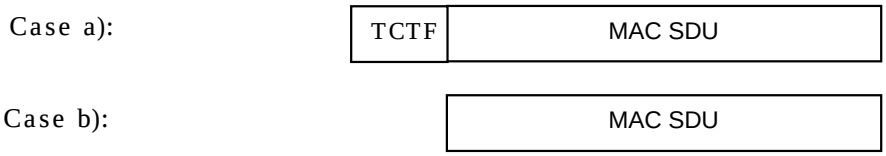


Figure 9.2.1.4.1 : MAC Data PDU format for SHCCH

~~*ANNEX C (informative):*~~

~~*MAC peer to peer communication*~~

~~*C.1 MAC messages for MAC peer to peer communication*~~

~~*(Note: Based on Tdoc TSGRAN WG2 285/ 99 for the use of MAC peer to peer communication WG2 has agreed to incorporate MAC messages for peer to peer communication into TS25.321, details are for further study.)*~~

~~*C.2 Format of MAC messages for MAC peer to peer communication*~~

~~*(Note: Based on Tdoc TSGRAN WG2 285/ 99 for the use of MAC peer to peer communication WG2 has agreed to incorporate MAC messages for peer to peer communication into TS25.321, details are for further study.)*~~

3GPP TSG-RAN meeting #5 ***Document R2-99979***

Kyongju, Korea, 6-8 October 1999

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** **004** Current Version: 3.0.0

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

For submision to TSG RAN#5 *list TSG meeting no. here ↑*

for approval [X] for information [ ] *(only one box should 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: *(at least one should be marked with an X)* USIM [ ] ME [X] UTRAN [X] Core Network [ ]

Source: TSG-RAN WG2 **Date:** 02/09/1999

Subject: Support of USCH/DSCH operation for TDD

3G Work item:

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

F	Correction	[ ]
A	Corresponds to a correction in a 2G specification	[ ]
B	Addition of feature	[X]
C	Functional modification of feature	[ ]
D	Editorial modification	[ ]

Reason for change: A means was missing to control USCH/DSCH operation in TDD. Therefore SAP SHCCH was introduced.

Clauses affected: 3.2, 4.2.3, 4.2.4, 4.3.2.1, 4.3.2.2, 4.3.3, 6.2.1, 6.2.2, Annex C

Other specs affected:

Other 3G core specifications	[ ]	→ List of CRs: 25.301 CR 004, 25.303 CR 012
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:

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

3. Definitions, abbreviations and symbols

3.1 Definitions

See [9] for a definition of fundamental concepts and vocabulary.

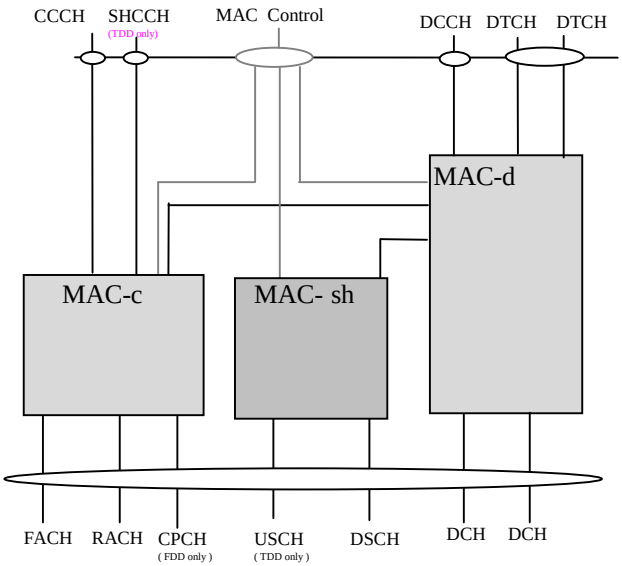
3.2 Abbreviations

ARQ	Automatic Repeat Request
ASC	Access Service Class
BCCH	Broadcast Control Channel
BCH	Broadcast Channel
C-	Control-
CC	Call Control
CCCH	Common Control Channel
CCTrCH	Coded Composite Transport Channel
CPCH	Common Packet Channel (UL)
CN	Core Network
CRC	Cyclic Redundancy Check
DC	Dedicated Control (SAP)
DCA	Dynamic Channel Allocation
DCCH	Dedicated Control Channel
DCH	Dedicated Channel
DL	Downlink
DRNC	Drift Radio Network Controller
DSCH	Downlink Shared Channel
DTCH	Dedicated Traffic Channel
FACH	Forward Link Access Channel
FAUSCH	Fast Uplink Signalling Channel
FCS	Frame Check Sequence
FDD	Frequency Division Duplex
GC	General Control (SAP)
HO	Handover
ITU	International Telecommunication Union
kbps	kilo-bits per second
L1	Layer 1 (physical layer)
L2	Layer 2 (data link layer)
L3	Layer 3 (network layer)
LAC	Link Access Control
LAI	Location Area Identity
MAC	Medium Access Control
MM	Mobility Management
Nt	Notification (SAP)
OCCCH	ODMA Common Control Channel
ODCCH	ODMA Dedicated Control Channel
ODCH	ODMA Dedicated Channel
ODMA	Opportunity Driven Multiple Access
ORACH	ODMA Random Access Channel
ODTCH	ODMA Dedicated Traffic Channel
PCCH	Paging Control Channel
PCH	Paging Channel
PDU	Protocol Data Unit
PHY	Physical layer
PhyCH	Physical Channels
RACH	Random Access Channel

RLC	Radio Link Control
RNC	Radio Network Controller
RNS	Radio Network Subsystem
RNTI	Radio Network Temporary Identity
RRC	Radio Resource Control
SAP	Service Access Point
SCCH	Synchronization Control Channel
SCH	Synchronization Channel
SDU	Service Data Unit
SHCCH	Shared Channel Control Channel
SRNC	Serving Radio Network Controller
SRNS	Serving Radio Network Subsystem
TDD	Time Division Duplex
TFCI	Transport Format Combination Indicator
TFI	Transport Format Indicator
TMSI	Temporary Mobile Subscriber Identity
TPC	Transmit Power Control
U-	User-
UE	User Equipment
UE_R	User Equipment with ODMA relay operation enabled
UL	Uplink
UMTS	Universal Mobile Telecommunications System
URA	UTRAN Registration Area
USCH	Uplink Shared Channel
UTRA	UMTS Terrestrial Radio Access
UTRAN	UMTS Terrestrial Radio Access Network

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 FACH and RACH common 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 t~~The MAC-sh transfers data from the DSCH to the MAC-d and from the MAC-d to the USCH (TDD only) under control of the ~~FACH~~RRC. In the FDD implementation, the MAC-c may transfer data from the MAC-d to the CPCH.



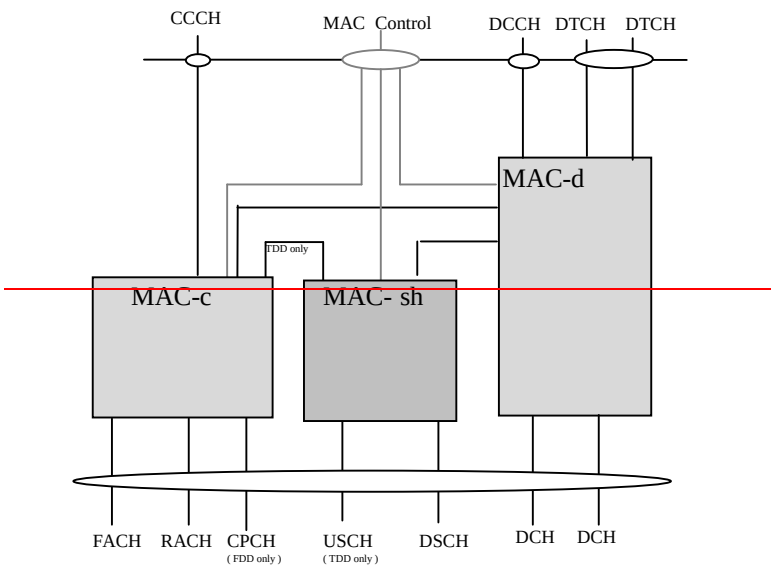
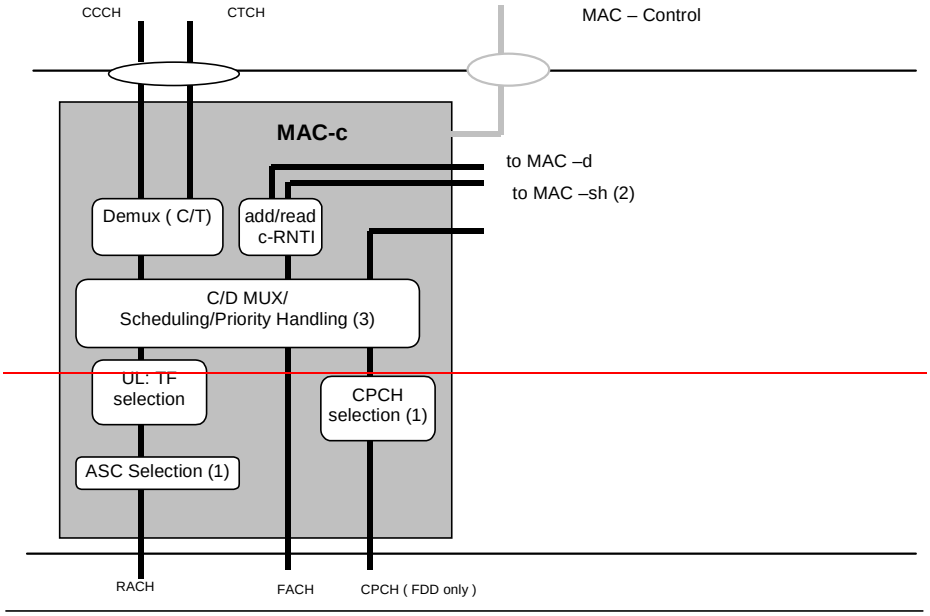


Figure 4.2.3.1 UE side MAC architecture

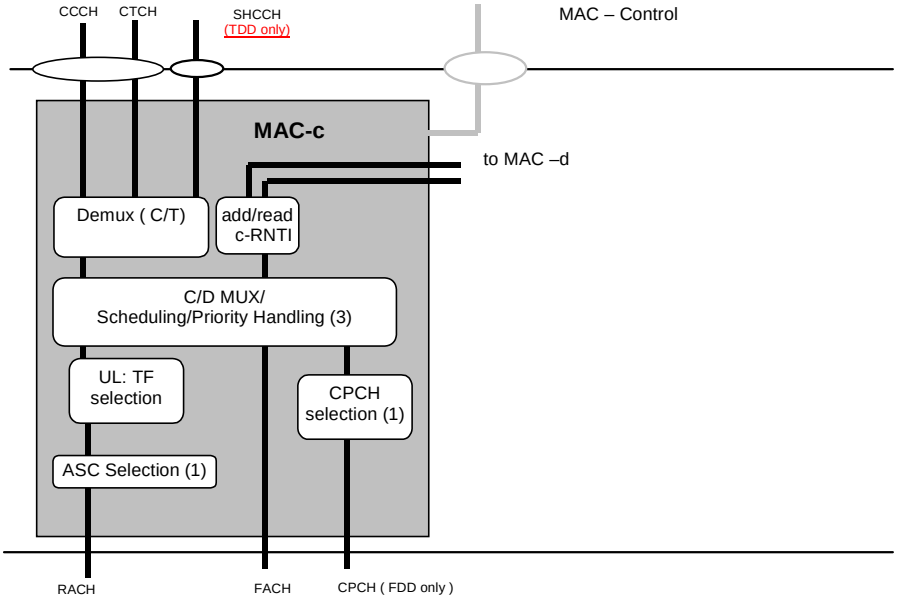
Figure 4.2.3.2 shows the UE side MAC-c entity. The following functionality is covered:

- 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).



DL Downlink
TF Transport Format
TFC Transport Format Combination
(1) details are ffs
(2) for TDD only
(3) Scheduling /Priority handling is applicable for CPCH, details are ffs.

c-RNTI Radio Network Temporary Identity
UE User Equipment
UL Uplink
Note: The usage of c-RNTI for MAC-sh connection has to be reviewed



DL Downlink
TF Transport Format
TFC Transport Format Combination
(1) details are ffs
(2) for TDD only
(3) Scheduling /Priority handling is applicable for CPCH, details are ffs.

c-RNTI Radio Network Temporary Identity
UE User Equipment
UL Uplink
Note: The usage of c-RNTI for MAC-sh connection has to be reviewed

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.

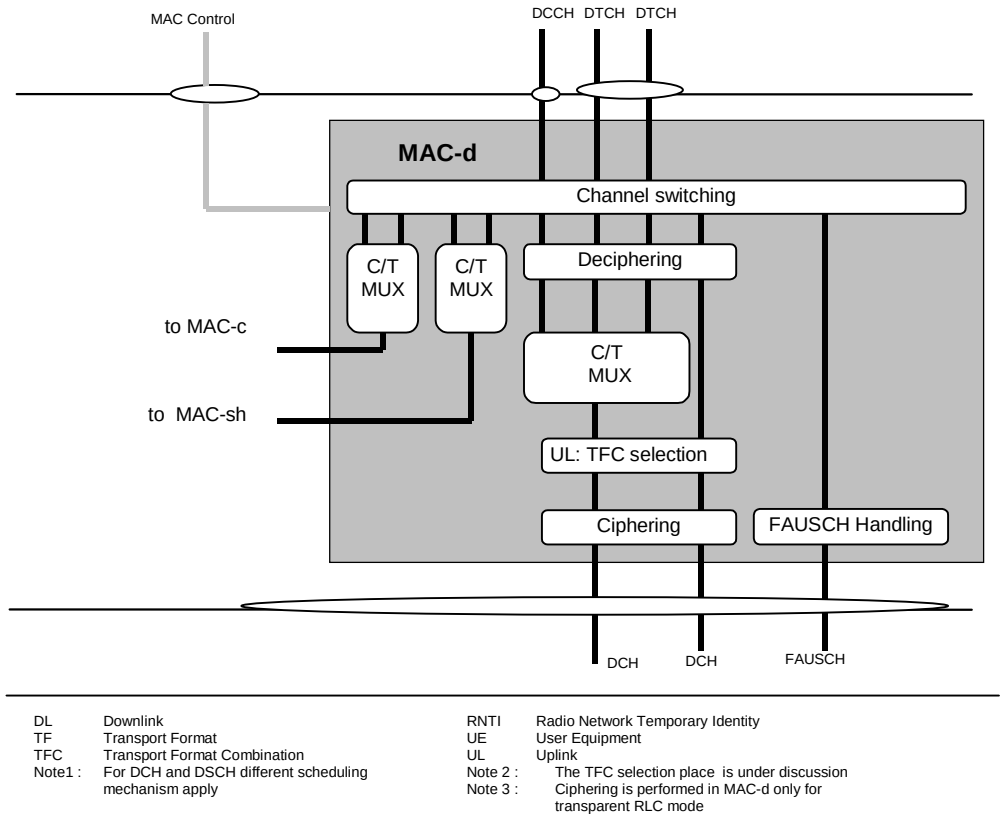


Figure 4.2.3.3. UE side MAC architecture / MAC-d details

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.

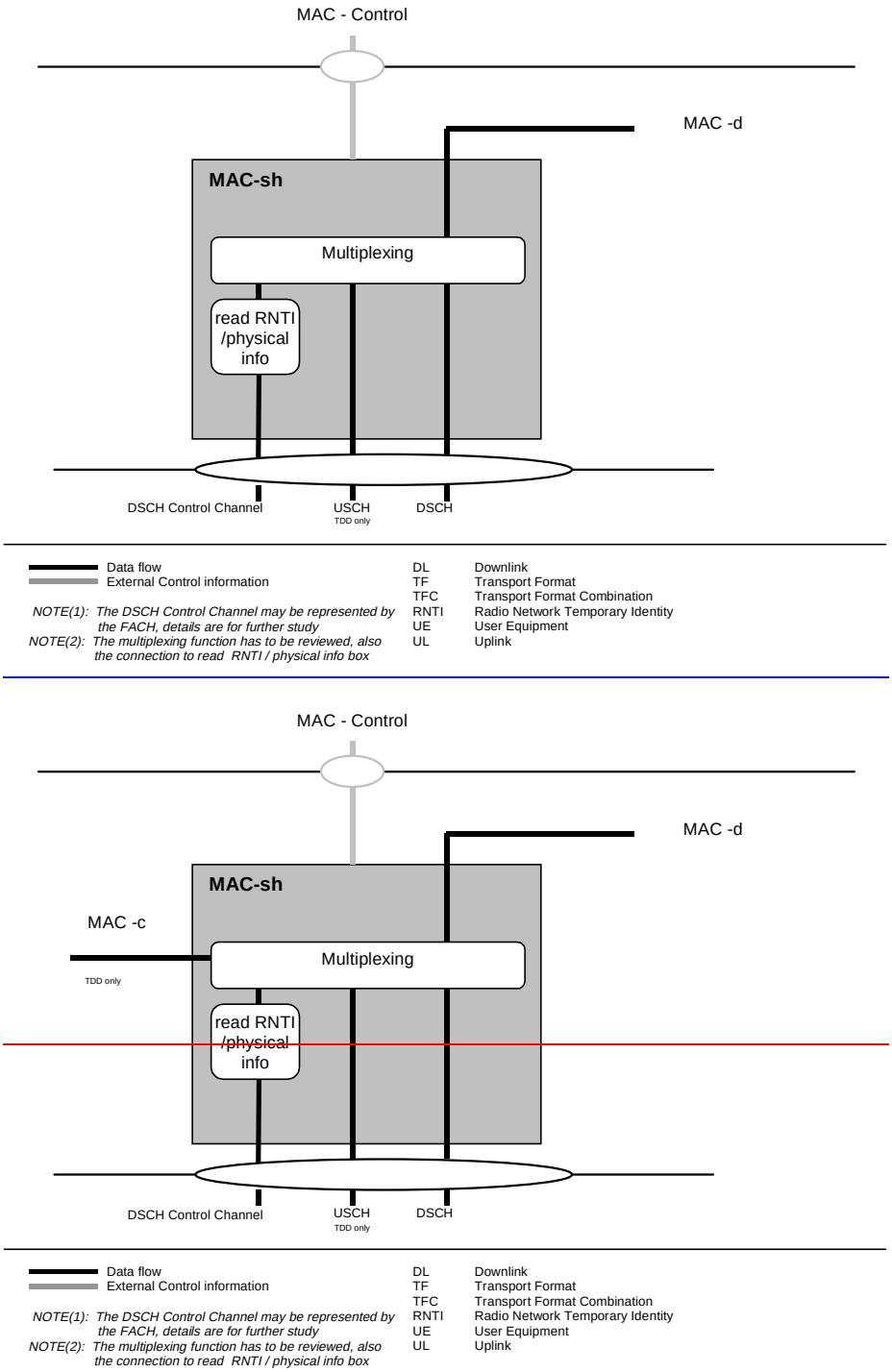


Figure 4.2.3.4. UE side MAC architecture / MAC-sh details

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 SHCCH SAP is used to transfer control information between the UE RRC and the RRC in the controlling RNC through MAC-c.~~ The MAC Control SAP is used to transfer Control information to each MAC entity belongs to one UE.

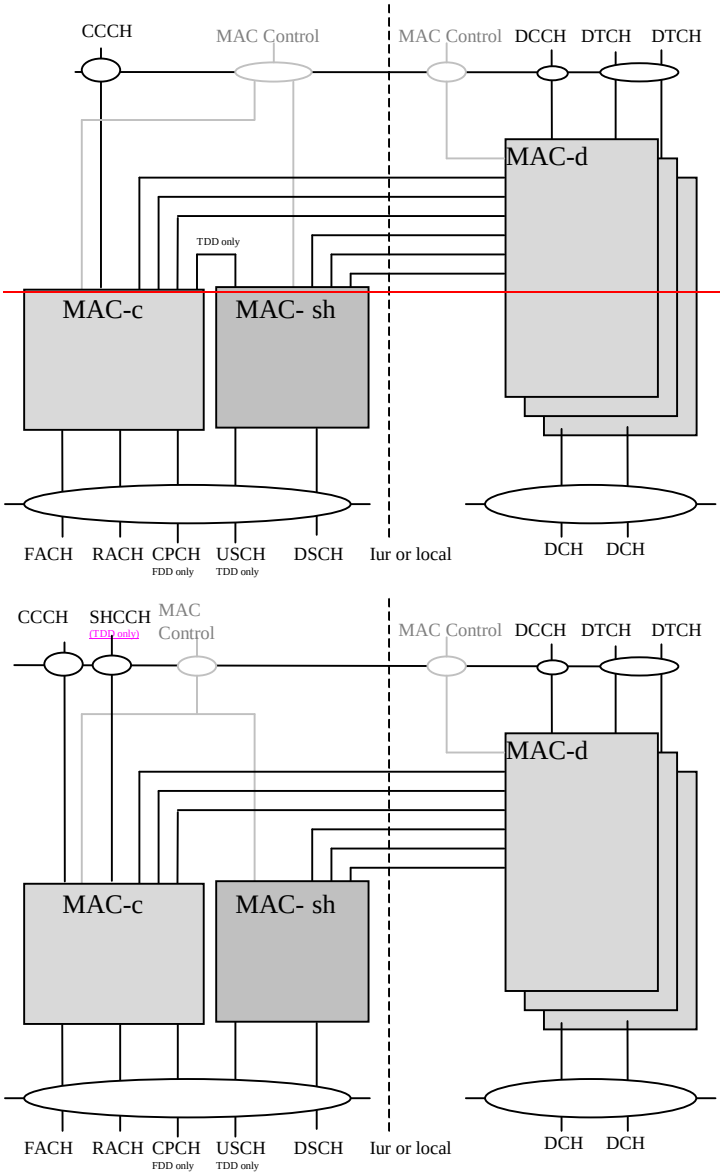


Figure 4.2.4.1: UTRAN side MAC architecture

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 UE's and between data flows 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 selection might be done if FACH is variable rate.
- The multiplexing of CTCH information and the CB-Scheduling function inside MAC-c supports the Short Message Service Cell Broadcast (SMS CB).

