3GPP TSG-RAN WG2 meeting #7 ***Document*** ***R2-99a67***

Malmoe, 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.

TS25.321	CR	003r1	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: Siemens AG / Interdigital **Date:** 24/08/99

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:

help.doc

<--------- 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 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-sh transfers data from the DSCH to the MAC-d and from the MAC-d to the USCH under control of the ~~FACH~~RRC. In the FDD implementation, the MAC-c may transfer data from the MAC-d to the CPCH.

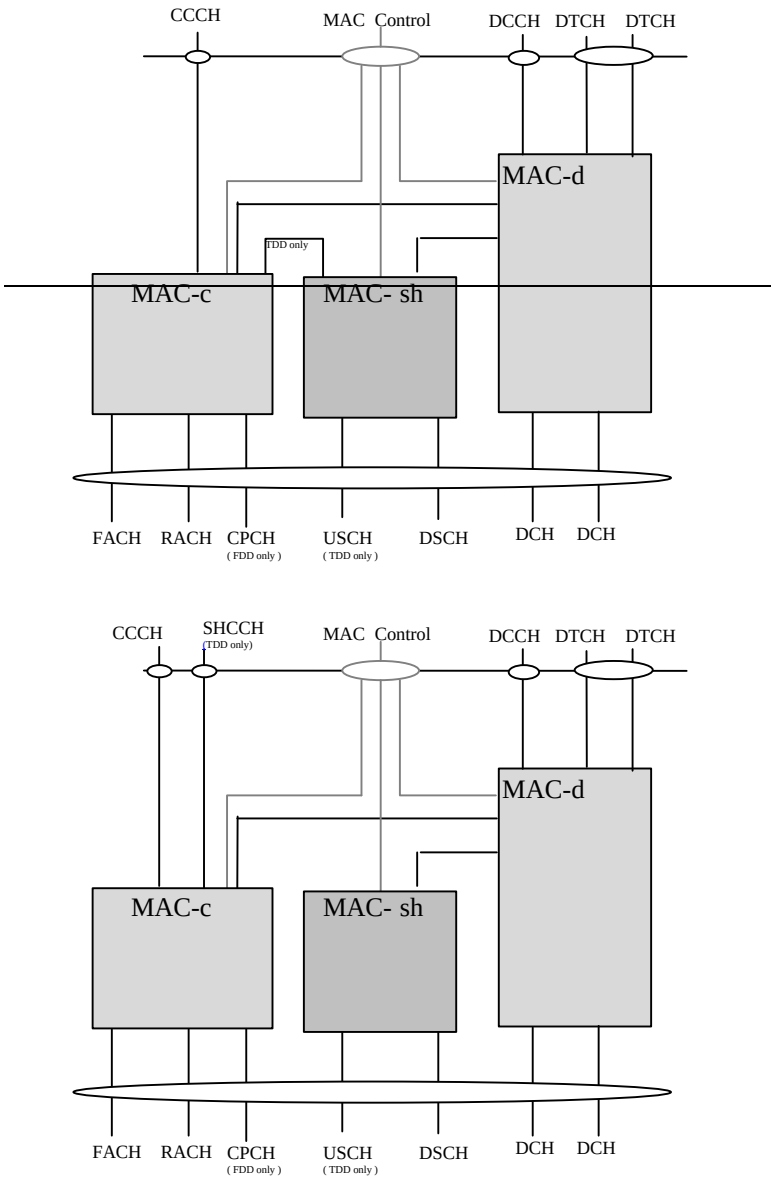
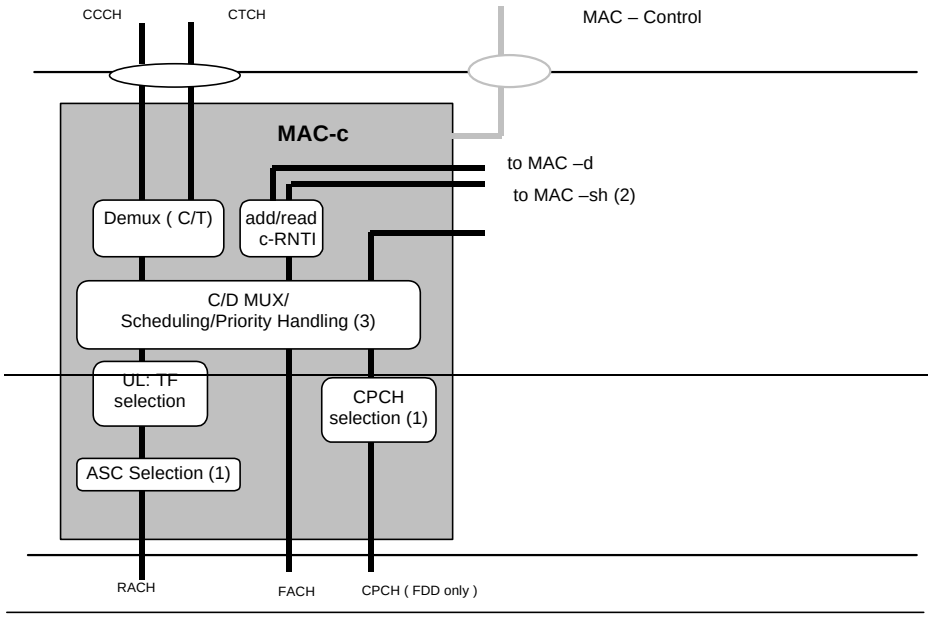


