TSG-RAN Meeting #10 **_RP-000567_**
Bangkok, Thailand, 6 - 8 December 2000

Title: **Agreed CRs to TS 25.321**

Source: **TSG-RAN WG2**

Agenda item: **5.2.3**

Doc-1st-	Status-	Spec	CR	Rev	Subject	Cat	Version	Versio
R2-002073	agreed	25.321	053	2	Corrections to logical channel priorities in MAC Protocol	F	3.5.0	3.6.0
R2-002052	agreed	25.321	055	1	Removal of FAUSCH	F	3.5.0	3.6.0
R2-002398	agreed	25.321	056	2	General MAC clarification	F	3.5.0	3.6.0
R2-002360	agreed	25.321	057	1	Error Handling in MAC	F	3.5.0	3.6.0
R2-002358	agreed	25.321	058	1	Error handling for MAC RACH and CPCH transmission control procedure	F	3.5.0	3.6.0
R2-002262	agreed	25.321	059		Inclusion of stage 3 for ciphering	F	3.5.0	3.6.0

3GPP TSG-RAN WG2 Meeting #16 | ***Document* R2-002073**

Beijing, China, 9-13 October 2000

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25.321	**CR**	**053r2**	Current Version: 3.5.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑   *↑ CR number as allocated by MCC support team*

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list expected approval meeting # here ↑		for information		non-strategic		*use only)*

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from:* ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: *(at least one should be marked with an X)*	(U)SIM		ME	X	UTRAN / Radio	X	Core Network	

Source:	TSG-RAN WG2	**Date:**	October 11, 2000

Subject:	Corrections to logical channel priorities in MAC protocol
Work item:	

Category:	F	Correction	X	**Release:**	Phase 2	
	A	Corresponds to a correction in an earlier release			Release 96	
(only one category	B	Addition of feature			Release 97	
shall be marked	C	Functional modification of feature			Release 98	
with an X)	D	Editorial modification			Release 99	X
					Release 00	

Reason for change:	The existing relative priority scheme is complex and incomplete, and its usage has not been fully justified. This CR proposes a simpler absolute priority scheme for multiplexing logical channels, to maximize the transmission of high priority data.
Clauses affected:	11.4

Other specs affected:	Other 3G core specifications		→ List of CRs:	25.331 CR 542
	Other GSM core specifications		→ List of CRs:	
	MS test specifications		→ List of CRs:	
			→ List of CRs:	
	O&M specifications		→ List of CRs:	

Other comments:	

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11.4 Transport format combination selection in UE

RRC can control the scheduling of uplink data by giving a priority value between 1 and 8 for each logical channel where 1 is the highest priority and 8 the lowest. The selection of TFC in the UE shall be done according to the priorities between logical channels indicated by RRC. Logical channels have ~~relative~~ absolute priority i.e. ~~data with a given priority may occasionally be transmitted even if it prevents data with a higher priority from being transmitted~~the UE shall maximize the transmission of high priority data.

The scheme is performed each time a TFC selection is performed, i.e., each time the shortest configured TTI begins.

~~A fraction of the transport blocks on a logical channel may be blocked for transmission in favour of data from a logical channel with the next lower used priority. If the fraction is set to zero, the priority scheme will be absolute priority, i.e. no transport blocks on the logical channel shall be blocked for transmission in favour of lower priority data.~~

~~The maximum fraction of transport blocks on a logical channel that may be blocked for transmission in favour of data with the next lower priority is given by RRC signalling. The blocked transport blocks shall be selected in a periodical manner, with the shortest possible periodicity. If the shortest periodicity can be achieved in more than one way, the minimum distance between two blocked transport block shall be as large as possible, to assure that the blocked frames are distributed uniformly. The rules for TFC selection in the above section shall apply to TF selection when RACH or CPCH is used.~~

Consider the priorities N1..N2 (N2>N1) where data is available for transmission at the time the TFC selection is performed. Let S1 and S2 be sets of TFCs.

1. Let S2 be the set of all TFCs in the TFCS that can be supported at the current UE maximum transmitter power.

2. Priority N = N1.

3. S1 = S2.

4. If S1 contains one single TFC, select this TFC and end the procedure.

5. Let S2 be the set of all TFCs in S1 that allow the highest amount of available priority N data bits to be transmitted.

6. N = N + 1.

7. If N > N2, select anyone of the TFCs in S2 and end the procedure.

8. Go back to step 3.

The above rules for TFC selection in the UE shall apply to DCH, and the same rules shall apply for TF selection on RACH and CPCH.

When the UE output power is approaching the UE maximum transmit power and the inner loop for power control can no longer be maintained for coverage reasons, the UE shall adapt to the TFC corresponding to the next lower bit rate, i.e. the TFC with the present total bit rate shall not be used. If the bit rate of a logical channel carrying data from a codec supporting variable-rate operation is impacted, the codec data rate shall be adopted accordingly.