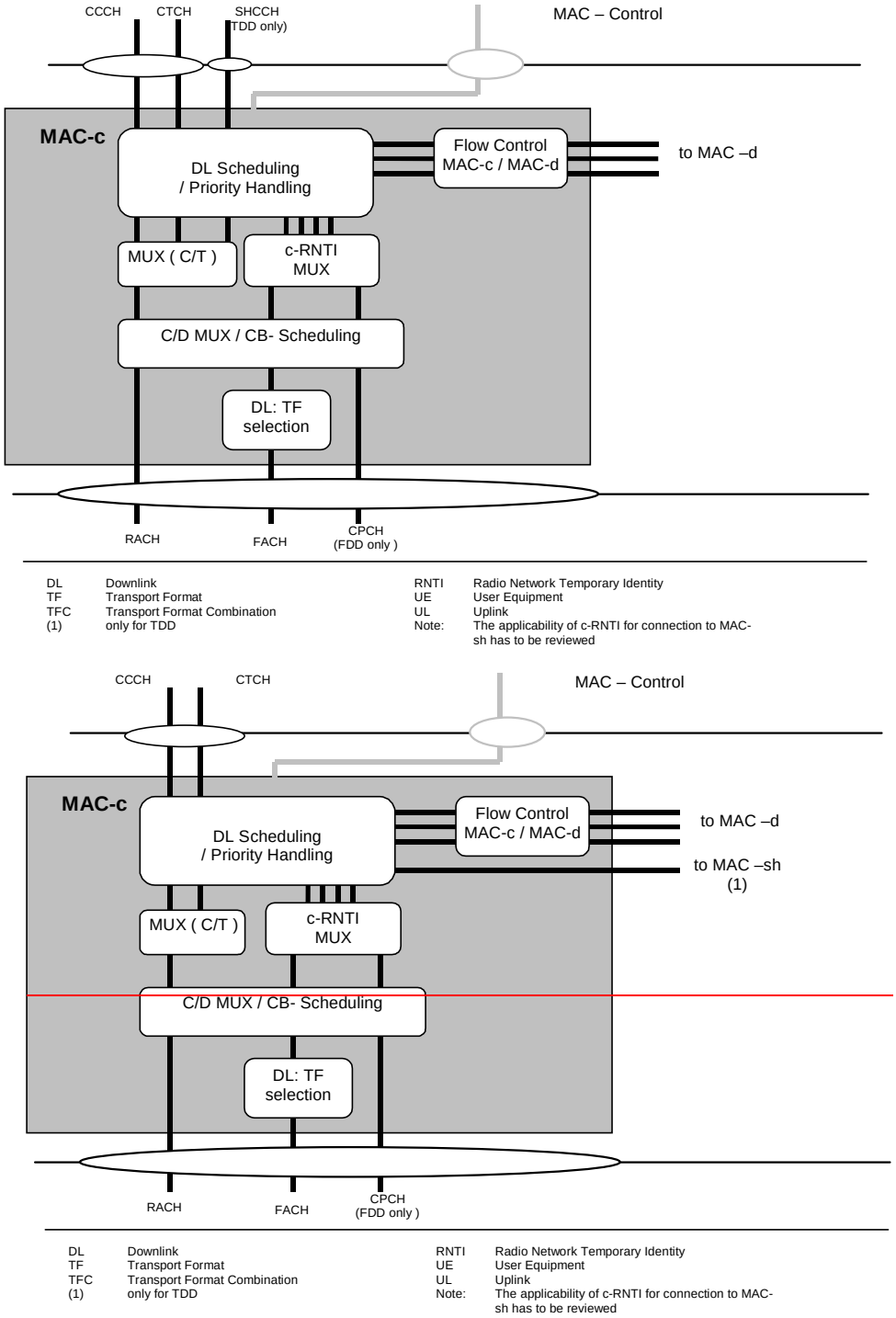


Figure 4.2.4.2 UTRAN side MAC architecture / MAC-c details

Figure 4.2.4.3 shows the UTRAN 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. C/T Mux is also responsible for priority setting on data received from DCCH / DTCH.
- Each 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 and DL (FACH) priority identification to MAC-c (priority identification of each PDU for DTCH NRT data is FFS).
- Each MAC-d entity using downlink shared channel is connected to a MAC-sh entity that handles the shared channels to which the UE is assigned and indicates the level of priority of each PDU to MAC-sh and to MAC-c.

- In the downlink, scheduling and priority handling of transport channels is performed within the allowed transport format combinations of the TFCS assigned by the RRC. This function supports the TFCI insertion in Node B .
- 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.
- A flow control function exists toward MAC-c and MAC-sh to limit buffering between MAC-d and MAC-c or MAC-sh entities. This function is intended to limit layer 2 signalling latency and reduce discarded and retransmitted data as a result of FACH or DSCH congestion. It also allows to handle quality of service if MAC-d requires it.

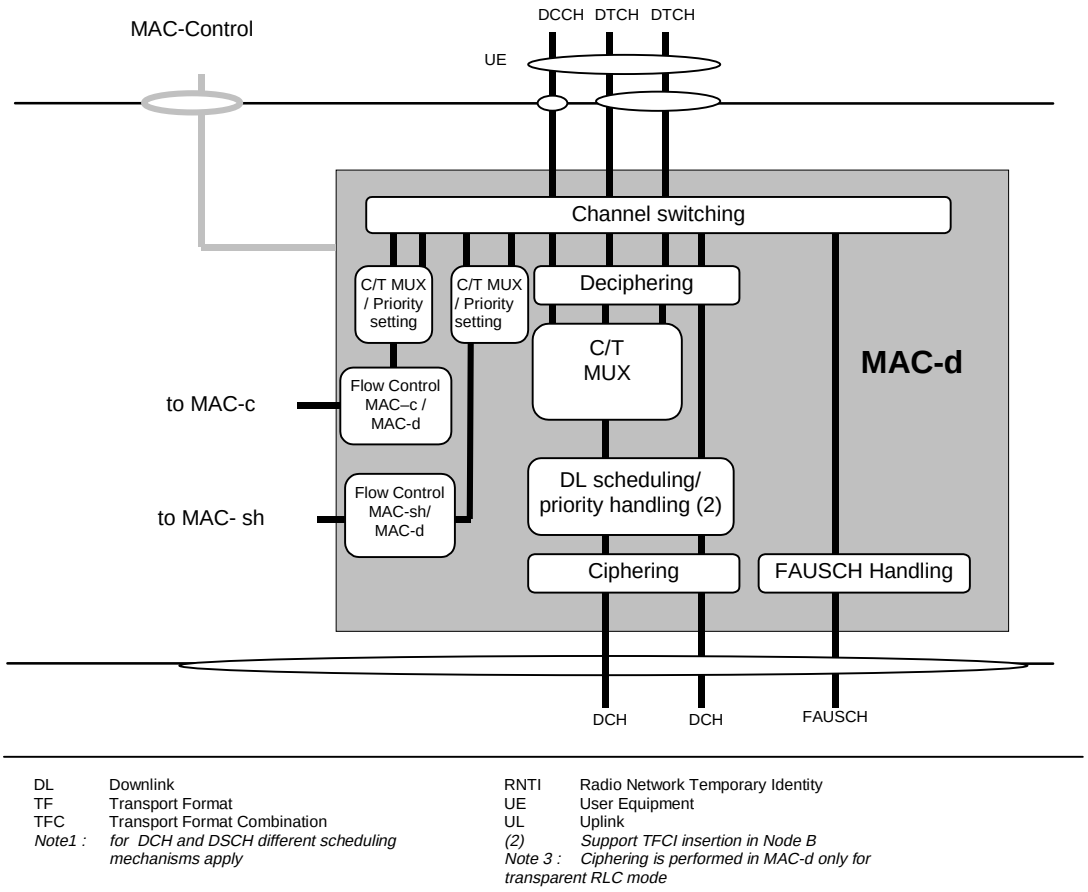


Figure 4.2.4.3 UTRAN side MAC architecture / MAC-d details

Figure 4.2.4.4 shows the UTRAN side MAC-sh entity. The following functionality is covered:

- A specific UE ID is needed when using the DSCH Control Channel to identify the UE on the DSCH. This specific UE ID may be optimised for DSCH and will be allocated when a RAB is mapped onto a DSCH. Additionally, some timing information is needed to tell the UE when to listen to DSCH.
- The scheduling /priority handling box in MAC-sh shares the DSCH resources between the UEs and between data flows according to their priority.
- For TDD operation the demultiplex function is used to separate USCH data from different UEs, i.e. to be transferred to different MAC-d entities.
- ~~The scheduling /priority handling box in MAC-sh shares the DSCH resources between the UEs and between data flows according to their priority. For TDD operation the demultiplex function is used to support the USCH, and the connection to the MAC-c.~~
- ~~The scheduling/priority handling box also prioritizes between UL & DL capacity allocation indications when the FACH is used for both DSCH and USCH control channels (FACH is used for TDD – FDD is FFS).~~
- DL code allocation is used to indicate the code used on the DSCH and the appropriate Transport format on the DSCH.
- Flow control is provided to MAC-d.

~~(Note: Capacity allocation synchronization related to the USCH/ DSCH transmission is ffs.)~~

The RLC has to provide RLC-PDU's to the MAC which fits into the available transport blocks on the transport channels respectively.

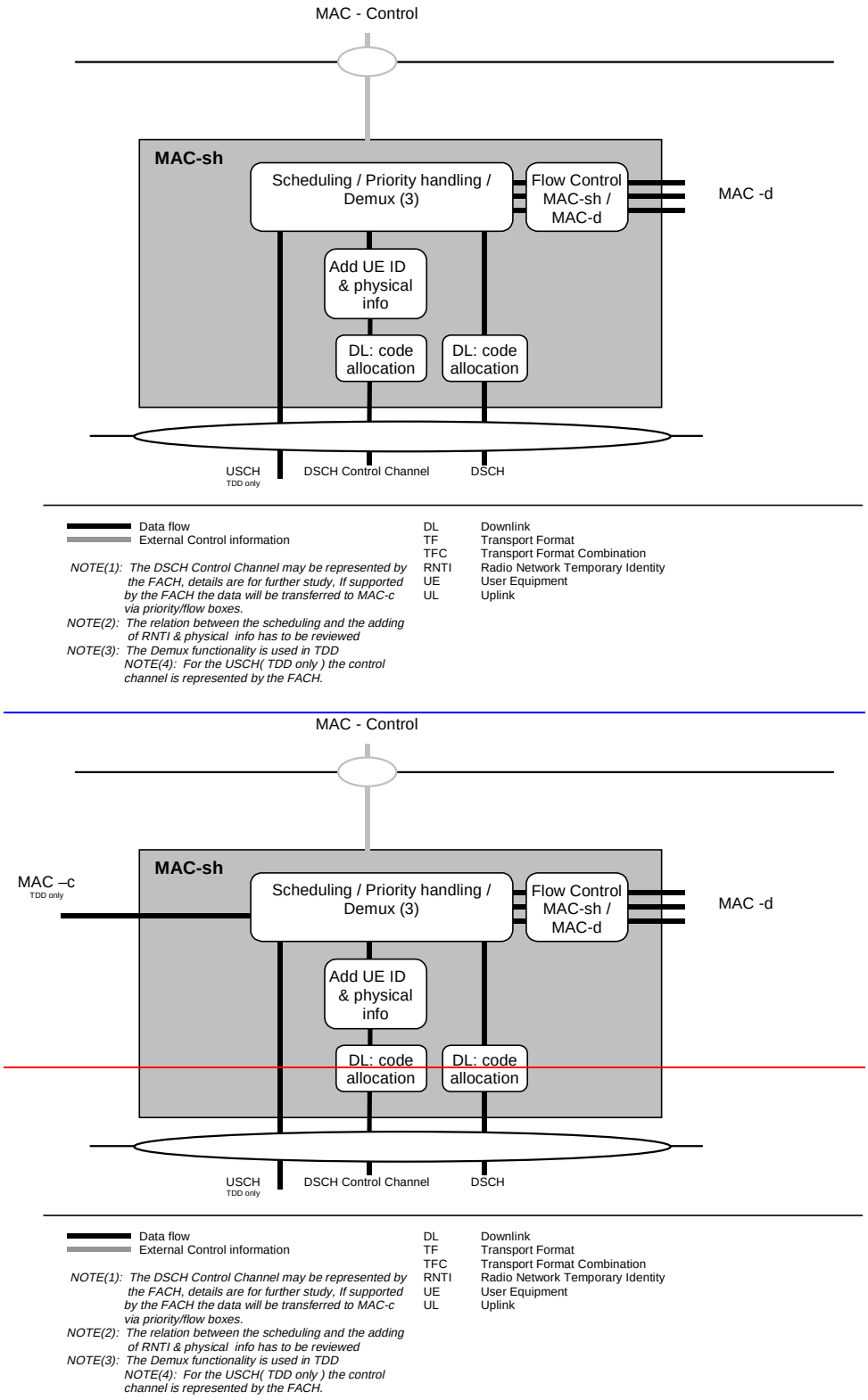


Figure 4.2.4.4 UTRAN side MAC architecture / MAC-sh details

4.3.2 Logical Channels

The MAC layer provides data transfer services on logical channels. A set of logical channel types is defined for different kinds of data transfer services as offered by MAC. Each logical channel type is defined by what type of information is transferred.

4.3.2.1 Logical channel structure

The configuration of logical channel types is depicted in Figure 4.3.2.1:

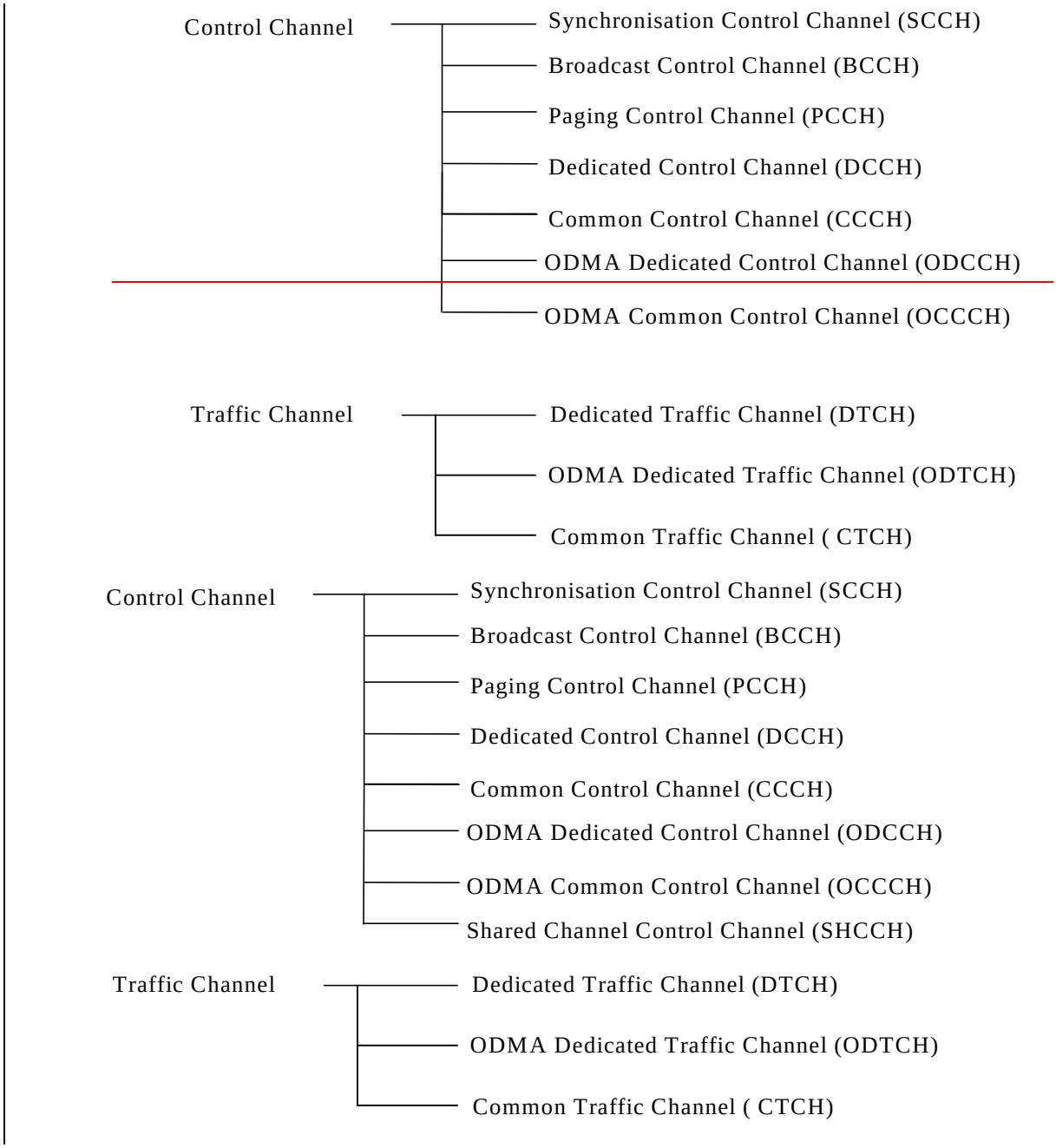


Figure 4.3.2.1 : Logical channel structure

4.3.2.2 Control Channels

Following control channels are used for transfer of control plane information only:

- Synchronisation Control Channel (SCCH)
- Broadcast Control Channel (BCCH)
- Paging Control Channel (PCCH)
- Common Control Channel (CCCH)
- Dedicated Control Channel (DCCH)
- ODMA Common Control Channel (OCCCH)

- ODMA Dedicated Control Channel (ODCCH)
- Shared Channel Control Channel (SHCCH)

4.3.3 Mapping between logical channels and transport channels

The following connections between logical channels and transport channels exist:

- SCCH is connected to SCH
- BCCH is connected to BCH
- PCCH is connected to PCH
- CCCH is connected to RACH and FACH
- DCCH and DTCH can be connected to either RACH and FACH, to CPCH and FACH, to RACH and DSCH, to DCH and DSCH, or to a DCH, the DCCH can be connected to FAUSCH.
- ODCCH, OCCCH and ODTCH can be connected to ORACH, ODCCH and ODTCH can be connected to ODCH.
- CTCH may be mapped to FACH and DSCH or BCH, the mapping is ffs
- DCCH and DTCH can be mapped to the USCH (TDD only)
- SHCCH is connected to RACH and FACH~~.~~

5. Services provided to upper layers

5.1 Description of Services provided to upper layers

- Data transfer
- Reallocation of radio resources and MAC parameters
- Reporting of measurements

~~The following potential service is regarded as a further study item:~~
~~• Allocation/de-allocation of radio resources~~

6.2 Relation between MAC Functions / Transport Channels and UE

6.2.1 Relation between MAC Functions and Transport Channels

Associated MAC Functions	Logical Ch	Transport Ch	TF Selection	Priority handling between users	Priority handling (one user)	Scheduling	Identification of UEs	Mux/Demux on common transport CH	Mux/ Demux on dedicated transport CH	Dynamic transport CH switching
Uplink (Rx)	CCCH	RACH						X		
	DCCH	RACH					X	X		
	DCCH	CPCH					X	X		X
	DCCH	DCH							X	
	DTCH	RACH					X	X		
	DTCH	CPCH					X	X		X
	DTCH	DCH							X	
	SHCCH	RACH					X	X		
Downlink (Tx)	SCCH	SCH								
	BCCH	BCH				X				
	PCCH	PCH				X				
	CCCH	FACH		X				X		
	DCCH	FACH		X			X	X		
	DCCH	DSCH		X				X		
	DCCH	DCH	X		X				X	
	DTCH	FACH	X(note1)	X			X	X		X
	DTCH	DSCH	X(note2)	X				X		X
	DTCH	DCH	X		X				X	X
	SHCCH	FACH		X				X		

Table 1 UTRAN MAC functions corresponding to the transport channel (note3)

(Note1) On FACH channel, the transport format set is limited.
(Note2) Whether DSCH has the transport format set is under discussion.
(Note3) The functions not included in the table are listed below.