Figure 4.2.3.1 UE side MAC architecture

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.		

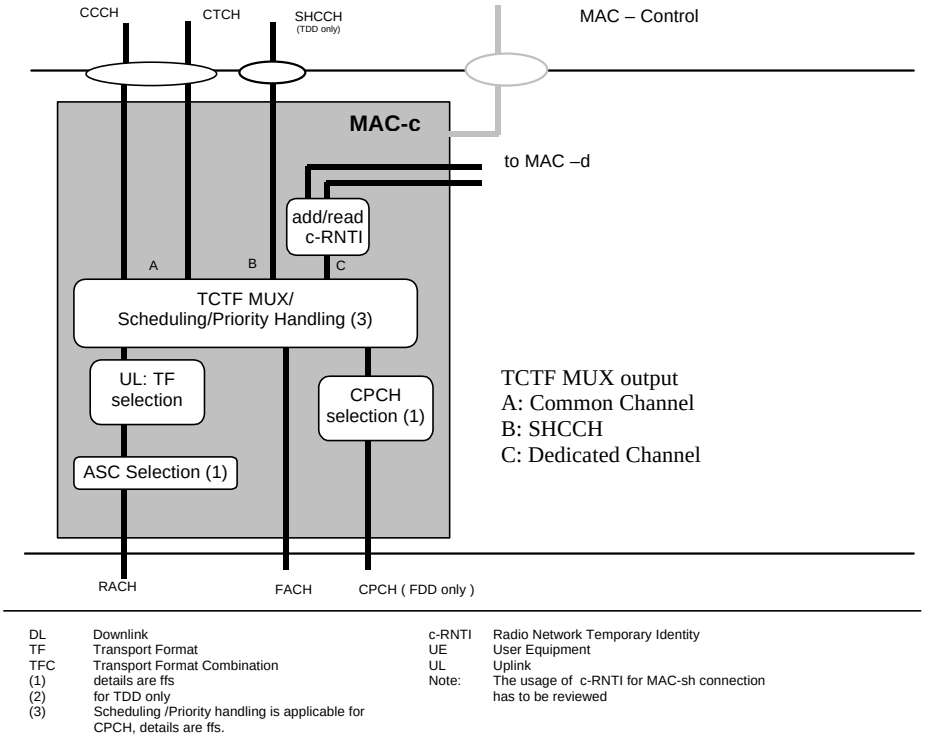
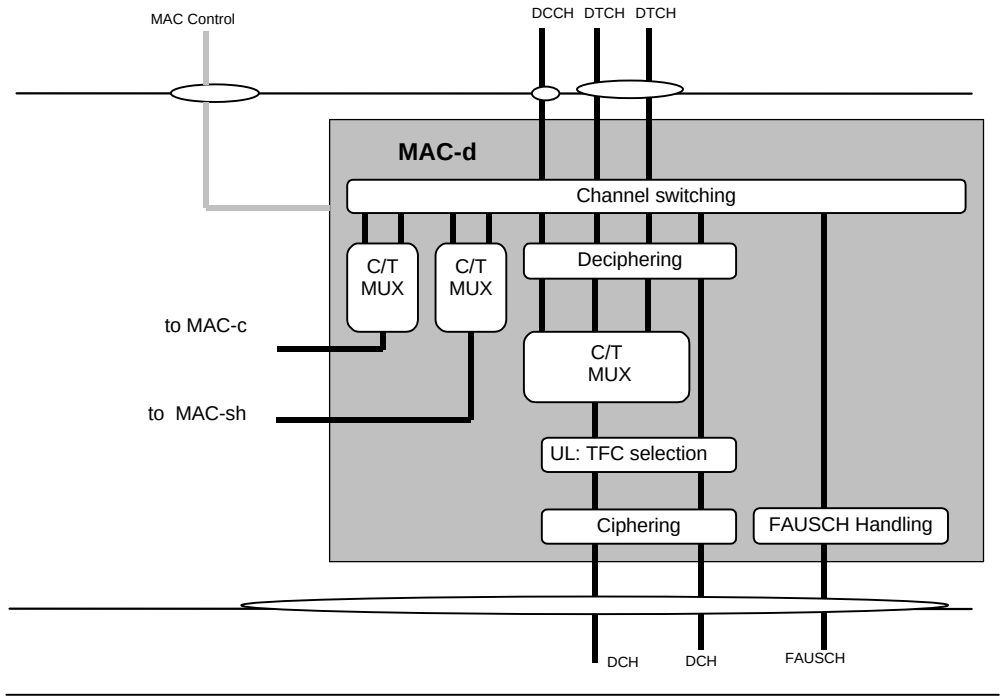