- Mapping between logical channels and transport channels.
- Traffic volume monitoring
- Constrained execution of open loop power control algorithms

~~Further, the following additional functions are not included yet in the table :~~
~~• Routing of higher layer signalling~~
~~• Maintenance of a MAC signalling connection between peer MAC entities~~
~~• Monitoring the links of the assigned resources~~
~~• Processing of messages received at common control channels~~

Note (this table has to be reviewed)

6.2.2 Relation of UE MAC functions corresponding to the Transport Channel MAC Functions and Transport Channels

Functions	Logical Ch	Transport Ch	TF Selection	Priority handling data of one user	Identification	Mux/Demux on common transport channels	Mux/Demux on dedicated transport channels	Dynamic transport channel type switching
Uplink (Tx)	CCCH	RACH				X		
	DCCH	RACH	X(note1)		X	X		
	DCCH	CPCH	X	X	X	X		X
	DCCH	DCH	X	X			X	
	DTCH	RACH	X(note1)		X	X		X
	DTCH	CPCH	X	X	X	X		X
	DTCH	DCH	X	X			X	X
	SHCCH	RACH				X		
Downlink (Rx)	SCCH	SCH						
	BCCH	BCH						
	PCCH	PCH						
	CCCH	FACH				X		
	DCCH	FACH			X	X		
	DCCH	DSCH				X		
	DCCH	DCH					X	
	DTCH	FACH			X	X		
	DTCH	DSCH				X		
	DTCH	DCH					X	
	SHCCH	FACH				X		

Table 2 UE MAC functions corresponding to the transport channel

(Note1) The RACH channel has the limited transport format set.

Note: This table has to be reviewed

~~ANNEX C (informative):~~

~~MAC peer to peer communication~~

~~C.1 MAC messages for MAC peer to peer communication~~

~~(Note: Based on Tdoc TSGRAN WG2 285/ 99 for the use of MAC peer to peer communication WG2 has agreed to incorporate MAC messages for peer to peer communication into TS25.321, details are for further study.)~~

~~C.2 Format of MAC messages for MAC peer to peer communication~~

~~(Note: Based on Tdoc TSGRAN WG2 285/ 99 for the use of MAC peer to peer communication WG2 has agreed to incorporate MAC messages for peer to peer communication into TS25.321, details are for further study.)~~

3GPP TSG-RAN meeting #5 ***Document*** ***R2-99997***

Kyongju, Korea, 6-8 October 1999

3G CHANGE REQUEST

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

TS 25.321 **CR** **005** Current Version: 3.0.0

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

For submission to TSG RAN#5 *list TSG meeting no. here* ↑ for approval [X] for information [ ] *(only one box should 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: *(at least one should be marked with an X)* USIM [ ] ME [X] UTRAN [X] Core Network [ ]

Source: TSG-RAN WG2 **Date:** 20/08/99

Subject: Restructuring of TS25.321 Annex B

3G Work item:

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

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

Reason for change: Removing of redundant information on CPCH.

Clauses affected: Annex B

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:

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ANNEX B (informative):

Control of CPCH

~~B.1 Overview~~

~~The Common Packet Channel (CPCH) is multi-access contention based transport channel in the uplink .~~

~~The MAC may multiplex control and user data from multiple logical channels in the same CPCH transmission. The MAC functions associated with the CPCH are~~

~~• Scheduling~~

~~• Multiplexing/demultiplexing~~

~~• Inband identification of UEs~~

~~Procedures associated with the CPCH are~~
~~• CPCH access procedure (see Annex B in TS25.301[2])~~

B.~~2~~1 Scheduling of control and user data transmission

Scheduling of control and data transmission on CPCH is similar to that of RACH ~~(cf. 14.2.4.2)~~.

Transmission scenarios for CPCH include:

- Initial CPCH transmission
- CPCH Busy Retransmission
- Collision Detected Retransmission
- Selection of CPCH Channel

UE MAC monitors the availability of the CPCH channels in the CPCH Set allocated to the UE. UE MAC selects an available channel considering RNC persistency parameter and the capacity of the CPCH. If access to the selected CPCH is denied, channel reselection and retransmission may occur.

~~B.3 Multiplexing/demultiplexing of higher layer PDUs to/from CPCH transport blocks~~

~~UE MAC supports service multiplexing for CPCH transport channels similar to the RACH (cf. 14.2.4.3).~~

~~B.4 Inband Identification of UEs~~

~~Inband identification of UEs for the CPCH is identical to that for the RACH (cf. 14.2.4.4)~~

B.5 Selection of CPCH Channel

UE MAC monitors the availability of the CPCH channels in the CPCH Set allocated to the UE. UE MAC selects an available channel considering RNC persistency parameter and the capacity of the CPCH. If access to the selected CPCH is denied, channel reselection and retransmission may occur.

3GPP TSG-RAN WG2 meeting #6
Sophia Antipolis, 16-20 August 1999

Document R2-99939

3G CHANGE REQUEST

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TS 25.321 **CR** **006** Current Version: 3.0.0

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

For submission to TSG RAN#5 *list TSG meeting no. here ↑* for approval [X] for information [ ] *(only one box should 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: *(at least one should be marked with an X)* USIM [ ] ME [X] UTRAN [X] Core Network [ ]

Source: Motorola, Sony **Date:** 20/08/99

Subject: Clarification on RACH partitioning and prioritisation via Access Service Classes (ASC) and relation to back-off algorithm

3G Work item:

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

F	Correction	
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: Enhancements are provided with regard to the mechanism for selecting RACH parameters according to access service class.

Clauses affected: 4.2.3, 6.1, A.1

Other specs affected:

Other 3G core specifications	[ ]	→ List of CRs: 25.301 YY
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:

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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 FACH and RACH common 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.

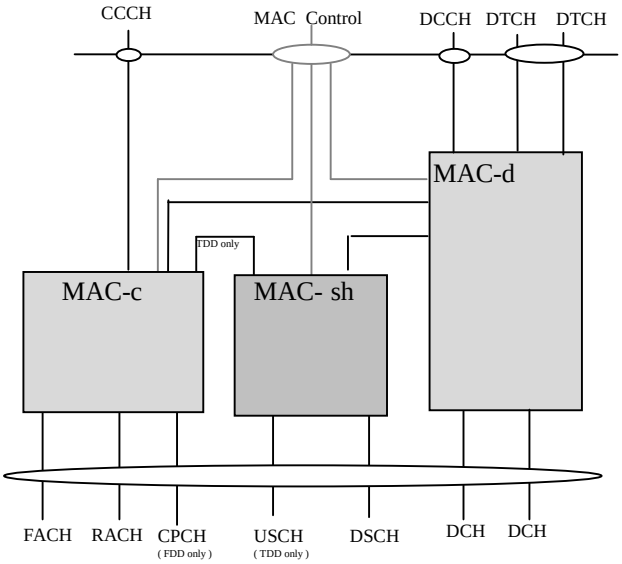
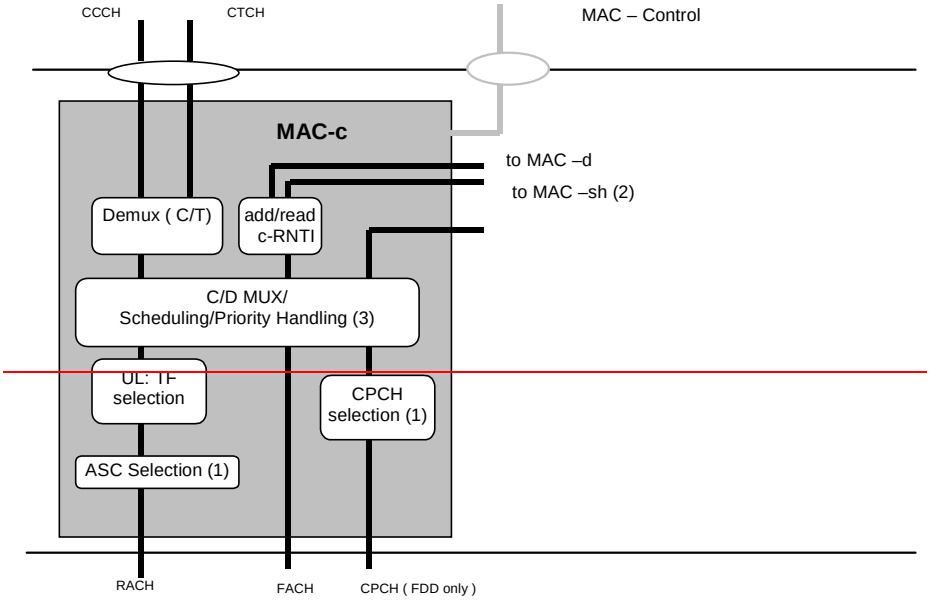


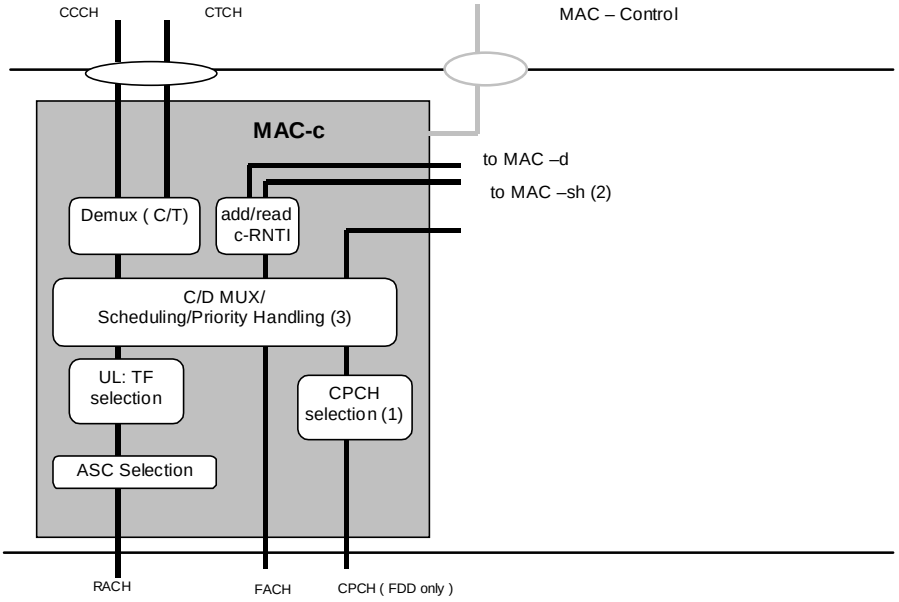
Figure 4.2.3.1 UE side MAC architecture

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~~ASC selection: MAC indicates the ASC associated with the PDU to the physical layer (this is to ensure that RACH messages associated with a given~~–~~ Access Service Class (ASC) are sent on the appropriate ~~for RACH~~ signature(s) and time slot(s)). MAC also applies the appropriate back-off parameter(s) associated with the given ASC.~~, 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).



DL	Downlink	c-RNTI	Radio Network Temporary Identity
TF	Transport Format	UE	User Equipment
TFC	Transport Format Combination	UL	Uplink
(1)	details are ffs	Note:	The usage of c-RNTI for MAC-sh connection has to be reviewed
(2)	for TDD only		
(3)	Scheduling /Priority handling is applicable for CPCH, details are ffs.		



DL	Downlink	c-RNTI	Radio Network Temporary Identity
TF	Transport Format	UE	User Equipment
TFC	Transport Format Combination	UL	Uplink
(1)	details are ffs	Note:	The usage of c-RNTI for MAC-sh connection has to be reviewed
(2)	for TDD only		
(3)	Scheduling /Priority handling is applicable for CPCH, details are ffs.		

6. Functions

6.1. Description of the MAC functions

The functions of MAC include:

- Mapping between logical channels and transport channels.
- Selection of appropriate Transport Format for each Transport Channel depending on instantaneous source rate
- Priority handling between data flows of one UE
- Priority handling between UEs by means of dynamic scheduling
- Priority handling between data flows of several users on the the DSCH and FACH
- Scheduling of broadcast, paging and notification messages
- Identification of UEs on common transport channels
- Multiplexing/demultiplexing of higher layer PDUs into/from transport blocks delivered to/from the physical layer on common transport channels
- Multiplexing/demultiplexing of higher layer PDUs into/from transport block sets delivered to/from the physical layer on dedicated transport channels
- Traffic volume monitoring
- Monitoring the links of the assigned resources
- Routing of higher layer signalling
- Maintenance of a MAC signalling connection between peer MAC entities
- Dynamic Transport Channel type switching
- Ciphering for transparent RLC
- Access Service Class selection for RACH transmission

The following potential functions is regarded as further study items:

- Processing of messages received at common control channels
- Successive Transmission on RACH
- ~~Access Service Class selection for RACH transmission~~.

Annex A (informative):

Description of random access procedure

[Note: This annex has to be reviewed for FDD and TDD operation]

A.1 Assumptions

The following assumptions for RACH transmission are made (for completeness assumptions are made also for other layers than MAC):

UE side:

- PRACH transmissions are triggered by data request from MAC to PHY (PHY-Data-REQ). This implies that any desired backoff in PRACH transmissions is controlled by MAC (or higher layer).
- The physical layer uses the PHY-Status-IND primitive to indicate the following conditions to MAC:
- Maximum preamble transmit power reached, no acknowledgement on AICH received,
- Negative acknowledgement received on AICH ("Nack") indicating that the preamble has been acquired, but transmission of the message shall be suspended,
- Positive acknowledgement received on AICH ("Ack"), RACH message has been transmitted,
- The following PRACH parameters are configured by RRC through C-SAP by means of CPHY-TrCH-Config-REQ primitive:
  - initial transmit power,
  - power ramping step size,
  - preamble-to-message transmit power offset,
  - PRACH maximum power
  - PRACH spreading code,
  - Association between each Access Service Class (ASC) ~~parameters (ffs.)~~ and the allowable time slot(s) and signature(s) on which RACHs belonging to this ASC can be transmitted.
  - Configuration of AICH parameters by RRC (using CPHY-TrCH-Config primitive)
  - AICH spreading code
  - timing information for search of acquisition indicator (if needed)
- The following parameters are randomly selected by the physical layer (~~possibly~~ within constraints defined by ASC parameters):
  - PRACH initial access slot,
  - PRACH signature

UTRAN side:

- Continuous monitoring of the PRACH is handled by layer 1 procedures. There is only a single primitive needed between PHY and MAC, indication of data (PHY-Data-IND).

3GPP TSG-RAN WG2 meeting #7 *Document* ***RP-99b42***

Malmö, Sweden, 20-24 September 1999

3G CHANGE REQUEST

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TS 25.321	**CR**	**010 r1**	Current Version:	3.0.0

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

For submission to TSG RAN#5 *list TSG meeting no. Here ↑* for approval [X] for information [ ] *(only one box should 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: *(at least one should be marked with an X)* USIM [ ] ME [X] UTRAN [X] Core Network [ ]

Source: Ericsson **Date:** 1999-09-16

Subject: Modifications on UE-Id formats

3G Work item:

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

F	Correction	[ ]
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:

The term UTRAN Radio Network Temporary Identifier (u-RNTI) is used instead of (SRNC ID + s-RNTI) in the Uu specifications as SRNC ID and s-RNTI are always present simultaneously.
C-RNTI is changed from “Controlling RNC RNTI” to “Cell RNTI”, reflecting that a C-RNTI is only valid within a cell.
Sizes of the UE id field in the MAC header are proposed.
UE-Id type sub-field is needed to differentiate between different UE-Id formats in the MAC header.
Furthermore, it was decided that UE-Id field can be removed from MAC header for CCCH.

Clauses affected: 4.2.3, 4.2.4, 9.2.1

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.

4.2.3 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 FACH and RACH common 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.

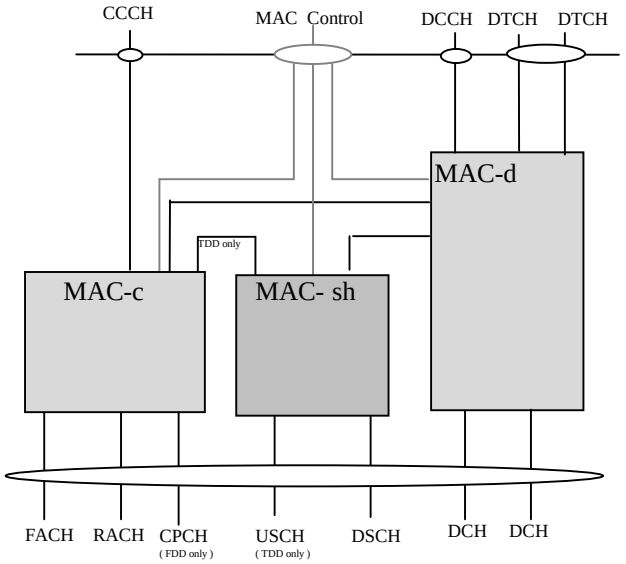
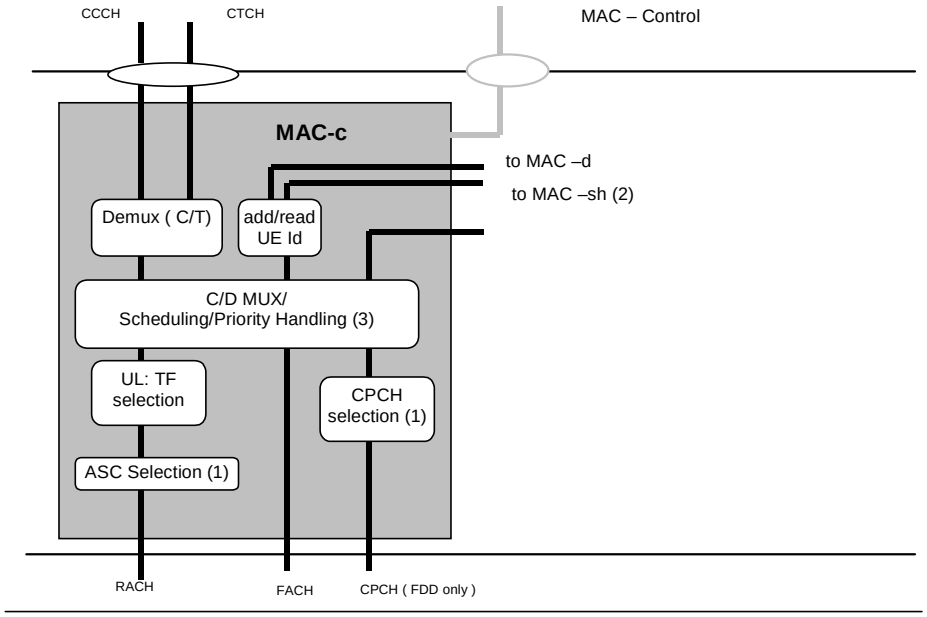


Figure 4.2.3.1 UE side MAC architecture

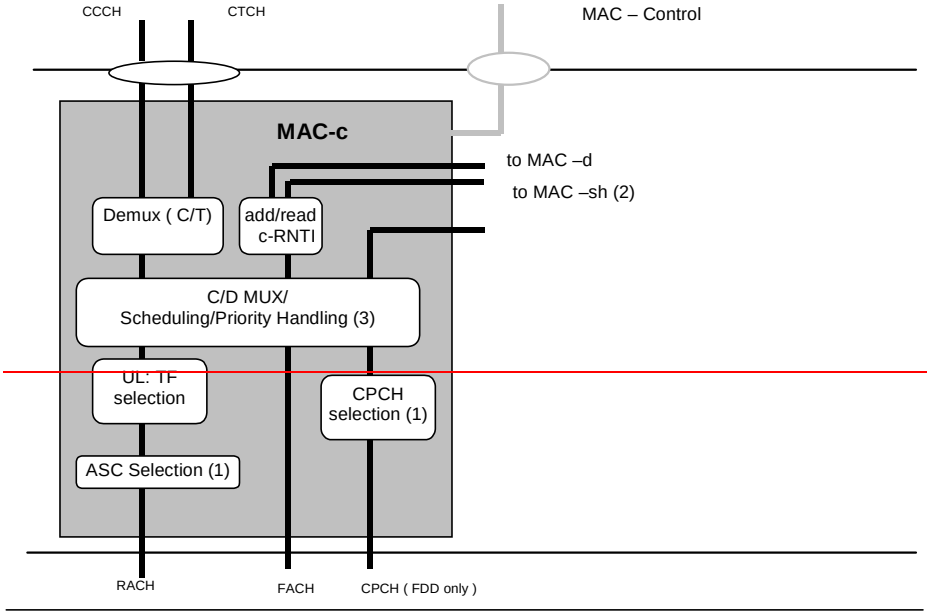
Figure 4.2.3.2 shows the UE side MAC-c entity. The following functionality is covered:

- 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~~UE Id 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).



DL Downlink
TF Transport Format
TFC Transport Format Combination
(1) details are ffs
(2) for TDD only
(3) Scheduling /Priority handling is applicable for CPCH, details are ffs.

~~c-RNTI Radio Network Temporary Identity~~
UE User Equipment
UL Uplink
~~Note: The usage of c-RNTI for MAC-sh connection has to be reviewed~~



DL Downlink
TF Transport Format
TFC Transport Format Combination
(1) details are ffs
(2) for TDD only
(3) Scheduling /Priority handling is applicable for CPCH, details are ffs.

c-RNTI Radio Network Temporary Identity
UE User Equipment
UL Uplink
Note: The usage of c-RNTI for MAC-sh connection has to be reviewed

Figure 4.2.3.2. UE side MAC architecture / MAC-c 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.

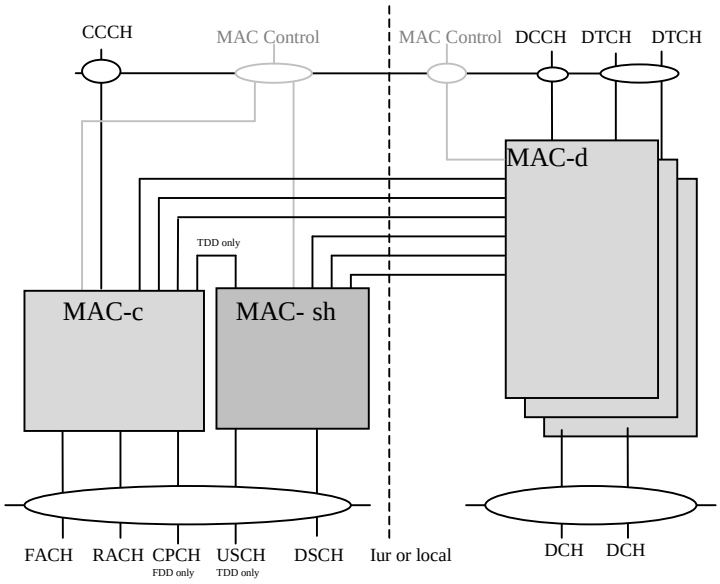
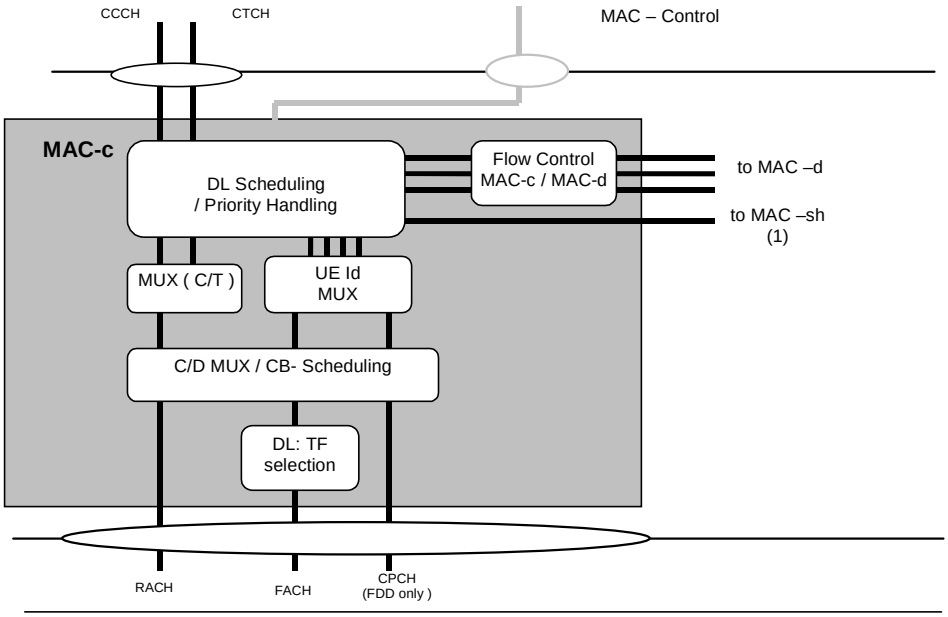


Figure 4.2.4.1: UTRAN side MAC architecture

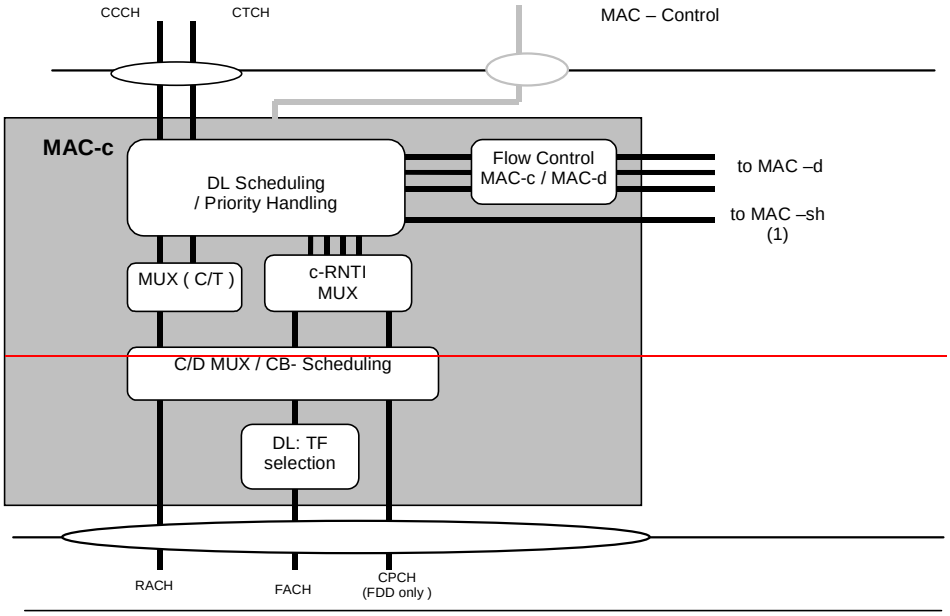
Figure 4.2.4.2 shows the UTRAN side MAC-c entity. The following functionality is covered:

- The Scheduling – Priority Handling box manages FACH resources between the UE's and between data flows 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~~UE Id field in the MAC header is used to distinguish between UEs.
- In the downlink, transport format selection might be done if FACH is variable rate.
- The multiplexing of CTCH information and the CB-Scheduling function inside MAC-c supports the Short Message Service Cell Broadcast (SMS CB).



DL Downlink
TF Transport Format
TFC Transport Format Combination
(1) only for TDD

~~RNTI Radio Network Temporary Identity~~
UE User Equipment
UL Uplink
~~Note: The applicability of c-RNTI for connection to MAC-sh has to be reviewed~~



DL Downlink
TF Transport Format
TFC Transport Format Combination
(1) only for TDD

RNTI Radio Network Temporary Identity
UE User Equipment
UL Uplink
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

9.2.1 MAC Data PDU: Parameters of the MAC header

- UE-Id
  The UE-Id field provides an identifier of the UE on common transport channels. The following types of UE-Id used on MAC are ~~currently~~ defined:

  ~~s-RNTI, this UE-Id is related to the serving RNC~~
  ~~c-RNTI, this UE-Id is related to the controlling RNC.~~

In addition for UE's having a RRC connection the S-RNC identifier exist.
UTRAN Radio Network Temporary Identity (U-RNTI) may be used in the MAC header of DCCH when mapped onto common transport channels.
Cell Radio Network Temporary Identity (C-RNTI) is used on DTCH, and may be used on DCCH, when mapped onto common transport channels.
The UE id to be used by MAC is configured through the MAC control SAP. The lengths of the UE-id field of the MAC header are given in Table 9.2.1.3.

s-RNTI together with S-RNC identifier is used for Cell and URA update RRC connection reestablishment and UTRAN originated paging messages and theire associated responses in CCCH or DCCH.

c-RNTI is used as a UE identifier in all other DCCH/DTCH common channel messages on the air interface.

UE Id type	Length of UE Id field
U-RNTI	32 bits
C-RNTI	16 bits

Table 9.2.1.3: Lengths of UE Id field

- UE-Id Type
  UE-Id Type sub-field inside the UE-Id field is needed to ensure the correct decoding of the UE-Id field in MAC Headers.

  The UE-Id Type sub-field definition:

UE-Id Type sub-field 2 bits	UE-Id Type
00	s-RNTI + SRNCIDU-RNTI
01	cC-RNTI
10	For future use
11	For future use

Note: Whether or not other UE-Id types are needed is ffs.

9.2.1.2 MAC header for CCCH

Note: The concept for using UE-Id on CCCH has to be reviewed

a) CCCH mapped to RACH/FACH:
   C/D has to be included and UE-id field may be included in MAC header. Details of usage the UE-id field is ffs.
b) CCCH mapped to RACH/FACH, where CCCH is the only channel (ffs):
   UE-id field may be included in the MAC header.

Note: The usage of the MAC header for BCCH and PCCH is ffs.
The address used for initial addressing is ffs, a possible solution may be to use a Random or CN related Identifier.

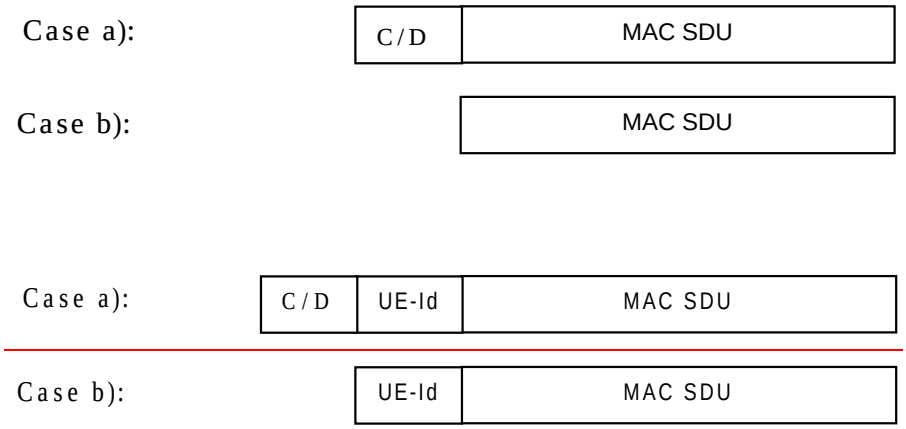


Figure 9.2.1.2.1 : MAC Data PDU formats for CCCH

3GPP TSG-RAN meeting #5 **Document R2-99936**

Kyongju, Korea, 6-8 October 1999

3G CHANGE REQUEST

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TS 25.321 **CR** **011** Current Version: 3.0.0

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

For submission to TSG RAN#5 *list TSG meeting no. here ↑* for approval [X] for information [ ] *(only one box should 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: *(at least one should be marked with an X)* USIM [ ] ME [X] UTRAN [X] Core Network [ ]

Source: TSG-RAN WG2 **Date:** 20/08/99

Subject: New CPCH parameters for MAC layer primitives

3G Work item:

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

F	Correction	[ ]
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: Interlayer primitives require modification to support use of CPCH resources.

Clauses affected: 8.3.1, 8.3.2

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:

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1.1 8.3.1 Primitives

The primitives between MAC and RRC are shown in Table 8.3.1

Generic Name	Type				Parameters
	Request	Indication	Response	Confirm	
CMAC-CONFIG	**X**				UE information elements RAB information elements TrCH information elements RACH transmission control elements Ciphering elements CPCH transmission control elements
CMAC-MEASUREMENT	**X**	**X**			Measurement information elements
CMAC-STATUS		**X**			Status info.

Table 8.3.1 Primitives between MAC sub-layer and RRC

CMAC-CONFIG-Req

- CMAC-CONFIG-Req is used to request for setup, release and configuration of a logical channel, e.g. RNTI allocation, the switching the connection between logical channels and transport channels, TFCS update or scheduling priority of logical channel.

CMAC-MEASUREMENT-Req/Ind

- CMAC-MEASUREMENT-Req is used by RRC to request MAC to perform measurements, e.g. traffic volume measurement.
- CMAC-MEASUREMENT-Ind is used to notify RRC of the measurement result.

CMAC-STATUS-Ind

- CMAC-STATUS-Ind primitive notifies RRC of status information.

8.3.2 Parameters

See 25.331 for a detailed description of the UE, RAB and TrCH information elements.

a) UE information elements
S-RNTI
SRNC identity
C-RNTI

Activation time

b) RAB information elements
RAB multiplexing info (Transport channel identity, Logical channel identity, MAC logical channel priority)

c) TrCH information elements
Transport Format Combination Set

d) Measurement information elements
(Details are ffs)

e) Status info

Maximum number of preamble ramping cycles reached

f) RACH transmission control elements
Persistence value P
Maximum number of preamble ramping cycles M_{max}
Others (ffs., e.g. minimum and maximum number of time units between two preamble ramping cycles)

g) Ciphering elements
Ciphering mode
Ciphering key
Ciphering sequence number

h) CPCH transmission control elements
CPCH persistency value

CPCH channel data rate (implicit in the UL channelisation code)

NFmax (Max packet length in frames)

3GPP TSG-RAN meeting #5

Kyongju, Korea, 6-8 October 1999

Document R2-99940

3G CHANGE REQUEST

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TS 25.321 **CR** **012** Current Version: 3.0.0

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

For submision to TSG *list TSG meeting no. here ↑* | for approval [X] | for information [ ] | *(only one box should 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: *(at least one should be marked with an X)* USIM [ ] ME [X] UTRAN [X] Core Network [ ]

Source: TSG-RAN WG2 **Date:** 18/08/99

Subject: Addition of RX Timing Deviation to MAC-DATA Indication

3G Work item:

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

F	Correction	[ ]
A	Corresponds to a correction in a 2G specification	[ ]
B	Addition of feature	[X]
C	Functional modification of feature	[ ]
D	Editorial modification	[ ]

Reason for change: Change is required for support of Timing Advance in TDD. The measured RX Timing Deviation was introduced in the MAC-DATA Indication.

Clauses affected: 8.2.1, 8.2.2

Other specs affected:

Other 3G core specifications	[X]	→ List of CRs:	25.301-CR012, 25.302-CR004
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:

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8. Elements for layer-to-layer communication

8.1 Primitives between layers 1 and 2

see TS25.302

8.2 Primitives between MAC and RLC

8.2.1 Primitives

The primitives between MAC layer and RLC layer are shown in Table 8.2.1.1

Generic Name	Type				Parameters
	Request	Indication	Response	Confirm	
MAC-DATA	X	X			MU, TD [(1)]
MAC-ERROR		X			[FFS]
MAC-STATUS		X	X		[FFS]

[(1)]: TDD only.

Table 8.2.1 Primitives between MAC layer and RLC layer

MAC-DATA Request/Indication

- MAC-DATA Request primitive is used to request that an upper layer PDU be sent using the procedures for the information transfer service.
- MAC-DATA Indication primitive indicates the arrival of an upper layer PDU received by means of the information transfer service.

MAC-ERROR Indication

- MAC-ERROR Indication primitive indicates to RLC that an error condition has occurred.

MAC-STATUS Indication/Response

- MAC-STATUS Indication primitive indicates to RLC about changes in the rules under which it may transfer data to MAC. Parameters of the primitive can indicate a transmission timer value, whether the RLC can transfer data and whether that data is restricted to supervisory frames only.
- MAC-STATUS Response enables RLC to acknowledge a MAC-STATUS Indication. It is possible that RLC would use this primitive to indicate that it has nothing to send or that it is in a suspended state.

8.2.2 Parameters

a) Message Unit (MU)
It contains the RLC layer message (RLC-PDU) to be transmitted or received by the MAC sub-layer.

b) RX Timing Deviation (TD), TDD only
It contains the RX Timing Deviation as measured by the physical layer for the physical resources carrying the data of the Message Unit. This parameter is optional and only for Indication. It is needed for the transfer of the RX Timing Deviation measurement of RACH transmissions carrying CCCH data to RRC.

[Note (from Tdoc WG2 009/99): This description are based on L2-LAC specification drafted TTC/ARIB Joint meeting. Because SAP between LAC and MAC is defined in our structure of MAC, the name of Signal is changed to Primitive. And format of explanation of primitives are changed to avoid verbose description. Request and Indication are combined to explain. Primitives for Activation/Deactivation or Establish/Release or Connect/Disconnect for MAC connection are FFS.]

[Note (from Tdoc WG2 009/99*)*: The parameters for RLCMAC-ERROR and RLCMAC-STATUS are FFS.]

3GPP TSG-RAN meeting #5 *Document* ***R2 99916***

Kyongju, Korea, 6-8 October 1999

3G CHANGE REQUEST

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25.321 **CR** **013** Current Version: 3.0.0

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

For submision to TSG RAN#5 *list TSG meeting no. here ↑* for approval [X] for information [ ] *(only one box should 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: *(at least one should be marked with an X)* USIM [ ] ME [X] UTRAN [X] Core Network [ ]

Source: TSG-RAN WG2 **Date:** 19/08/99

Subject: MAC Traffic Volume Measurement Function

3G Work item:

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

F	Correction	[ ]
A	Corresponds to a correction in a 2G specification	[ ]
B	Addition of feature	[X]
C	Functional modification of feature	[ ]
D	Editorial modification	[ ]

Reason for change: Addition of a MAC functionality of Traffic Volume Measurement

Clauses affected: 8.2, 8.3, 11

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.

8.2 Primitives between MAC and RLC

8.2.1 Primitives

The primitives between MAC layer and RLC layer are shown in Table 8.2.1.1

Generic Name	Type				Parameters
	Request	Indication	Response	Confirm	
MAC-DATA	X	X			MU, BO
MAC-ERROR		X			[FFS]
MAC-STATUS		X	X		[FFS]

Table 8.2.1 Primitives between MAC layer and RLC layer

MAC-DATA Request/Indication

- MAC-DATA Request primitive is used to request that an upper layer PDU be sent using the procedures for the information transfer service.
- MAC-DATA Indication primitive indicates the arrival of an upper layer PDU received by means of the information transfer service.

MAC-ERROR Indication

- MAC-ERROR Indication primitive indicates to RLC that an error condition has occurred.

MAC-STATUS Indication/Response

- MAC-STATUS Indication primitive indicates to RLC about changes in the rules under which it may transfer data to MAC. Parameters of the primitive can indicate a transmission timer value, whether the RLC can transfer data and whether that data is restricted to supervisory frames only.
- MAC-STATUS Response enables RLC to acknowledge a MAC-STATUS Indication. It is possible that RLC would use this primitive to indicate that it has nothing to send or that it is in a suspended state.

8.2.2 Parameters

a) Message Unit (MU)
It contains the RLC layer message (RLC-PDU) to be transmitted or received by the MAC sub-layer.

b) Buffer Occupancy (BO)

The parameter Buffer Occupancy (BO) indicates the amount of data that is currently queued for transmission (or retransmission) in RLC layer

[Note (from Tdoc WG2 009/99): This description are based on L2-LAC specification drafted TTC/ARIB Joint meeting. Because SAP between LAC and MAC is defined in our structure of MAC, the name of Signal is changed to Primitive. And format of explanation of primitives are changed to avoid verbose description. Request and Indication are combined to explain. Primitives for Activation/Deactivation or Establish/Release or Connect/Disconnect for MAC connection are FFS.]

[Note (from Tdoc WG2 009/99): The parameters for RLCMAC-ERROR and RLCMAC-STATUS are FFS.]

8.3 Primitives between MAC and RRC

8.3.1 Primitives

The primitives between MAC and RRC are shown in Table 8.3.1

Generic Name	Type				Parameters
	Request	Indication	Response	Confirm	
CMAC-CONFIG	**X**				CHI
CMAC-CONNECT	**X**			**X**	ffs
CMAC-MEASUREMENT	**X**	**X**			~~TRIG. TH, RESULT, PER~~ Measurement information elements (for Request), Measurement result (for Indication)
CMAC-STATUS		**X**			Status info.
CMAC-ERROR		**X**			Reason for error

Table 8.3.1 Primitives between MAC sub-layer and RRC

CMAC-CONFIG Request

- CMAC-CONFIG Request is used to request for the switching the connection between logical channels and transport channels

CMAC-CONNECT Request/Confirm

- CMAC-CONNECT Request is used initiate a RRC connection
- CMAC-CONNECT Confirm is used to confirm the establishment of a RRC connection.

CMAC-MEASUREMENT Request/Indication

- CMAC-MEASUREMENT .Request is used to request to measure something radio quality at both BS and MS sides. (for example : Transport Block Error)
- CMAC-MEASUREMENT. Indication is used to notify measuring result.

CMAC-STATUS Indication

- CMAC-STATUS Indication primitive notifies the management entity of status information.

CMAC-ERROR Indication

- CMAC-ERROR Indication primitive notifies the management entity of an error detected in the operation of the MAC sub layer protocol such as excessive number of transmission attempts for Ack-mode. and timer time out.

8.3.2 Parameters

a) Channel Information (CHI)
Channel information for active transport channel. For example, common channel or dedicated channel notification in user packet transmission.

b) Measurement information elements
- Mode (periodic, event-trigerred or both)
- TH_U
- TH_L (Optional)

- Measurement quantity identifiers

- Report Interval

c) Measurement result
- Mode
- Reporting Quantities
- Event Type (overflow or underflow)

~~b)TH~~
~~Threshold information for measurement. For example, traffic monitor or transmission quality. When an specific value is assigned, it means measuring should be reported with law data.~~

~~c)PER~~
~~Period information for measurement. When an specific value is assigned, it means measuring should be reported only when measuring result exceed the given threshold.~~

~~d)TRIG~~
~~Trigger information which request to start measuring.~~

~~e)RESULT~~
~~Measurement result.~~

~~f)~~d) Status info
It is management entity of status information.

~~g)~~e) Reason for error
It contains the management entity of an error detected in the operation of the MAC sub layer protocol (e.g. excessive number of transmission attempts for Ack-mode).

[Note(from Tdoc WG2 009/99): If used with a threshold information, the MEASURE primitive is same as an alarm indication or request for channel switching. When the condition that channel switching is needed is detected at UE side, appropriate RRC message will be sent to Network side.

11 Elementary procedures

Examples: data transfer, random access procedure, transport channel type switching (dedicated/common channel)

11.1 ~~Dynamic radio access bearer control~~ Traffic volume measurement for dynamic radio access bearer control

~~• This procedure is applicable only in case of optimisation of established radio bearers~~

~~• The algorithm exist in the UE and is controlled by the network. The algorithm requests to RRC for a reconfiguring of radio resources, details are ffs.~~

Dynamic radio access bearer control is performed in RRC, based on the traffic volume measurement reported by MAC. Traffic volume information is gathered and measured in MAC layer and the result is reported from MAC layer to RRC layer.

Traffic volume monitoring procedure in MAC is shown in figure 11.1.1 MAC receives RLC PDUs together with information of RLC transmission buffer. Every TTI, MAC compares the amount of data corresponding to a Transport Channel with the thresholds set by RRC. If the value is out of range, MAC indicates the measurement reports on traffic volume status to RRC. Thereby, RRC can be informed the traffic volume status of each transport channel, and therefore can take proper action for new radio access bearer configuration accordingly.