Figure 4.2.3.2. UE side MAC architecture / MAC-c details

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.



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

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

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

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

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

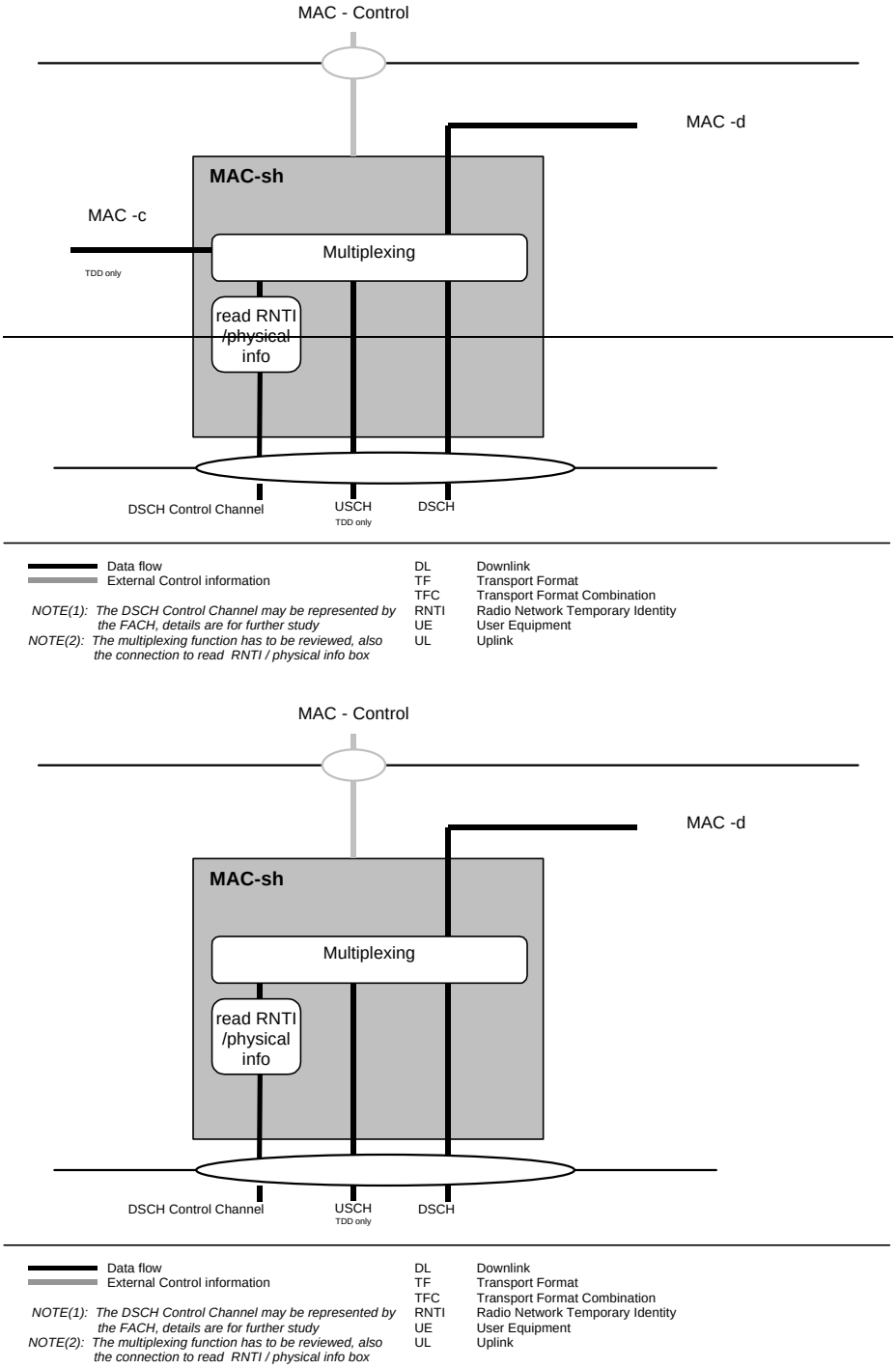


Figure 4.2.3.4. UE side MAC architecture / MAC-sh details

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.

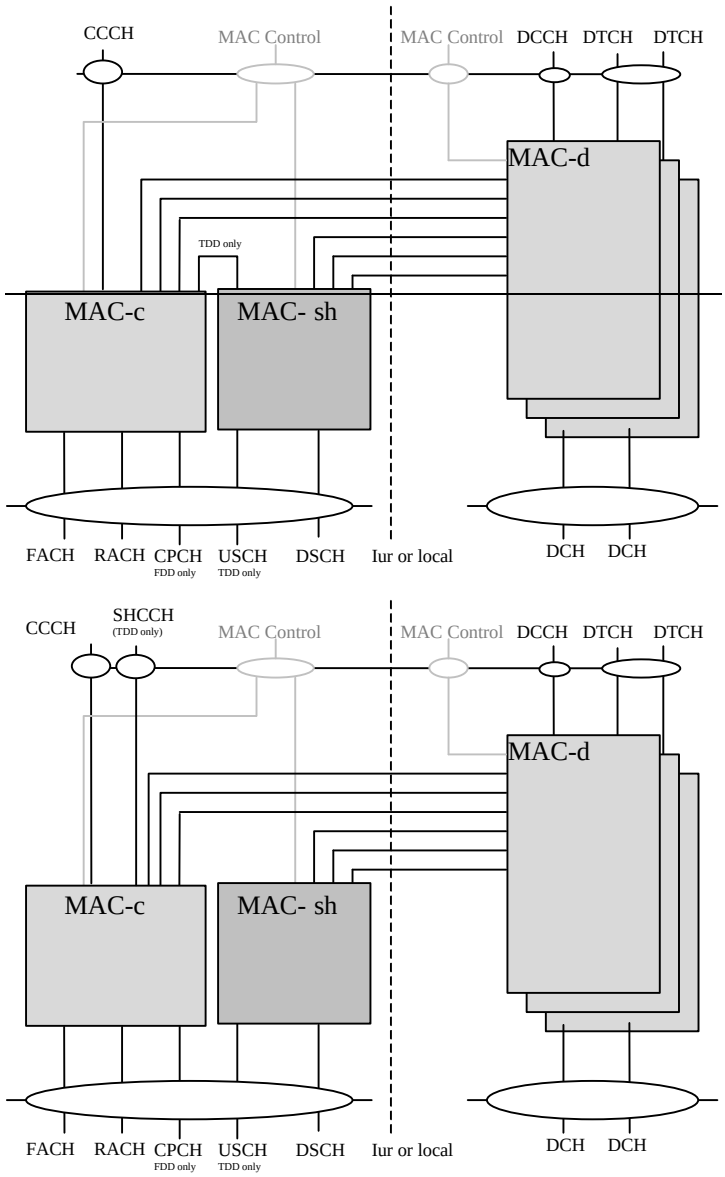


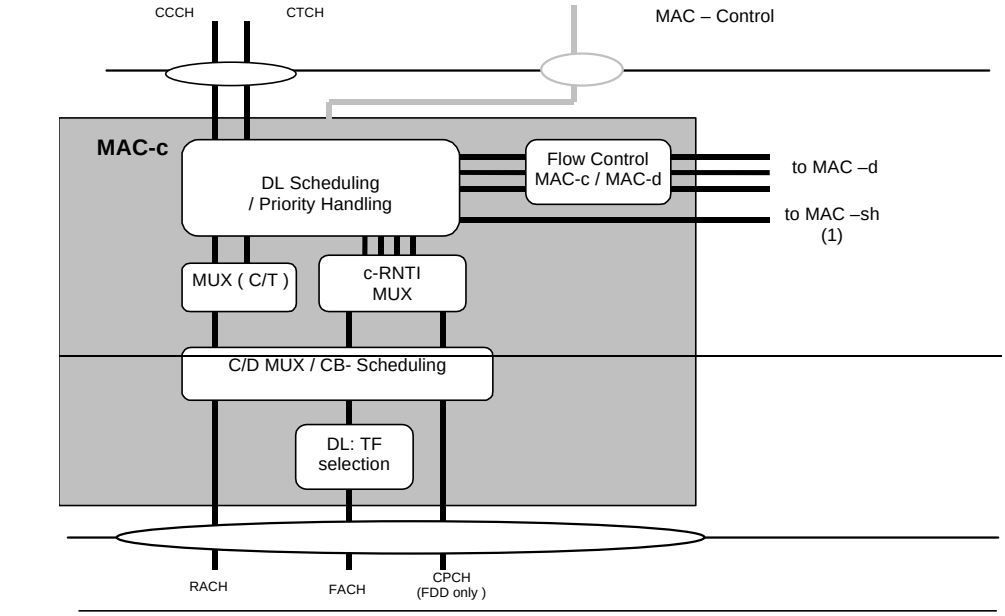
Figure 4.2.4.1: UTRAN side MAC architecture

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.

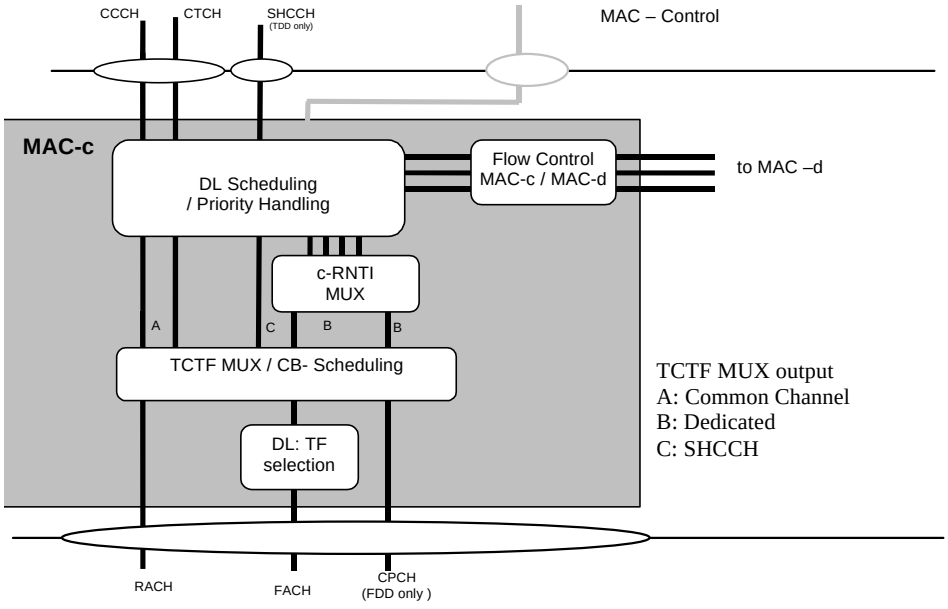
~~The C/D box represents the insertion and detection of the field in the MAC header, indicating whether a common or dedicated logical channel is used.~~

- 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
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