RRC requests MAC measurement report with the primitive CMAC-Measure-REQ including following parameters.

Measurement information elements

- Mode
  Indicates whether the report should be periodical or by event-triggered
- TH_U
  Upper threshold value for every transport channel, applicable when mode is event-triggered
- TH_L (Optional)
  Lower threshold value for every transport channel, applicable when mode is event-triggered
- Measurement quantity identifiers
  Indicates what should be reported to RRC layer
  For each RAB, Buffer amount (mandatory), Variance (optional), or Average (optional)

- Report Interval
  Indicates the report interval, applicable when report mode is periodic

MAC receives RLC PDUs with the primitive MAC-Data-REQ including following parameters:

- Data (RLC PDU)
- Buffer Occupancy (BO)
  The parameter Buffer Occupancy (BO) indicates the amount of data that is currently queued for transmission (or retransmission)

MAC receives measurement information elements with the primitive CMAC-Measure-REQ which includes parameters such as Mode, report interval, and TH_L and TH_U for each transport channel. Whenever MAC receives RLC PDUs from different RLC entities, it is notified by RLC amount of data queued in RLC transmission buffer. If the mode is event-triggered, MAC compares the amount of data to be transmitted on a transport channel with threshold values passed by RRC, TH_L and TH_U. In case that the measured value is out of range, MAC reports the status of result of comparison and status of each RAB to RRC. On the other hand, if the mode is periodic, MAC reports measurement result to RRC periodically. Measurement result can contain average and variance as well as amount of data for each RAB as follows:

Measurement result

- Mode
  Periodic, or event-triggered
- Reporting Quantity
  For each RAB, Buffer Occupancy (mandatory), Variance (optional), and Average (optional)
- Event type
  Indicates overflow or underflow for each transport channel, applicable when mode is event-triggered

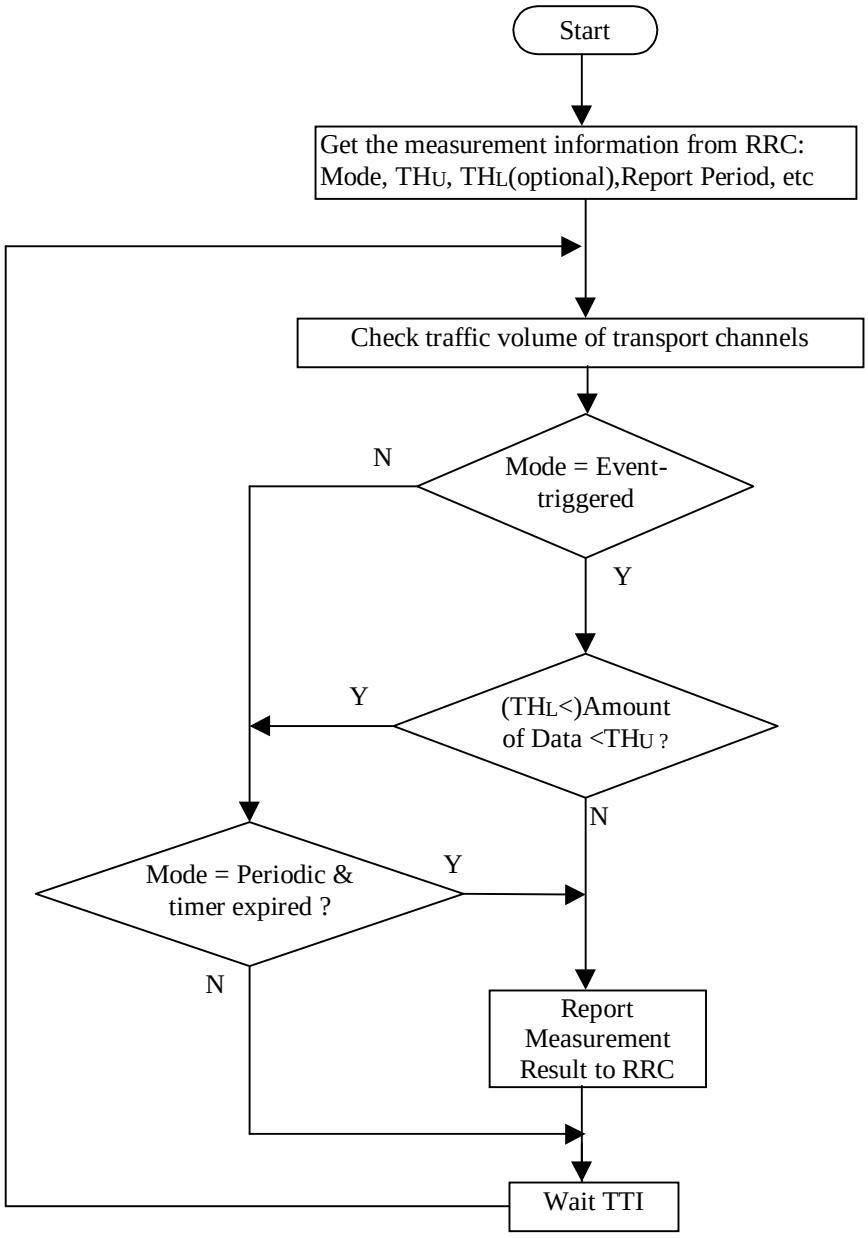

Figure 11.1.1: Traffic volume measurement/report procedure in MAC

3GPP TSG-RAN meeting #7 ***Document R2-99b38***

Malmö, Sweden, 20-24 September 1999

3G CHANGE REQUEST

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

TS 25.321	CR	014	Current Version:	3.0.0

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

For submision to TSG RAN #5 *List TSG meeting no. here ↑*

for approval [X]
for information [ ]

(only one box should 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: *(at least one should be marked with an X)* USIM [ ] ME [X] UTRAN [X] Core Network [ ]

Source: Ericsson **Date:** 1999-09-16

Subject: Mapping of BCCH logical channel onto FACH transport channel

3G Work item:

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

F	Correction	[ ]
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: Some RRC System Information messages will be transmitted on FACH. It is assumed that all System Information messages are carried on a BCCH logical channel. This implies that mapping of a BCCH to a FACH transport channel shall be possible.

Clauses affected: 4.2.3, 4.2.4, 4.3.3, 6.2.1, 6.2.2, 9.1.1, 9.2.1

Other specs affected:

Other 3G core specifications	[ ]	→ List of CRs:	TS 25.301 CR 018
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:
Comments for WG2:
- The principle was agreed at WG2#6 (R2-99811)
- This CR is closely related to CR003 for 25.321 as both affect the same MAC header field (TCTF).


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

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 FACH and RACH common 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.

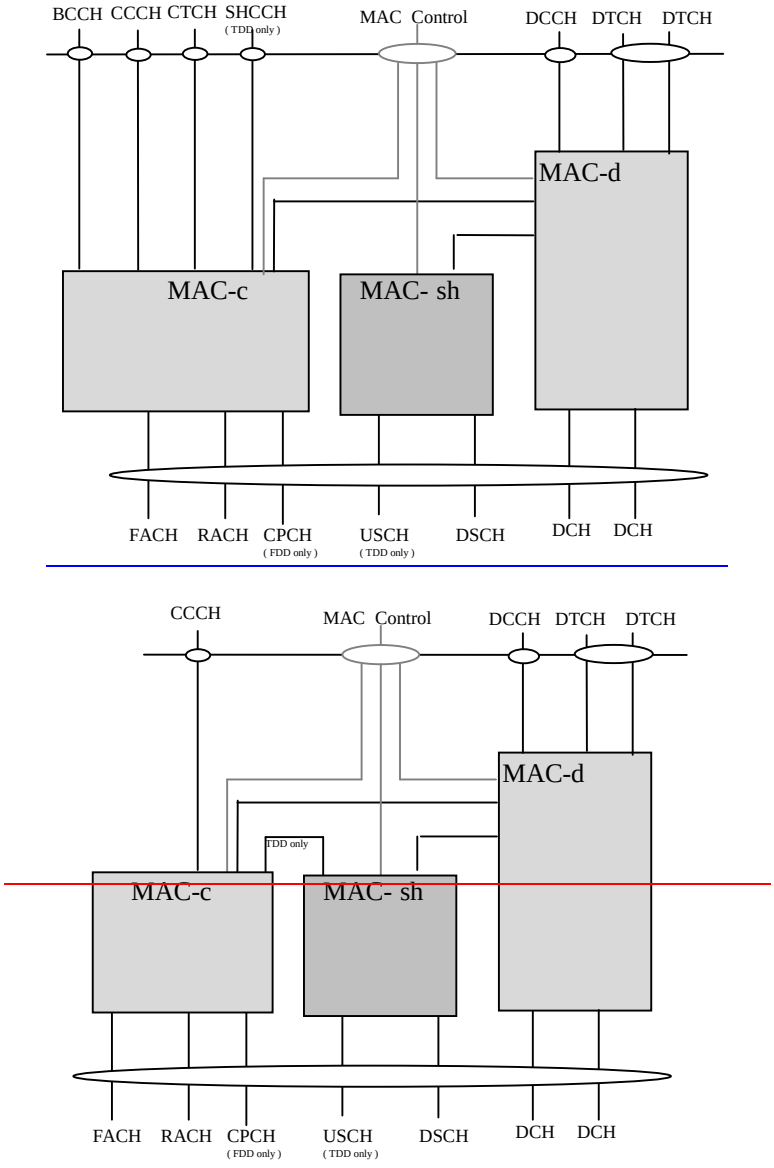


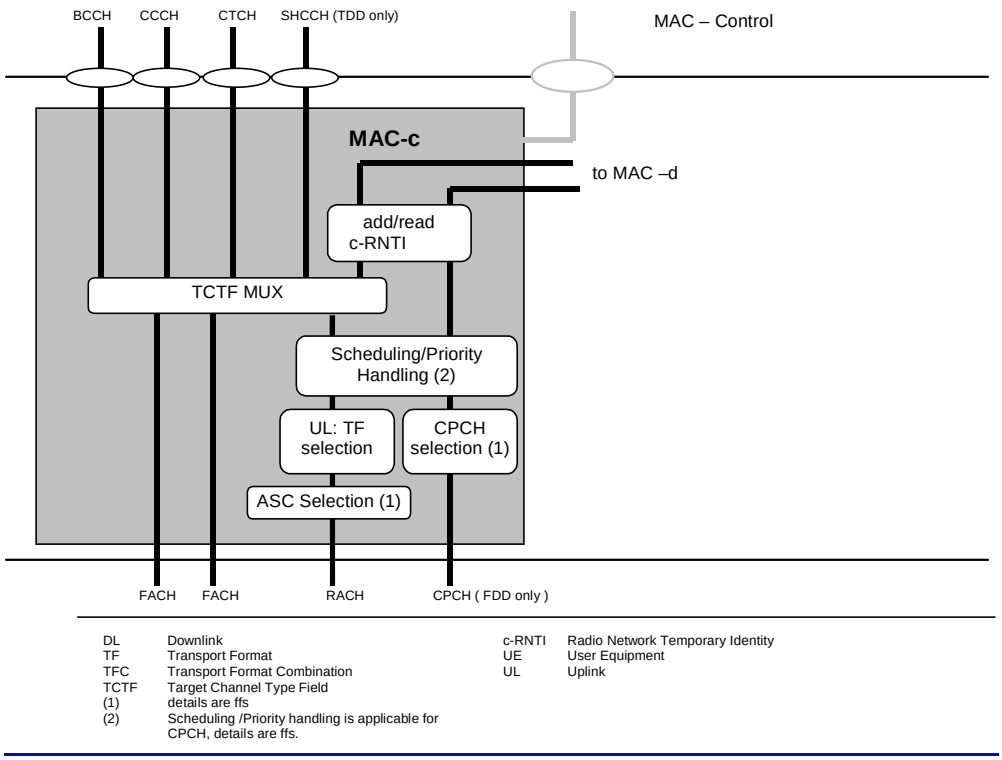
Figure 4.2.3.1 UE side MAC architecture

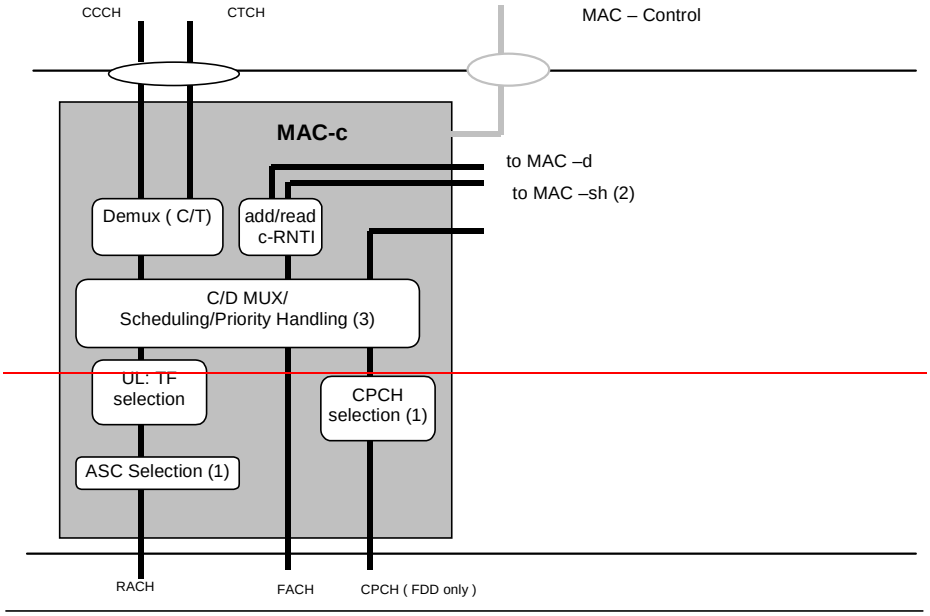
Figure 4.2.3.2 shows the UE side MAC-c entity. The following functionality is covered:

~~• 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 TCTF MUX box represents the handling (insertion or detection and deletion) of the TCTF field in the MAC header, and the respective mapping between logical and transport channels. The TCTF field indicates the common logical channel type, or if a 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/s~~Scheduling /priority handling is used to transmit ~~the received~~ information received from MAC-d 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).~~



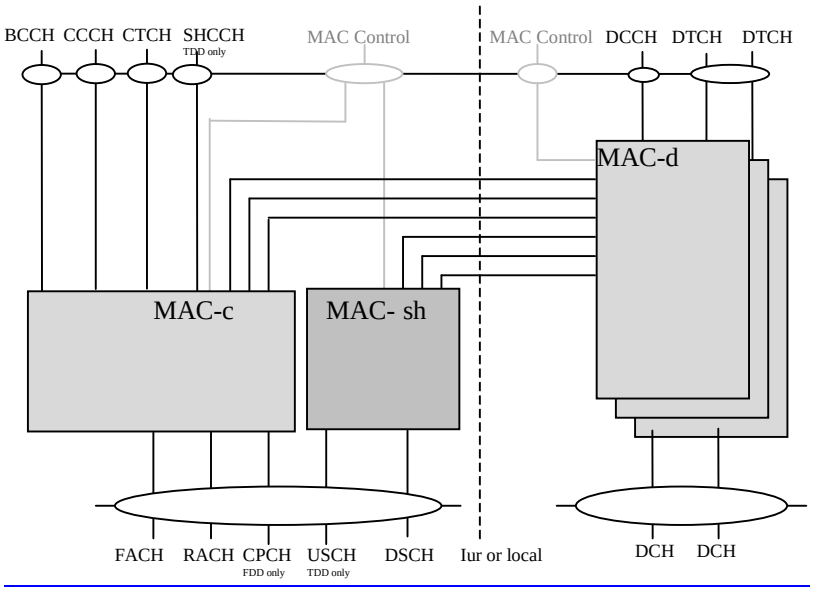


DL	Downlink	c-RNTI	Radio Network Temporary Identity
TF	Transport Format	UE	User Equipment
TFC	Transport Format Combination	UL	Uplink
(1)	details are ffs	Note:	The usage of c-RNTI for MAC-sh connection has to be reviewed
(2)	for TDD only		
(3)	Scheduling /Priority handling is applicable for CPCH, details are ffs.		

Figure 4.2.3.2. UE side MAC architecture / MAC-c 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.



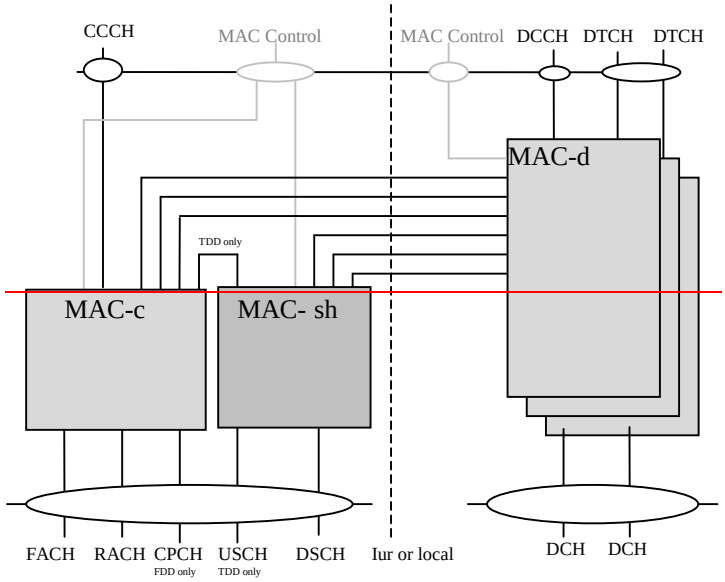


Figure 4.2.4.1: UTRAN side MAC architecture

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 UE's and between data flows according to their priority. DL flow control is also provided to MAC-d.
- The TCTF MUX box represents the handling (insertion or detection and deletion) of the TCTF field in the MAC header, and the respective mapping between logical and transport channels. The TCTF field indicates the common logical channel type, or if a dedicated logical channel is used.
- ~~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 selection might be done if FACH is variable rate.
- The ~~multiplexing of CTCH information and the~~ CB-Scheduling function inside MAC-c supports the Short Message Service Cell Broadcast (SMS CB).

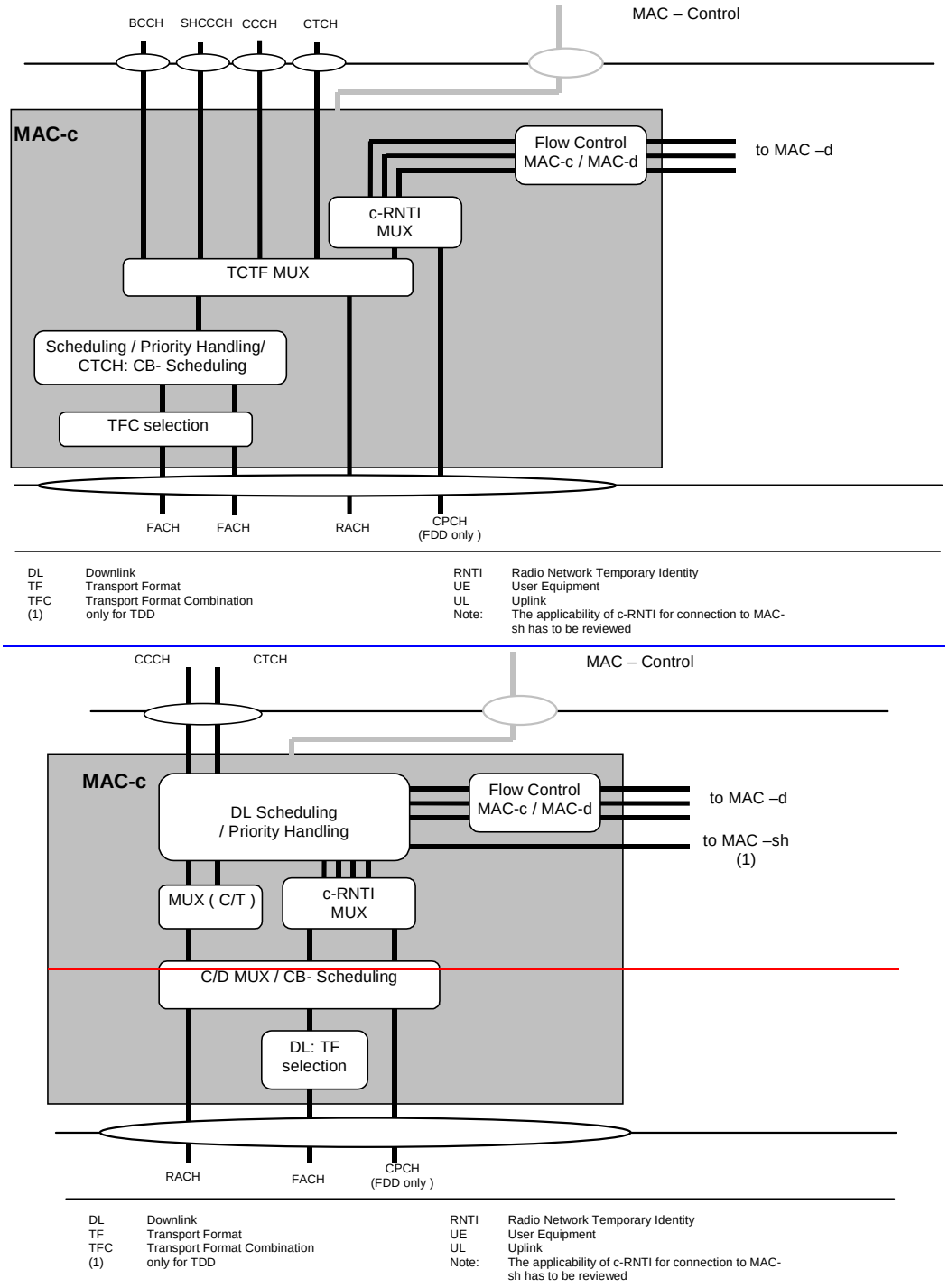


Figure 4.2.4.2 UTRAN side MAC architecture / MAC-c details

4.3 Channel structure

4.3.1 Transport channels

4.3.2 Logical Channels

4.3.3 Mapping between logical channels and transport channels

The following connections between logical channels and transport channels exist:

- SCCH is connected to SCH
- BCCH is connected to BCH or FACH
- PCCH is connected to PCH
- CCCH is connected to RACH and FACH
- DCCH and DTCH can be connected to either RACH and FACH, to CPCH and FACH, to RACH and DSCH, to DCH and DSCH, or to a DCH, the DCCH can be connected to FAUSCH.
- ODCCH, OCCCH and ODTCH can be connected to ORACH, ODCCH and ODTCH can be connected to ODCH.
- CTCH may be mapped to FACH and DSCH or BCH, the mapping is ffs
- DCCH and DTCH can be mapped to the USCH (TDD only).