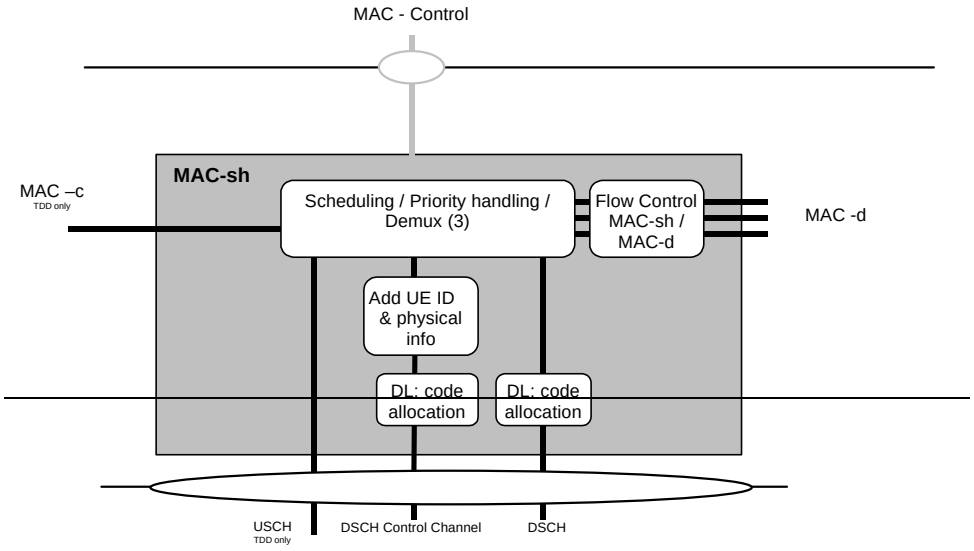
Figure 4.2.4.2 UTRAN side MAC architecture / MAC-c details

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.)

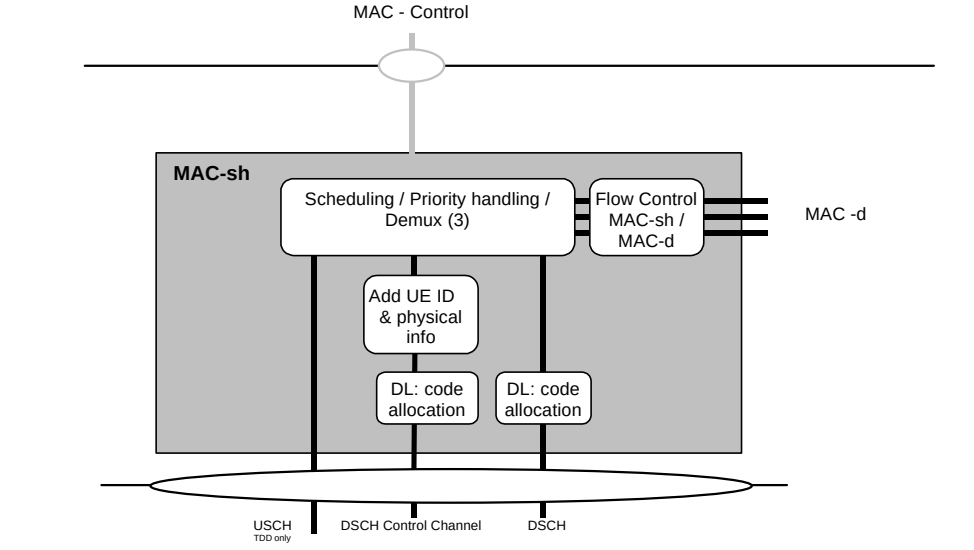
The RLC has to provide RLC-PDU's to the MAC which fits into the available transport blocks on the transport channels respectively.



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:

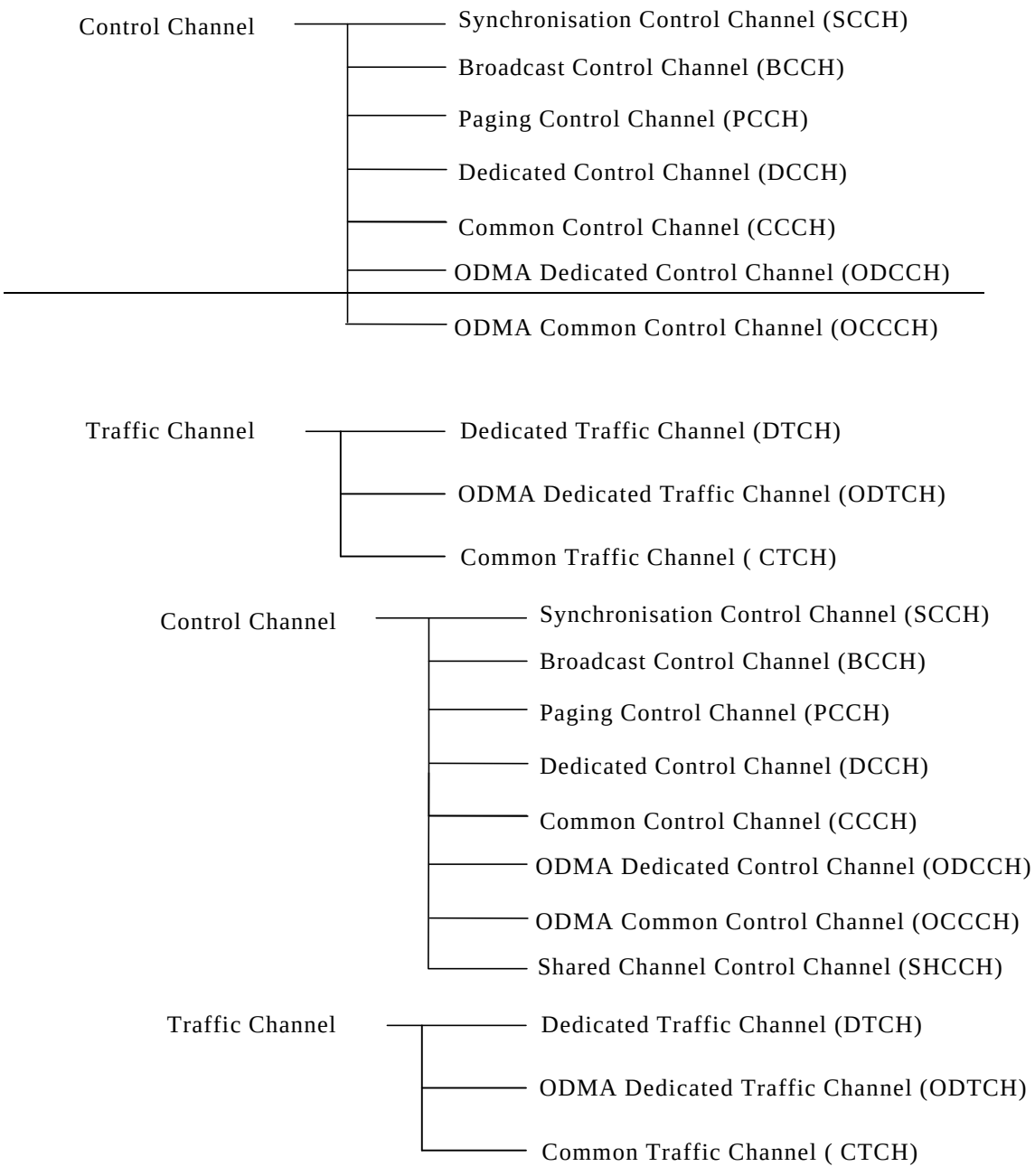


Figure 4.3.2.1 : Logical channel structure

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.

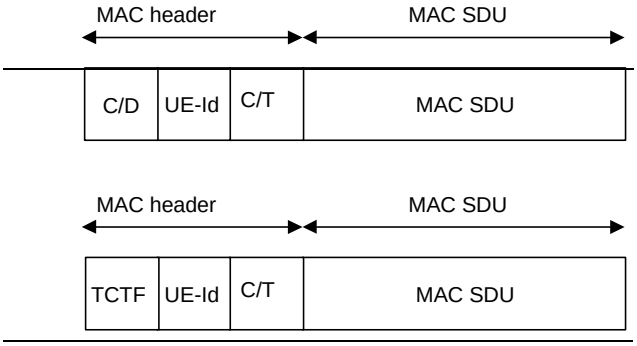


Figure 9.1.1.1 MAC data PDU

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.