6 Functions

6.1 Description of the MAC functions

6.2 Relation between MAC Functions / Transport Channels and UE

6.2.1 Relation between MAC Functions and Transport Channels

Associated MAC Functions	Logical Ch	Transport Ch	TF Selection	Priority handling between users	Priority handling (one user)	Scheduling	Identification of UEs	Mux/Demux on common transport CH	Mux/ Demux on dedicated transport CH	Dynamic transport CH switching
Uplink (Rx)	CCCH	RACH						X		
	DCCH	RACH					X	X		
	DCCH	CPCH					X	X		X
	DCCH	DCH							X	
	DTCH	RACH					X	X		
	DTCH	CPCH					X	X		X
	DTCH	DCH							X	
Downlink (Tx)	SCCH	SCH								
	BCCH	BCH				X				
	BCCH	FACH	X			X		X		
	PCCH	PCH				X				
	CCCH	FACH		X				X		
	DCCH	FACH		X			X	X		
	DCCH	DSCH		X				X		
	DCCH	DCH	X		X				X	
	DTCH	FACH	X(note1)	X			X	X		X
	DTCH	DSCH	X(note2)	X				X		X
	DTCH	DCH	X		X				X	X

Table 1 UTRAN MAC functions corresponding to the transport channel (note3)

(Note1) On FACH channel, the transport format set is limited.
(Note2) Whether DSCH has the transport format set is under discussion.
(Note3) The functions not included in the table are listed below.

- Mapping between logical channels and transport channels.
- Traffic volume monitoring
- Constrained execution of open loop power control algorithms

Further, the following additional functions are not included yet in the table :

- Routing of higher layer signalling
- Maintenance of a MAC signalling connection between peer MAC entities
- Monitoring the links of the assigned resources
- Processing of messages received at common control channels

Note (this table has to be reviewed)

6.2.2 Relation of UE MAC functions corresponding to the Transport Channel MAC Functions and Transport Channels

Functions	Logical Ch	Transport Ch	TF Selection	Priority handling data of one user	Identification	Mux/Demux on common transport channels	Mux/Demux on dedicated transport channels	Dynamic transport channel type switching
Uplink (Tx)	CCCH	RACH				X		
	DCCH	RACH	X(note1)		X	X		
	DCCH	CPCH	X	X	X	X		X
	DCCH	DCH	X	X			X	
	DTCH	RACH	X(note1)		X	X		X
	DTCH	CPCH	X	X	X	X		X
	DTCH	DCH	X	X			X	X
Downlink (Rx)	SCCH	SCH						
	BCCH	BCH						
	BCCH	FACH				X		
	PCCH	PCH						
	CCCH	FACH				X		
	DCCH	FACH			X	X		
	DCCH	DSCH				X		
	DCCH	DCH					X	
	DTCH	FACH			X	X		
	DTCH	DSCH				X		
	DTCH	DCH					X	

Table 2 UE MAC functions corresponding to the transport channel

(Note1) The RACH channel has the limited transport format set.

Note: This table has to be reviewed

9 Elements for peer-to-peer communication

9.1 Protocol data units

9.1.1 MAC Data PDU

MAC PDU consists of an optional MAC header and a MAC Service Data Unit (MAC SDU), see figure 9.1.1. Both the MAC header and the MAC SDU are of variable size.

The content and the size of the MAC header depends on the type of the logical channel, and in some cases none of the parameters in the MAC header are needed.

The size of the MAC-SDU depends on the size of the RLC-PDU, which is defined during the setup procedure.

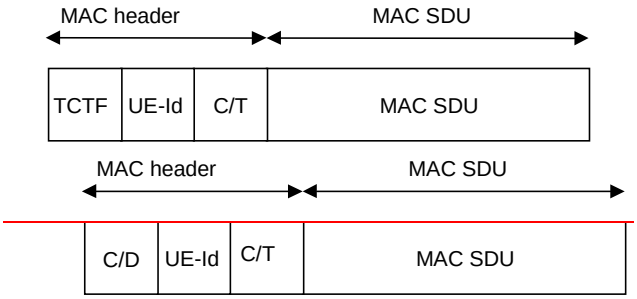


Figure 9.1.1.1 MAC data PDU

9.1.2 MAC Control PDU

MAC Control PDU consist elements for the control of the operation. The details are ffs.

9.2 Formats and parameters

9.2.1 MAC Data PDU: Parameters of the MAC header

The following fields are defined for the MAC header:

- Target Channel Type Field
  The TCTF field is a flag that provides identification of the logical channel class on FACH and RACH transport channels, i.e. whether it carries BCCH, CCCH, CTCH, SHCCH or dedicated logical channel information.

TCTF	Designation
000	BCCH
001	CCCH
010	CTCH
011	DCCH or DTCH over FACH
100	TDD: SHCCH FDD: For future use
101-111	For future use

Table 9.2.1.1: Coding of the Target Channel Type Field on FACH

TCTF	Designation
00	CCCH
01	DCCH or DTCH over RACH
10	TDD: SHCCH FDD: For future use
11	For future use

Table 9.2.1.2: Coding of the Target Channel Type Field on RACH

~~• C/D field~~

~~The C/D field is a single bit flag that provides identification of the logical channel class on FACH and RACH transport channels, i.e. whether it carries CCCH or dedicated logical channel information.~~

~~C/D field~~	~~Designation~~
~~1~~	~~CCCH~~
~~0~~	~~DCCH or DTCH~~

~~Table 9.2.1.1: Coding of the C/D Field~~

- C/T field
  The C/T field provides identification of the logical channel instance when multiple logical channels are carried on the same transport channel. The C/T field is used also to provide identification of the logical channel type on dedicated transport channels and on FACH and RACH when used for user data transmission. The size of the C/T field may be variable.

C/T field (e.g. 4 bits)	Designation
0000	Logical channel 1
0001	Logical channel 2
...	...
1111	Logical channel 16

Table 9.2.1.2: Structure of the C/T field

- UE-Id
  The UE-Id field provides an identifier of the UE . The following types of UE-Id are currently defined:

s-RNTI , this UE Id is related to the serving RNC
c-RNTI, this UE Id is related to the controlling RNC.

In addition for UE's having a RRC connection the S-RNC identifier exist.

s-RNTI together with S-RNC identifier is used for URA update RRC connection reestablishment and UTRAN originated paging messages and there associated responses.

c-RNTI is used as a UE identifier in all other DCCH/DTCH common channel messages on the air interface.

Note: Whether or not other UE-Id types are needed is ffs.

9.2.1.1 MAC header for DTCH and DCCH

a) DTCH or DCCH mapped to DCH, no multiplexing of dedicated channels on MAC:
No MAC header is required.

b) DTCH or DCCH mapped to DCH, with multiplexing of dedicated channels on MAC:
C/T field is included in MAC header.

c) DTCH or DCCH mapped to RACH/FACH:
~~C/D~~TCTF field and UE-Id are included in the MAC header. C/T field is included if multiplexing on MAC is applied.

~~d)DTCH or DCCH mapped to RACH/FACH, where DTCH or DCCH are the only channels (ffs).~~
~~UE-Id field is included in MAC header. C/T field is included if multiplexing on MAC is applied.~~

~~e)~~d) DTCH or DCCH mapped to DSCH:
The MAC-PDU format for DSCH is left for further study.

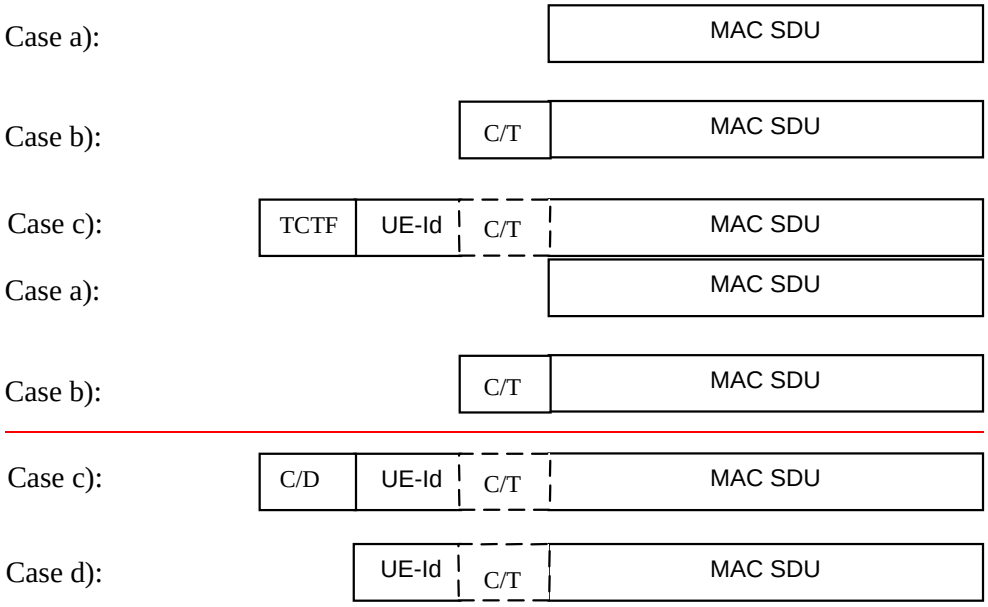


Figure 9.2.2.1: MAC Data PDU formats for DTCH and DCCH

9.2.1.2 MAC header for BCCH

a) BCCH mapped to BCH:
No MAC header is required.
b) BCCH mapped to FACH:
The TCTF field is included in MAC header.

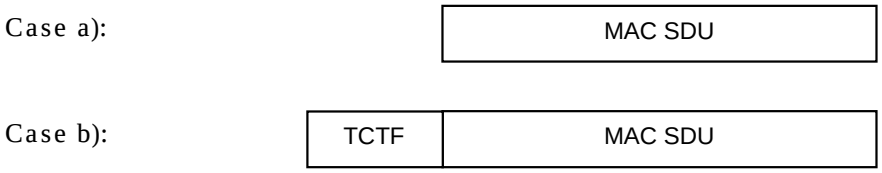


Figure 9.2.1.3.1 : MAC Data PDU formats for BCCH

9.2.1.3 MAC header for CCCH

Note: The concept for using UE Id on CCCH has to be reviewed

a) CCCH mapped to RACH/FACH:
~~C/D has to be~~TCTF field is included and UE-id field may be included in MAC header. Details of usage the UE-id field is ffs.

~~b)CCCH mapped to RACH/FACH, where CCCH is the only channel (ffs):~~
~~UE-id field may be included in the MAC header.~~

Note: The usage of the MAC header for ~~BCCH and~~ PCCH is ffs.
The address used for initial addressing is ffs, a possible solution may be to use a Random or CN related Identifier.

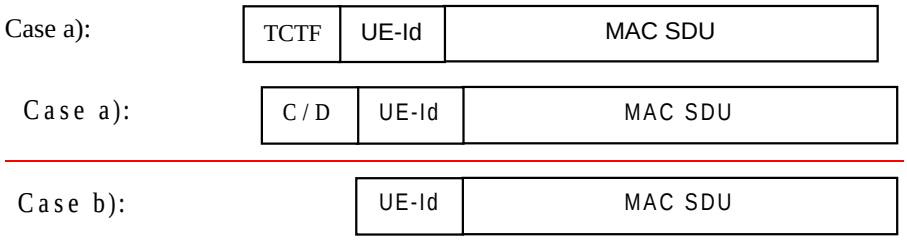


Figure 9.2.1.2.1 : MAC Data PDU formats for CCCH

9.2.1.4 MAC Header for CTCH

The MAC header for CTCH mapped to FACH is as shown in figure 9.2.1.3.1

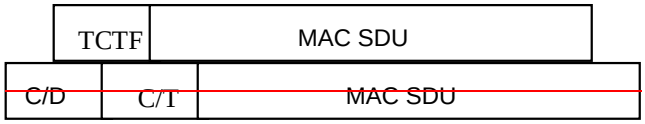


Figure 9.2.1.3.1 : MAC Data PDU format for CTCH

~~C/D field indicates whether data is mapped to the common or dedicated logical channel~~. The TCTF field indicates whether data is mapped to common or dedicated channels, and whether it belongs to BCCH ,CCCH, CTCH or SHCCH.
~~C/T field indicates whether it belongs to CCCH or CTCH.~~ In case of CTCH, it identifies whether the message is SMS CB message or Schedule message

3GPP TSG-RAN meeting #7 **Document R2-99c51**

Malmö, Sweden, 20-24 September 1999

3G CHANGE REQUEST

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

TS 25.321	CR	015 r1	Current Version:	3.1.0

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

For submision to TSG RAN #5 *List TSG meeting no. here ↑*

for approval [X]
for information [ ]

(only one box should 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: *(at least one should be marked with an X)* USIM [ ] ME [X] UTRAN [X] Core Network [ ]

Source: TSG RAN WG2 **Date:** 1999-09-24

Subject: MAC PDU format for PCCH

3G Work item:

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

F	Correction	
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: MAC PDU formats for PCCH have until now been marked as FFS.
No reason have been found to use MAC multiplexing of several PCCHs. Therefore no MAC header is needed for PCCH.

Clauses affected: 9.2.1.1 - 9.2.1.3

Other specs affected:

Other 3G core specifications	[ ]	→ List of CRs: Ts 25.301 CR019
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.

9.2.1. MAC Data PDU: Parameters of the MAC header

9.2.1.1 MAC header for DTCH and DCCH

9.2.1.2 MAC header for PCCH

There is no MAC header for PCCH.

~~9.2.1.2~~9.2.1.3 MAC header for CCCH

Note: The concept for using UE Id on CCCH has to be reviewed

a) CCCH mapped to RACH/FACH:
C/D has to be included and UE-id field may be included in MAC header. Details of usage the UE-id field is ffs.
b) CCCH mapped to RACH/FACH, where CCCH is the only channel (ffs):
UE-id field may be included in the MAC header.

Note: The usage of the MAC header for BCCH ~~and PCCH~~ is ffs.
The address used for initial addressing is ffs, a possible solution may be to use a Random or CN related Identifier.

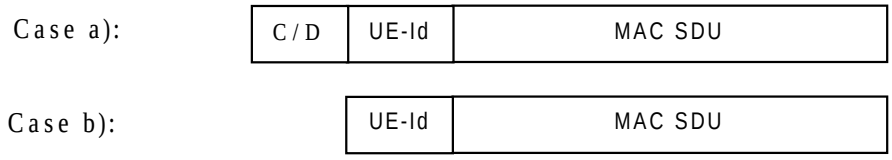


Figure 9.2.1.2.1 : MAC Data PDU formats for CCCH

3GPP TSG-RAN meeting #7 ***Document R2-99c88***

Malmö, Sweden, 20-24 September 1999

3G CHANGE REQUEST

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TS 25.321	CR	016 r1	Current Version:	3.0.0

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

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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: *(at least one should be marked with an X)* USIM [ ] ME [X] UTRAN [X] Core Network [ ]

Source: TSG RAN WG2 **Date:** 1999-09-24

Subject: Informative parts that shall not specify or constrain implementations

3G Work item:

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

F	Correction	[ ]
A	Corresponds to a correction in a 2G specification	[ ]
B	Addition of feature	[ ]
C	Functional modification of feature	[ ]
D	Editorial modification	[X]

Reason for change: It is proposed to include explicit statements that the overview part of the MAC architecture is a model not representing implementations and that the MAC primitives shall not specify or constrain implementations.

Clauses affected: 4.2, 9

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:

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4. General

4.1 Objective

4.2 Overview on MAC architecture

The following provides a~~n~~ model~~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. The description in this chapter is a model and does not represent implementations.

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

9. Elements for layer-to-layer communication

The interaction between the MAC layer and other layers are described in terms of primitives where the primitives represent the logical exchange of information and control between the MAC layer and other layers. The primitives shall not specify or constrain implementations.

9.1 Primitives between layers 1 and 2

see TS25.302

9.2 Primitives between MAC and RLC

9.3 Primitives between MAC and RRC

3GPP TSG-RAN WG2 meeting #7 ***Document R2-99d00***

Malmö, Sweden, 20-24 September 1999

3G CHANGE REQUEST

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TS 25.321 **CR** **017 r1** Current Version: 3.0.0

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

For submission to TSG RAN#5 *list TSG meeting no. here ↑* for approval [X] for information [ ] *(only one box should 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: *(at least one should be marked with an X)* USIM [ ] ME [X] UTRAN [X] Core Network [ ]

Source: Ericsson **Date:** 24/09/99

Subject: Modification of RACH transmission control procedure on MAC

3G Work item:

Category: *(only one category Shall be marked with an X)*

F	Correction	[ ]
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: Some parts of the present RACH transmission control procedure were left for further study, i.e. backoff of RACH transmission timing. The RACH backoff algorithm for FDD mode is clarified in this change request, leading to a simplified RACH transmission control procedure on MAC.

Clauses affected: Sec. 11.2

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:

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11.2 Control of RACH transmissions

The MAC sublayer is in charge of controlling the timing of RACH transmissions on transmission time interval level (i.e. on 10 ms-radio frame level; the timing on access slot level is controlled by L1). Note that retransmissions in case of erroneously received RACH message part are under control of higher layers, i.e. RLC, or RRC for CCCH (and SHCCH for TDD).

11.2.1 Control of RACH transmissions for FDD mode

~~*[Note: This procedure has to be reviewed for FDD and TDD operation]*~~

~~The MAC sublayer is in charge of controlling the timing of RACH transmissions on transmission time interval level (i.e. on 10 ms-radio frame level; the timing on access slot level is controlled by L1). MAC controls the timing of each initial preamble ramping cycle as well as successive preamble ramping cycles in case that none or a negative acknowledgement is received. Note that retransmissions in case of erroneously received RACH message part are under control of higher layers (i.e. RLC, or RRC for CCCH data).~~

The RACH transmissions are ~~performed~~ controlled by the UE MAC sublayer as ~~shown~~ outlined in Figure ~~2~~11.2.1. Note that the figure shall illustrate the operation of the transmission control procedure as specified below. It shall not impose restrictions on implementation. MAC controls the timing of each initial preamble ramping cycle as well as successive preamble ramping cycles in case that none or a negative acknowledgement is received on AICH.

MAC receives the following RACH transmission control parameters from RRC with the CMAC-Config-REQ primitive:

- persistence value P (transmission probability),
- maximum number of preamble ramping cycles M_{max},
- range of backoff interval for timer T_{BO1}, given in terms of numbers of transmission time intervals N_{BO1max} and N_{BO1min}, applicable when negative acknowledgement on AICH is received,
- Access Service Class (ASC) parameters.
- ~~others (ffs., e.g. minimum and maximum number of time units between two preamble ramping cycles).~~

Based on the persistence value P, the UE decides whether to start the L1 ~~power ramping~~ PRACH transmission procedure (see TS 25.214) in the present transmission time interval or not. If transmission is allowed, the PRACH transmission procedure (starting with a preamble power ramping cycle) is initiated by sending of a PHY-Data-REQ primitive~~, the L1 preamble power ramping procedure is started~~. MAC then waits for status indication from L1 via PHY-Status-IND primitive. If transmission is not allowed, a ~~backoff timer T_{BO1} is started and another attempt is performed after expiry of the timer~~ new persistency check is performed in the next transmission time interval. The persistency check is repeated until transmission is permitted.

When the preamble has been acknowledged on AICH, respective L1 status information is indicated to MAC with PHY-Status-IND primitive, and the PRACH transmission procedure shall be completed with transmission of the PRACH message part ~~is transmitted~~ according to L1 specifications.

When PHY indicates that no acknowledgement on AICH is received while the maximum number of preamble retransmissions is reached (defined by parameter Preamble_Retrans_Max on L1), a new persistency test is performed in the next transmission time interval. The timer T_2 ensures that two successive persistency tests are separated by at least one transmission time interval. ~~backoff timer T_{BO2} is started and another preamble ramping cycle is performed.~~

In case that a negative acknowledgement has been received on AICH a backoff timer T_{BO1}~~3~~ is started. After expiry of the timer, persistence check is performed again. Backoff timer T_{BO1} is set to an integer number N_{BO1} of transmission time intervals, randomly drawn within an interval $0 \le N_{BO1min} \le N_{BO1} \le N_{BO1max}$ (with uniform distribution). N_{BO1min} and N_{BO1max} may be set equal when a fixed delay is desired, and even to zero when no delay other than the one due to persistency is desired.