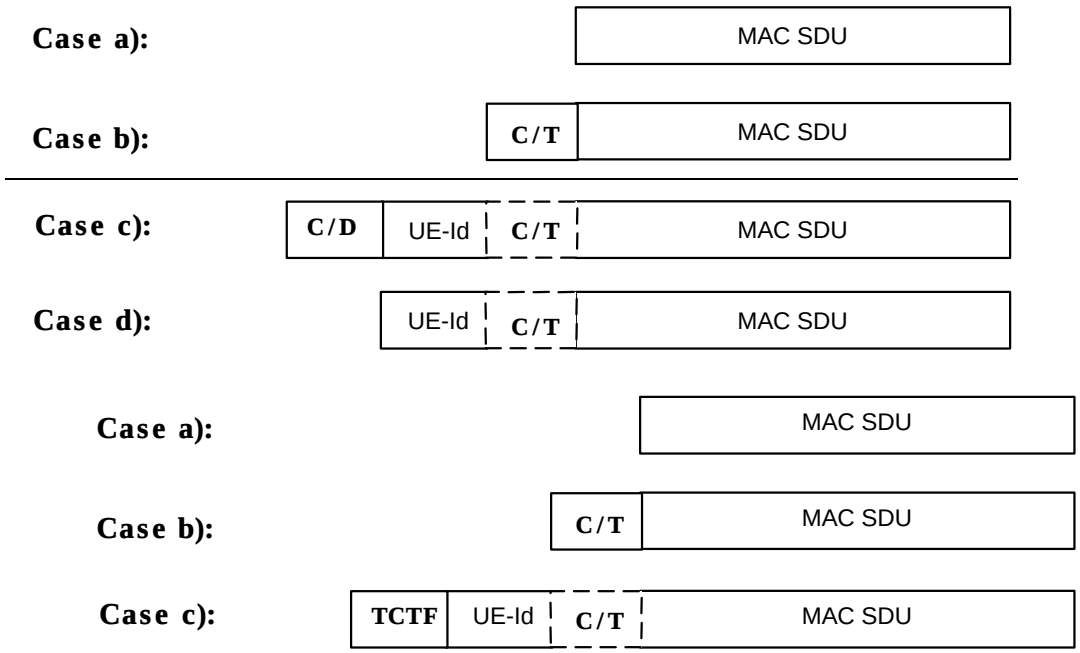


Figure 9.2.2.1: MAC Data PDU formats for DTCH and DCCH

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.

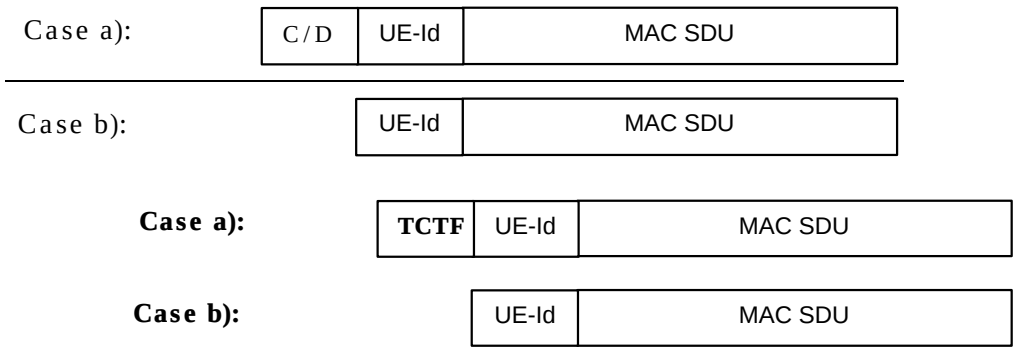


Figure 9.2.1.2.1 : MAC Data PDU formats for CCCH

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

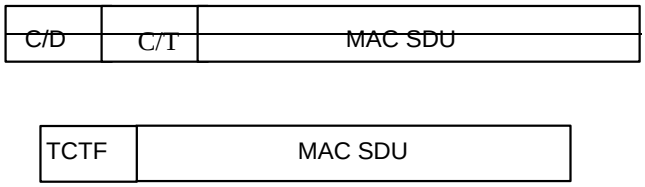


Figure 9.2.1.3.1 : MAC Data PDU format for CTCH

~~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:

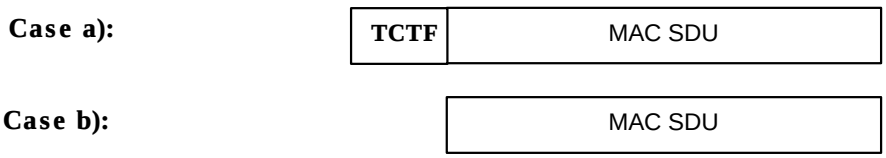


Figure 9.2.1.4.1 : MAC Data PDU format for SHCCH

~~*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.)*~~