Before a persistency test is performed it shall be checked whether any new RACH transmission control parameters have been received from RRC with CMAC-Config-REQ primitive. The latest set of RACH transmission control parameters shall be applied.

[Note 1: An alternative proposal for determining the backoff additional to persistency drawing and testing in the case of a negative acknowledgement on AICH (L1 status "NACK") has been proposed which is for further study]

[Note 2: There is a need to study the use of multiple persistence values when there are multiple Access Service Classes and multiple RACH partitions.]

~~The settings of the backoff timers T_{BO1}, T_{BO2}, T_{BO3} is ffs. The setting is an integer number (≥ 1) of transmission time intervals, either fixed or randomly drawn from an interval defined by RACH transmission control parameters received from RRC, which might be updated dynamically, together with update of persistence value.~~

~~*[Note: The three timers are introduced at this stage mainly to keep the algorithm most general. Possibly T_{BO1} and T_{BO2} can simply be set to their minimum value, which is currently assumed to be 10 ms. However, smaller backoff timing units such as access slot intervals may also be considered. The introduction of random backoff with T_{BO3} could especially be useful when the update time for the persistence value is low, i.e. larger than a radio frame.]*~~

~~The backoff algorithm encompasses currently both~~

~~(a)a persistency check and~~

~~(b)a backoff time~~

~~at both stages,~~

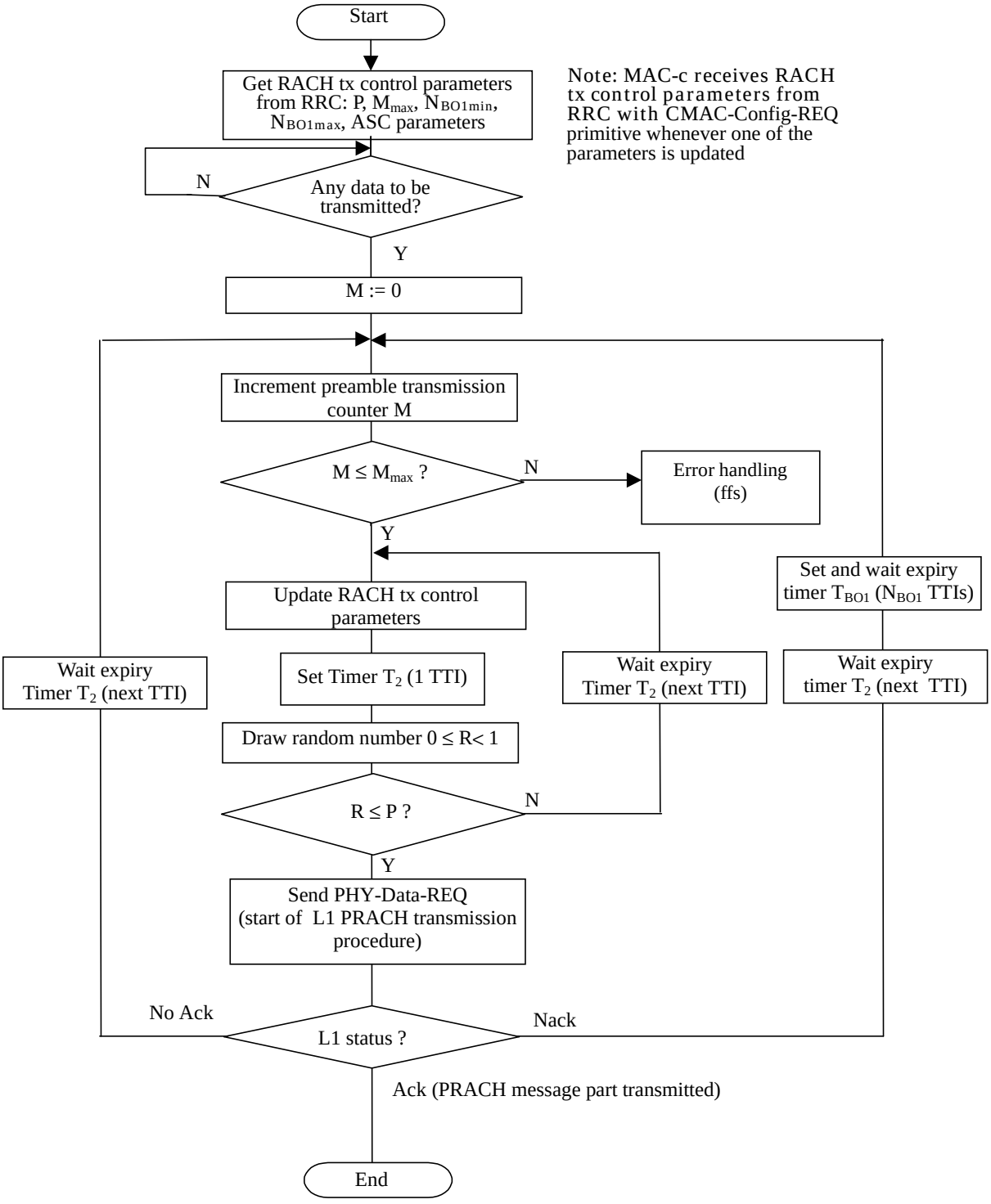
~~• initial (i.e. very first) attempt after the request to send RACH data has been received by MAC, and~~

~~• subsequent attempt, which is needed in case of the following conditions:~~

~~(i)after an unsuccessful preamble ramping cycle (No Ack)~~

~~(ii)after a Nack from L1.~~

~~For both stages it is FFS if both (a) and (b) are needed or if one of (a) or (b) is sufficient.~~


Start
Get RACH tx control parameters from RRC: P, M_{max}, N_{BO1min}, N_{BO1max}, ASC parameters
Note: MAC-c receives RACH tx control parameters from RRC with CMAC-Config-REQ primitive whenever one of the parameters is updated
N
Any data to be transmitted?
Y
M := 0
Increment preamble transmission counter M
$M \leq M_{max}$?
N
Error handling (ffs)
Y
Update RACH tx control parameters
Set and wait expiry timer T_{BO1} (N_{BO1} TTIs)
Wait expiry Timer T_2 (next TTI)
Set Timer T_2 (1 TTI)
Wait expiry Timer T_2 (next TTI)
Wait expiry timer T_2 (next TTI)
Draw random number $0 \leq R < 1$
$R \leq P$?
N
Y
Send PHY-Data-REQ (start of L1 PRACH transmission procedure)
No Ack
L1 status ?
Nack
Ack (PRACH message part transmitted)
End

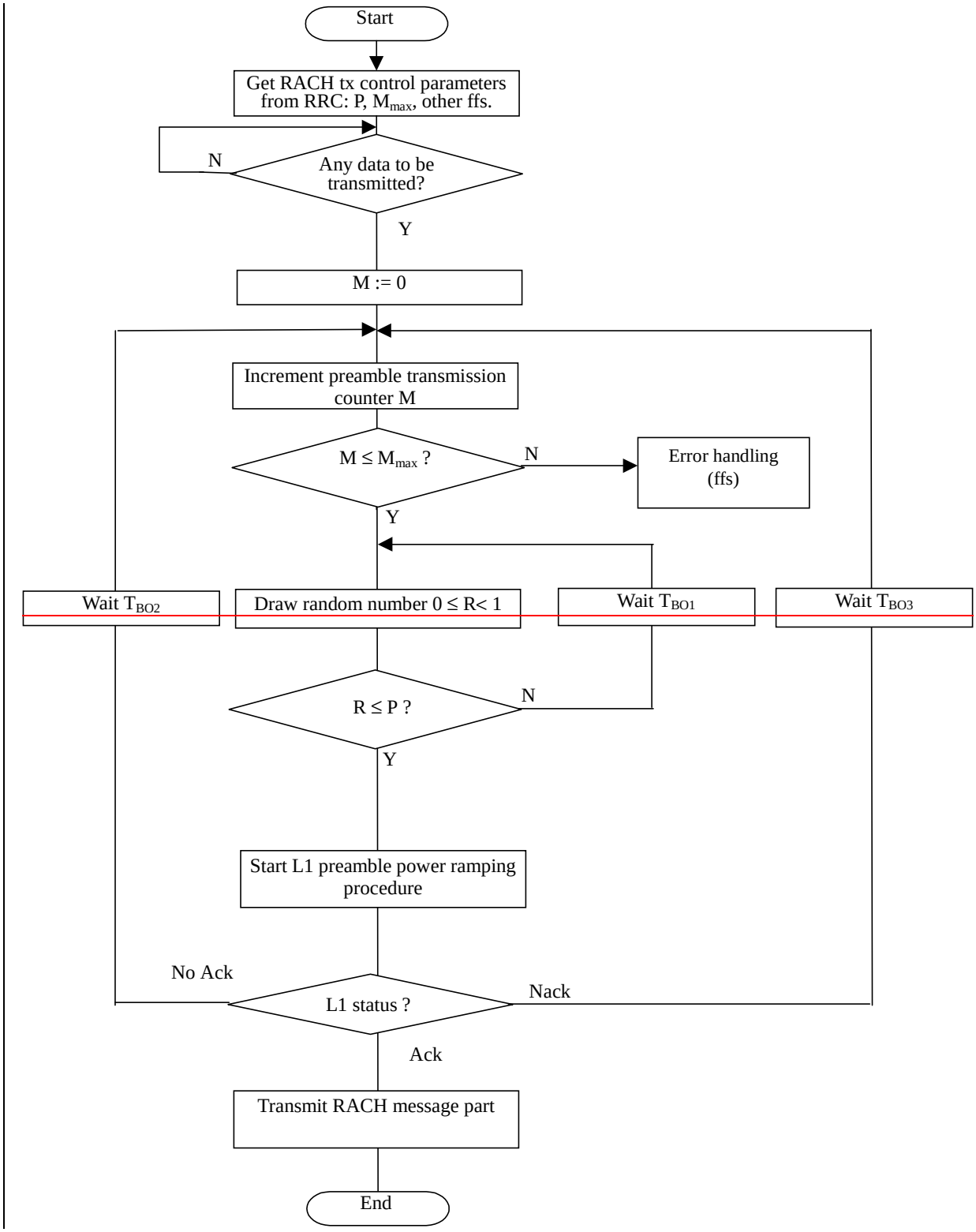


Figure 11.2.1 : RACH transmission control procedure (UE side, informative)

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Malmö, Sweden, 20-24 Sept 1999

Document R2-99c47

3G CHANGE REQUEST

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TS25.321 **CR** **018** Current Version: 3.0.0

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

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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: *(at least one should be marked with an X)* USIM [ ] ME [X] UTRAN [X] Core Network [ ]

Source: Ericsson **Date:** 24/09/99

Subject: Removal of MAC function for system information and paging scheduling

3G Work item:

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

F	Correction	[ ]
A	Corresponds to a correction in a 2G specification	[ ]
B	Addition of feature	[ ]
C	Functional modification of feature	[ ]
D	Editorial modification	[X]

Reason for change: It has been agreed that RRC will handle the scheduling of system information and paging. This CR proposes to remove that function from the list of MAC functions.

Clauses affected: 6.1

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:


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6.1 Description of the MAC functions

The functions of MAC include:

- Mapping between logical channels and transport channels.
- Selection of appropriate Transport Format for each Transport Channel depending on instantaneous source rate
- Priority handling between data flows of one UE
- Priority handling between UEs by means of dynamic scheduling
- Priority handling between data flows of several users on the the DSCH and FACH
- ~~Scheduling of broadcast, paging and notification messages~~
- Identification of UEs on common transport channels
- Multiplexing/demultiplexing of higher layer PDUs into/from transport blocks delivered to/from the physical layer on common transport channels
- Multiplexing/demultiplexing of higher layer PDUs into/from transport block sets delivered to/from the physical layer on dedicated transport channels
- Traffic volume monitoring
- Monitoring the links of the assigned resources
- Routing of higher layer signalling
- Maintenance of a MAC signalling connection between peer MAC entities
- Dynamic Transport Channel type switching
- Ciphering for transparent RLC

The following potential functions is regarded as further study items:

- Processing of messages received at common control channels
- Successive Transmission on RACH
- Access Service Class selection for RACH transmission.

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Malmö, Sweden, 20-24 September 1999

3G CHANGE REQUEST

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TS 25.321	**CR**	**019 r1**	Current Version:	3.0.0

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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: *(at least one should be marked with an X)* USIM [ ] ME [X] UTRAN [X] Core Network [ ]

Source: Siemens **Date:** 24/09/99

Subject: RACH transmission control procedure on MAC for TDD mode

3G Work item:

Category: *(only one category Shall be marked with an X)*

F	Correction	[ ]
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: The present version of TS 25.321 includes a RACH transmission control procedure for FDD mode, which had to be reviewed for the TDD mode. This CR proposes the modifications (simplification of present procedure) for TDD.

Clauses affected: Sec. 11.2

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:

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1. Scope
2. References
3. Definitions, abbreviations and symbols
4. General
5. Services provided to upper layers
6. Functions
7. Services expected from physical layer
8. Elements for layer-to-layer communication
9. Elements for peer-to-peer communication
10. Handling of unknown, unforeseen and erroneous protocol data
11. Elementary procedures

11.1 Dynamic radio bearer control in UE

11.2 Control of RACH transmissions

~~[Note: This procedure has to be reviewed for FDD and TDD operation]~~

The MAC sublayer is in charge of controlling the timing of RACH transmissions on transmission time interval level (i.e. on 10 ms-radio frame level; the timing on access slot level is controlled by L1). Note that retransmissions in case of erroneously received RACH message part are under control of higher layers, i.e. RLC, or RRC for CCCH (and SHCCH for TDD).

11.2.1 Control of RACH transmissions for FDD

11.2.2 Control of RACH transmissions for TDD

The RACH transmissions are performed by the UE as shown in Figure 11.2.2. Note that the figure shall illustrate the operation of the transmission control procedure as specified below. It shall not impose restrictions on implementation.

MAC receives the following RACH transmission control parameters from RRC with the CMAC-Config-REQ primitive:

- persistence value P (transmission probability),
- Access Service Class parameters

Based on the persistence value P, the UE decides whether to send the message on the RACH. If transmission is allowed, the PRACH transmission procedure is initiated by sending of a PHY-Data-REQ primitive. If transmission is not allowed, a new persistency check is performed in the next transmission time interval. The persistency check is repeated until transmission is permitted.

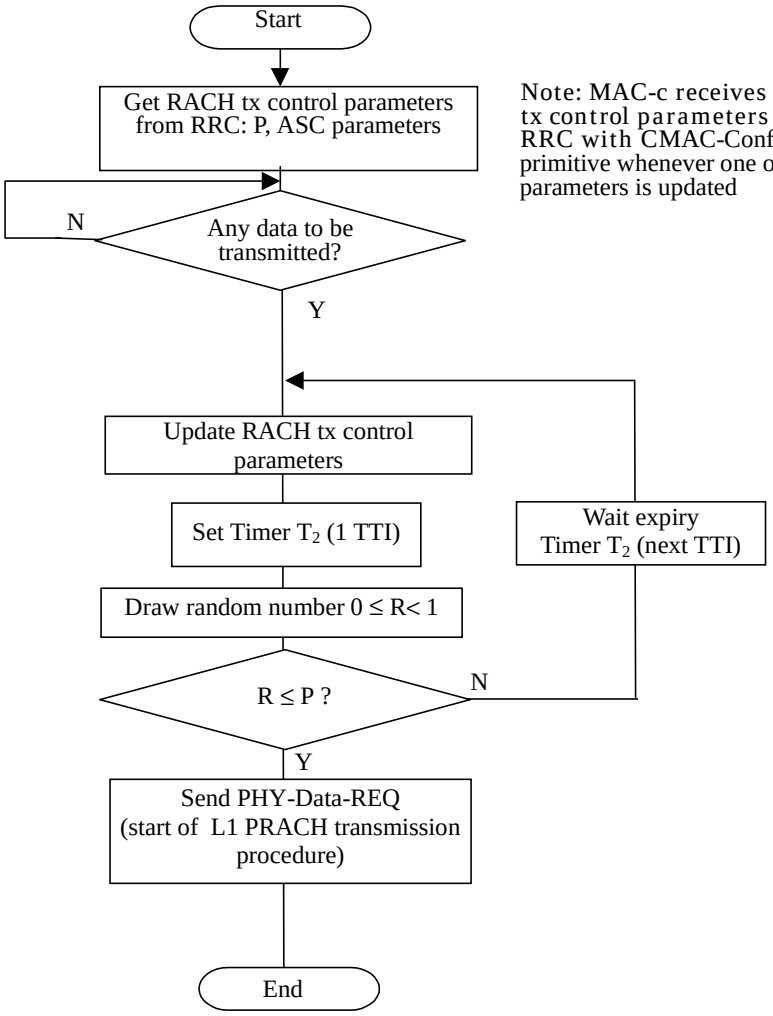

Figure 11.2.2 : RACH transmission control procedure for TDD (UE side, informative)

3GPP TSG-RAN WG2 meeting #7 ***Document*** ***R2-99d02***

Malmö, Sweden, 20-24 September 1999

3G CHANGE REQUEST

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TS 25.321 **CR** **020 r1** Current Version: 3.0.0

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

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

Source: Ericsson **Date:** 24/09/99

Subject: MAC procedure for control of CPCH transmission

3G Work item:

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

F	Correction	[ ]
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: Added procedure to specify MAC control of CPCH transmission.

Clauses affected: 11.3 (new clause added)

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:

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11.3 Control of CPCH Transmission

The MAC layer controls the timing of CPCH transmissions on transmission time interval level (i.e. on 10, 20, 40 or 80 ms level); the timing on access slot level is controlled by L1. MAC controls the timing of each initial preamble ramping cycle as well as successive preamble ramping cycles. Note that retransmissions in case of erroneously received CPCH message part are under control of higher layers (i.e. RLC, or RRC for CCCH data). The CPCH transmissions are performed by the UE as illustrated in Figures 11.3.1 and 11.3.2. Figure 11.3.1 procedure is used for initial access to CPCH channel. Figure 11.3.2 procedure is used for subsequent TTI transmissions while the UE continues to transmit on the CPCH channel obtained using the initial access procedure.

MAC receives the following CPCH transmission control parameters from RRC with the CMAC-Config-REQ primitive. A set of transmission control parameters is received for each CPCH channel in the CPCH set.

- persistence value, PV (transmission probability),
- Nap_retrans_max, maximum number of preamble ramping cycles,
- CPCH channel data rate (implicit in the UL channelisation code),
- NF_max, maximum frame length for CPCH transmission,
- Backoff control timer parameters,
- others (ffs., e.g. maximum data rate limit for this UE).

The MAC procedure for transmission control of first TTI shall be invoked when the UE has data to transmit and the UE is not currently transmitting on a previously accessed CPCH channel. The steps for this procedure are listed here:

1. The UE shall reset counters M1, M2 and Frame Count Transmitted (FCT) upon entry to the first TTI procedure.
2. The UE shall clear the Busy Table and build a transport block set for the next TTI.
3. The UE shall update the CPCH transmission control parameters, including CPCH Set Info, Persistency PV, Nap_retrans_max, priority delays, NF_max, Backoff timer parameters, etc.
4. UE shall select a CPCH channel from the set of CPCH channels defined in the CPCH set which is assigned for use on the transport channel with data to be transmitted. UE shall use the persistence value, the CPCH channel capacity (max CPCH length and data rate), availability table information, and busy table information to select one CPCH channel for L1 to access. UE shall maintain an availability table which timestamps CPCH busy/idle indications received from L1. L1 uses best efforts to monitor AICHs broadcast by Node B to all UEs. When an AP-AICH_ack or AP-AICH_nak is received by L1, a PHY-Status_IND is sent to MAC indicating that that CPCH channel is busy. When a CD-AICH_nak (IDLE-AICH) is received by L1, a PHY-Status_IND is sent to MAC indicating that that CPCH channel is idle. This information shall be recorded in the availability table to permit UE to select a CPCH channel which is most likely idle and available for use. In addition UE shall maintain a busy table for each CPCH intial access attempt. The busy table marks a CPCH channel as busy when a selected channel fails the persistence test or when an AP-AICH_nak is received in response to an access attempt. (an example channels selection algorithm is presented at the end of this section.)
5. UE shall implement a test based on the Persistence value (PV) to determine whether to attempt access to the selected CPCH channel. If access is allowed, the UE shall implement an initial delay based on priority of the data to be transmitted, then shall sent the TTI transport block set to L1 for CPCH access and transmission. If the PV test does not allow transmission, the selected CPCH channel shall be marked busy in the Busy Table. If all channels are marked busy, the UE shall reset and start timer Tboc1, wait until timer expiry, and increment counter M2. If counter M2 is equal to N_ap_retrans_max, the UE shall execute an access failure error procedure and the CPCH transmit procedure ends. If counter M2 is less than N_ap_retrans_max, the procedure shall continue from step 2. If all channels are not marked busy, the UE shall resume the procedure from step 3.

6. After the UE has sent the transport block set to L1 for transmission, L1 may return one of five status indications to MAC as shown in Figure 11.3.1. If the L1 status is that the TTI transport block set was sent normally, then UE shall increment the Frame Count Transmitted counter by the length of the TTI just transmitted and the procedure ends.
7. If L1 status is no AP-AICH received or no CD-AICH received, the UE shall reset and start timer Tboc3, wait until timer expiry, and increment counter M1. If counter M1 is equal to Nap_retrans_max, the UE shall execute a link failure error procedure and the CPCH transmit procedure ends. If counter M1 is less than Nap_retrans_max. UE shall select another CPCH channel and proceed from step 3.
8. If L1 status is AP-AICH_nak received, the UE shall reset and start timer Tboc2, wait unitl timer expiry, and mark the selected channel busy in the Busy Table. If all channels are marked busy, the UE shall reset and start timer Tboc1, wait until timer expiry, and increment counter M2. If counter M2 is equal to N_ap_retrans_max, the UE shall execute an access failure error procedure and the CPCH transmit procedure ends. If counter M2 is less than N_ap_retrans_max, the procedure shall continue from step 2. If all channels are not marked busy, the UE shall resume the procedure from step 3.
9. If L1 status is CD-AICH signature mismatch, the UE shall reset and start timer Tboc4, wait until timer expiry, and increment counter M2. If counter M2 is equal to N_ap_retrans_max, the UE shall execute an access failure error procedure and the CPCH transmit procedure ends. If counter M2 is less than N_ap_retrans_max, the procedure shall continue from step 2.

The MAC procedure for transmission control of subsequent TTIs shall be invoked when the UE has data to transmit and the UE is currently transmitting on a previously accessed CPCH channel. The steps for this procedure are listed here:

1. The UE shall build a transport block set for the next TTI.
2. If the sum of the Frame Count Transmitted counter plus the number of frames in the next TTI is greater than NF_max, the UE shall exit this procedure and start the MAC procedure for CPCH transmission of the first TTI. This shall release the CPCH channel in use and the UE will contend again for a new CPCH channel to continue transmission. If the sum of the Frame Count Transmitted counter plus the number of frames in the next TTI is greater than NF_max, the UE shall send the transport block set to L1 to continue transmission on the CPCH channel which has previously been accessed.
3. If L1 returns status of transmission error, the UE shall execute a transmission error procedure and the CPCH transmit procedure ends.
4. If the L1 returns status of normal transmission, then the UE shall increment the Frame Count Transmitted counter by the length of the TTI just transmitted and the procedure ends.

Table 11.3: CPCH Backoff Delay Timer Values

Timer	Based on parameter	Fixed/random	Suggested parameter range (informative)
T_{BOC1} (all Busy)	NF_bo_all_busy	Random	1 - 16 frames
T_{BOC2} (channel Busy)	NS_bo_busy	Fixed	0 - 15 access slots
T_{BOC3} (no AICH)	NF_bo_no_aich	Fixed	1 - 16 frames
T_{BOC4} (collision)	NF_bo_collision	Random	10 – 100 frames

For $T_{BOC4,}$ UE shall randomly select a timer value at each execution of the timer. A uniform random draw shall be made to select an integer number of frames within the range [1, NF_bo_collision]. For $T_{BOC1,}$ UE would randomly select a timer value at each execution of the timer. A uniform random draw shall be made to select an integer number of frames within the range [1, NF_bo_all busy].

Example CPCH Channel Selection Algorithm:

The UE MAC channel selection algorithm is left to implementation and is out of the scope of this specification. However the following example is presented to show one way UE may select a CPCH channel. In this example CPCH channel selection is a 4 step process:

1. From the set of all channels defined in the CPCH set, UE eliminates all channels marked busy in the busy table.
2. Then it selects from the non-busy channels the set of channels with capacity adequate to transmit the amount of queued data in a single packet. If there are none, then it selects the highest capacity channel and selection is complete.
3. If there are multiple channels selected at step 2, UE uses availability table information to select one channel. If any of the channels have a timestamped IDLE-status in the availability table, one of these is selected randomly and selection is complete.
4. If none of the channels selected at step 2 have a timestamped IDLE-status in the availability table, the channel with the oldest BUSY-status is selected.

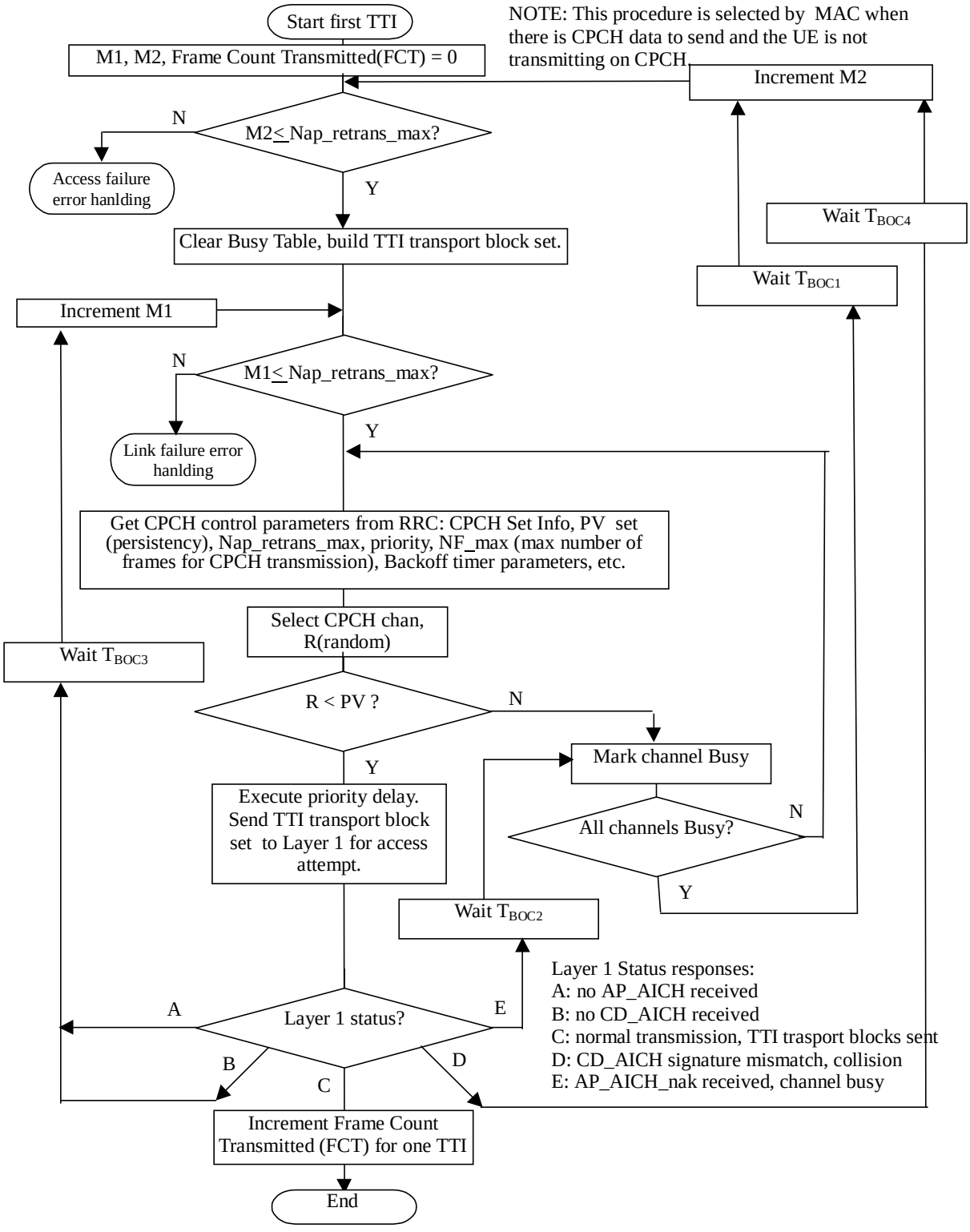
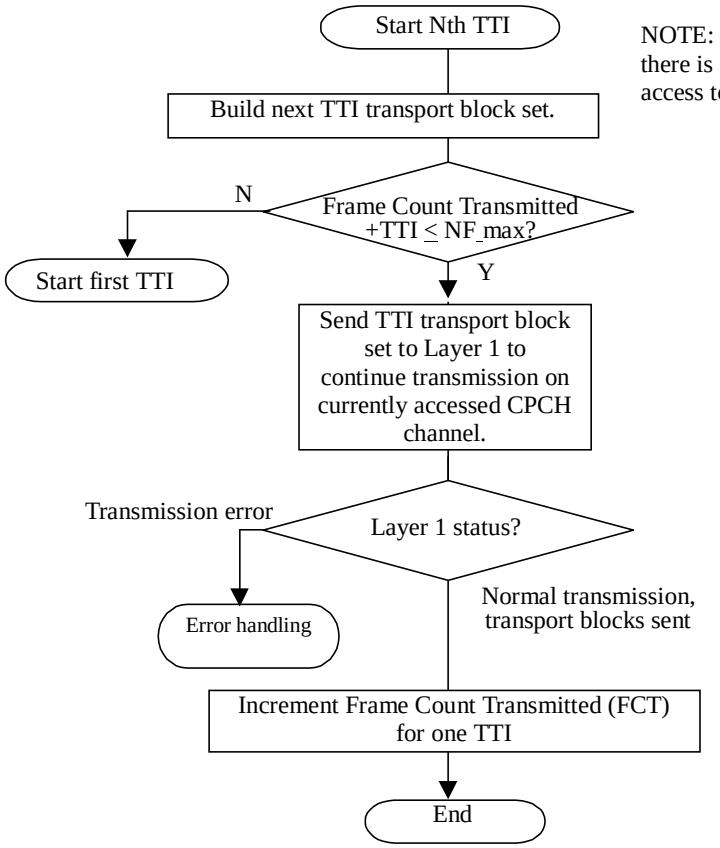


Figure 11.3.1: CPCH transmission control procedure for first TTI (informative)



NOTE: This procedure is selected by MAC when there is CPCH data to send while the UE has access to a CPCH channel.

Figure 11.3.2: CPCH transmission control procedure for Nth TTI (informative)

3GPP TSG-RAN WG2 meeting #7 ***Document R2-99d01***

Malmö, Sweden, 20-24 September 1999

3G CHANGE REQUEST

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

TS 25.321 **CR** **021 r1** Current Version: 3.0.0

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

For submission to TSG RAN#5 *list TSG meeting no. here ↑* for approval [X] for information [ ] *(only one box should 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: *(at least one should be marked with an X)* USIM [ ] ME [X] UTRAN [X] Core Network [ ]

Source: Ericsson **Date:** 24/09/99

Subject: Removal of Annex A and B of TS 25.321

3G Work item:

Category: *(only one category Shall be marked with an X)*

F	Correction	[ ]
A	Corresponds to a correction in a 2G specification	[ ]
B	Addition of feature	[ ]
C	Functional modification of feature	[ ]
D	Editorial modification	[X]

Reason for change: It is proposed to remove Annex A since this information has been agreed in WG2 to be moved into TS 25.303, see CR 009 to TS 25.303. Also, the information contained in Annex B for CPCH will be covered by the main part of TS 25.321 provided that CR 0xx to TS 25.321 (R2-99d02) will be accepted.

Clauses affected: Annex A and B

Other specs Affected:

Other 3G core specifications	[ ]	→ List of CRs:	TS 25.303 CR 009
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.

Annex A (informative):

Description of random access procedure

[Note: This annex has to be reviewed for FDD and TDD operation]

A.1 Assumptions

The following assumptions for RACH transmission are made (for completeness assumptions are made also for other layers than MAC):

UE side:

- PRACH transmissions are triggered by data request from MAC to PHY (PHY-Data-REQ). This implies that any desired backoff in PRACH transmissions is controlled by MAC (or higher layer).
- The physical layer uses the PHY-Status-IND primitive to indicate the following conditions to MAC:
- Maximum preamble transmit power reached, no acknowledgement on AICH received,
- Negative acknowledgement received on AICH ("Nack") indicating that the preamble has been acquired, but transmission of the message shall be suspended,
- Positive acknowledgement received on AICH ("Ack"), RACH message has been transmitted,
- The following PRACH parameters are configured by RRC through C-SAP by means of CPHY-TrCH-Config-REQ primitive:
- initial transmit power,
- power ramping step size,
- preamble-to-message transmit power offset,
- PRACH maximum power
- PRACH spreading code,
- Access Service Class (ASC) parameters (ffs.).
- Configuration of AICH parameters by RRC (using CPHY-TrCH-Config primitive)
- AICH spreading code
- timing information for search of acquisition indicator (if needed)
- The following parameters are randomly selected by the physical layer (possibly within constraints defined by ASC parameters):
- PRACH initial access slot,
- PRACH signature

UTRAN side:

- Continuous monitoring of the PRACH is handled by layer 1 procedures. There is only a single primitive needed between PHY and MAC, indication of data (PHY-Data-IND).

A.2 Example message sequence for random access procedure

RACH transmissions are split into two phases, preamble power ramping and message transmission. The message is transmitted when acquisition of the preamble has been acknowledged, where a fixed timing between that last transmitted

preamble, the acquisition indicator and the message needs to be maintained. Under certain conditions (see below) it will be necessary to perform multiple attempts of preamble power ramping before the message can be sent.

The timing of RACH transmissions on transmission time interval level is controlled by the MAC sublayer (i.e. introduction of backoff delay based on transmission time interval units).

An example message sequence for random access is shown in Figure 1. RACH transmission is performed as follows:

The RACH and AICH are configured once via a CPHY-TrCH-Config-REQ primitive. This primitive needs to be issued only for initial configuration or when a parameter shall be changed, not for every RACH transmission.

The CMAC-Config-REQ primitive is used to configure MAC parameters required for the random access procedure. The parameters could include random access control parameters such as, e.g. persistence value, maximum number of preamble ramping cycles, and minimum and maximum backoff time in terms of number of transmission time intervals (i.e. radio frames of 10 ms) when transmission is allowed.

[Note: Above listed access control parameters are only examples for further study. Also it is ffs how the access control parameters are obtained by RRC from e.g. broadcast information.]

When there is data to be transmitted on the RACH, i.e. reception of a MAC-Data-REQ primitive, the RACH transmission control procedure is started.

After some initial backoff, a primitive PHY-Data-REQ is sent to L1, which triggers the PRACH preamble transmission procedure, i.e. the physical layer selects a PRACH access slot without further backoff delay imposed on L1 (possibly within ASC constraints). Note that the initial backoff time may in certain conditions be set to zero (e.g. when the uplink load is low).

In the example it is assumed that the preamble power ramping procedure is completed with one of the following conditions:

(i)maximum permitted transmission power was reached without receiving an acknowledgement, or

(ii)a negative acknowledgement (Nack) has been received on AICH.

The first condition can be due to following reasons:

1.)missed preamble in Node B at max power due to detection probability <1,

2.)collision with another user,

3.)an acknowledgement was sent but it was missed at the UE.

This condition should occur very rarely and may not necessarily require backoff for a repetition of the preamble ramping cycle (except case 1.) is due to overload, which however should be prevented by the system in some suitable way). However some backoff should be imposed to provide a better interference distribution over time.

The second condition, reception of "Nack" on AICH, shall be used to prevent the user from sending his message in case of danger of a temporary congestion (it could be ignored by "special users"). In this case, a new access attempt should be started by MAC after some further backoff delay. Note that this "subsequent" backoff time might be calculated differently than the *initial* backoff time applied in the first preamble power ramping cycle. Also, the subsequent backoff time may be set differently for either of the above conditions (i) and (ii).

This condition could occur a number of consecutive times. The number of preamble ramping cycles is counted on MAC. When the maximum number of cycles is exceeded an error condition is signaled to RRC (with CMAC-Status or CMAC-Error primitive, ffs.) and the MAC PDU is removed.

Upon successful transmission of a preamble, MAC receives an acknowledgement via PHY-Status-IND primitive that the acquisition indicator was received and the message sent.

At the UTRAN side MAC the further processing of received RACH message depends on the MAC header. An acknowledgement that the message was received correctly is either be given by RRC procedure or by a RLC retransmission procedure, depending on the type of the message. The parameters of PRACH transmission are chosen such that retransmission of the messages is a very rare event. Incorrectly received messages should **not** be due to overload situations since this condition should have been signaled via the Nack on AICH after preamble acquisition. It is thus not needed to impose an additional outer backoff time for retransmission of the message. Message retransmission shall be handled entirely on RLC, or RRC for CCCH messages, employing retransmission timers.

It should be noted that for transmission on common transport channels some parameters of the RLC retransmission protocol may need to be updated to cope with delays introduced by the MAC RACH transmission control function.

[Note: An additional negative acknowledgement (Nack) given by L1 for erroneously received RACH message part is ffs.]

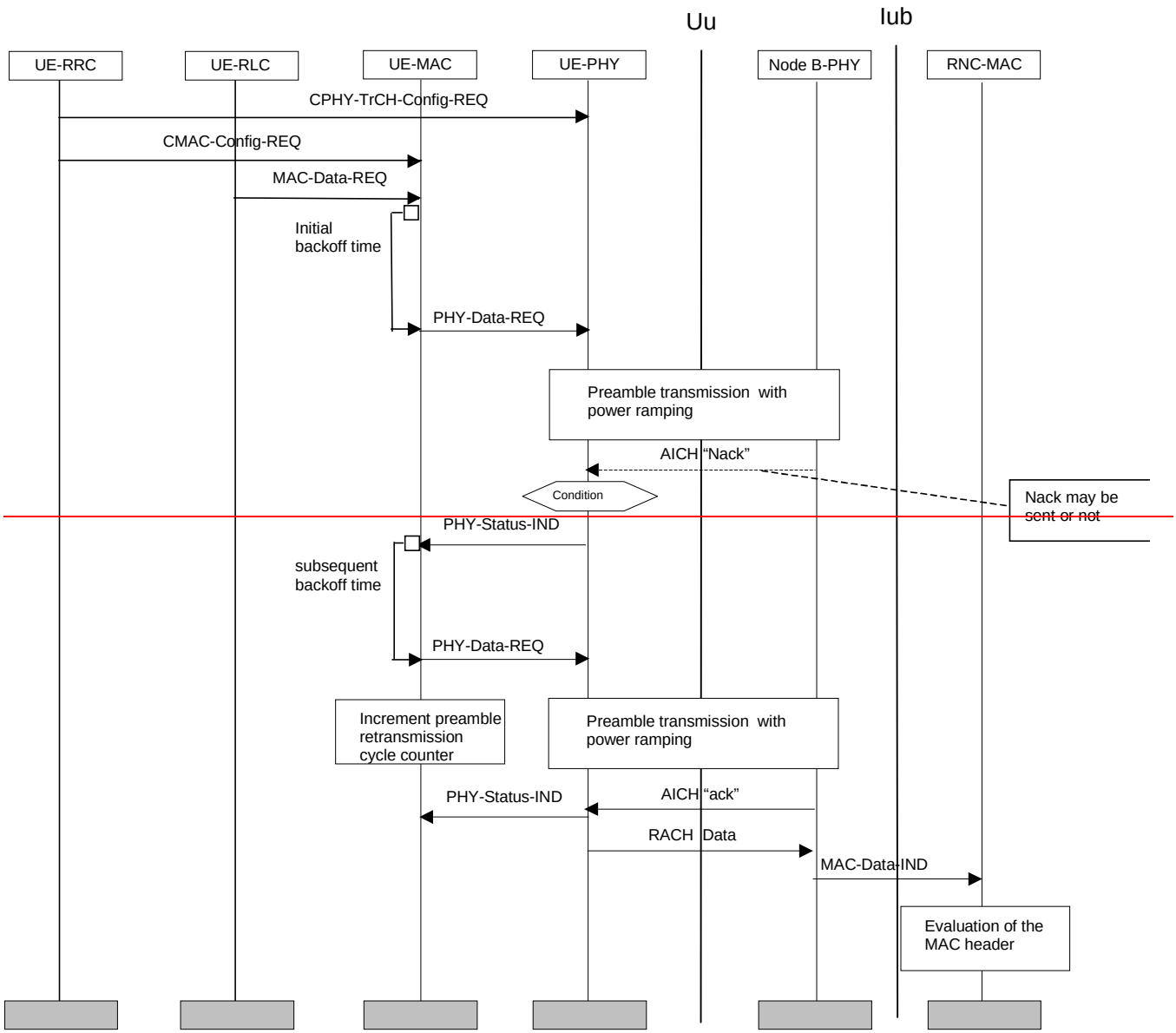


Figure A.1: Example random access transmission sequence

ANNEX B (informative):

Control of CPCH

B.1 Overview

The Common Packet Channel (CPCH) is multi access contention based transport channel in the uplink .

The MAC may multiplex control and user data from multiple logical channels in the same CPCH transmission. The MAC functions associated with the CPCH are

- Scheduling
- Multiplexing/demultiplexing
- Inband identification of UEs

Procedures associated with the CPCH are
- CPCH access procedure (see Annex B in TS25.301[2])

B.2 Scheduling of control and user data transmission

Scheduling of control and data transmission on CPCH is similar to that of RACH (cf. 14.2.4.2).

Transmission scenarios for CPCH include:
- Initial CPCH transmission
- CPCH Busy Retransmission
- Collision Detected Retransmissio

B.3 Multiplexing/demultiplexing of higher layer PDUs to/from CPCH transport blocks

UE MAC supports service multiplexing for CPCH transport channels similar to the RACH (cf. 14.2.4.3).

B.4 Inband Identification of UEs

Inband identification of UEs for the CPCH is identical to that for the RACH (cf. 14.2.4.4)

B.5 Selection of CPCH Channel

UE MAC monitors the availability of the CPCH channels in the CPCH Set allocated to the UE. UE MAC selects an available channel considering RNC persistency parameter and the capacity of the CPCH. If access to the selected CPCH is denied, channel reselection and retransmission may occur.