The UE shall continuously estimate whether the maximum transmitter power is sufficient to support the temporarily blocked TFC. When the maximum transmitter power is sufficient, the temporarily blocked TFC shall again be considered in the TFC selection.

The maximum UE power is defined in [25.331].

3GPP RAN WG2 Meeting #16
Beijing, 9st – 13th October 2000

***Document* R2-002052**
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25.321	**CR**	**055r1**	Current Version:	3.5.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	TSG-RAN #10	for approval	X	strategic	*(for SMG use only)*
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Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: (U)SIM [ ] ME [X] UTRAN / Radio [X] Core Network [ ]
(at least one should be marked with an X)

Source: TSG-RAN WG2 **Date:** 9/10/2000

Subject: Removal of FAUSCH

Work item:

Category:				**Release:**	
	F	Correction	X	Phase 2	
	A	Corresponds to a correction in an earlier release		Release 96	
(only one category	B	Addition of feature		Release 97	
shall be marked	C	Functional modification of feature		Release 98	
with an X)	D	Editorial modification		Release 99	X
				Release 00	

Reason for change: - FAUSCH don't belong to Release 1999. So, for the consistency with other specification, the contents related FAUSCH moved from the TS 25.321.

Clauses affected: 3.2, 4.1, 4.2.3.2, 4.2.4.2, 4.3.1, 4.3.3

Other specs affected:				
	Other 3G core specifications		→	List of CRs:
	Other GSM 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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3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the terms and definitions given in [9] and [1] apply.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

ASC	Access Service Class
BCCH	Broadcast Control Channel
BCH	Broadcast Channel
C-	Control-
CCCH	Common Control Channel
CPCH	Common Packet Channel (UL)
DCCH	Dedicated Control Channel
DCH	Dedicated Channel
DL	Downlink
DSCH	Downlink Shared Channel
DTCH	Dedicated Traffic Channel
FACH	Forward Link Access Channel
~~FAUSCH~~	~~Fast Uplink Signalling Channel~~
FDD	Frequency Division Duplex
L1	Layer 1 (physical layer)
L2	Layer 2 (data link layer)
L3	Layer 3 (network layer)
MAC	Medium Access Control
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
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
U-	User-
UE	User Equipment
UL	Uplink
UMTS	Universal Mobile Telecommunications System

USCH	Uplink Shared Channel
UTRA	UMTS Terrestrial Radio Access
UTRAN	UMTS Terrestrial Radio Access Network

4 General

4.1 Objective

The objective is to describe the MAC architecture and the different MAC entities from a functional point of view.

~~NOTE: FAUSCH is not part of release 99.~~

4.2 MAC architecture

The description in this subclause is a model and does not specify or restrict implementations.

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

4.2.1 MAC Entities

The diagrams that describe the MAC architecture are constructed from MAC entities.

The entities are assigned the following names.

- MAC-b is the MAC entity that handles the following transport channels:
  - broadcast channel (BCH)
- MAC-c/sh, is the MAC entity that handles the following transport channels:
  - paging channel (PCH)
  - forward access channel (FACH)
  - random access channel (RACH)
  - common packet channel (UL CPCH). The CPCH exists only in FDD mode.
  - downlink shared channel (DSCH)
  - uplink shared channel (USCH). The USCH exists only in TDD mode.
- MAC-d is the MAC entity that handles the following transport channels:
  - dedicated transport channels (DCH)

The exact functions completed by the entities are different in the UE from those completed in the UTRAN.

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.

4.2.2 MAC-b

The following diagram illustrates the connectivity of the MAC-b entity in a UE and in each cell of the UTRAN.

MAC-b represents the control entity for the broadcast channel (BCH).

There is one MAC-b entity in each UE and one MAC-b in the UTRAN for each cell.

The MAC Control SAP is used to transfer Control information to MAC-b.

The MAC-b entity is located in the Node B.

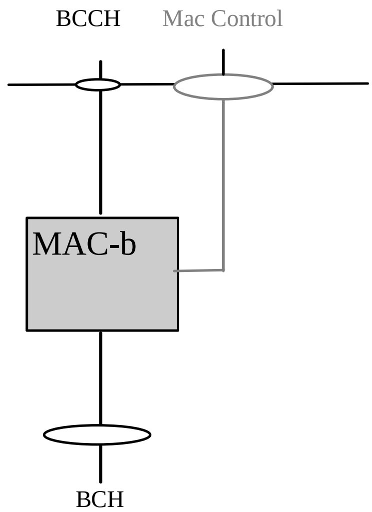


Figure 4.2.2.1: UE side and UTRAN side architecture

4.2.3 Traffic Related Architecture - UE Side

Figure 4.2.3.1 illustrates the connectivity of MAC entities.

The MAC-c/sh controls access to common transport channels.

The MAC-d controls access to dedicated transport channels.

If logical channels of dedicated type are mapped to common channels then MAC-d passes the data to MAC-c/sh via the illustrated connection between the functional entities.

The mapping of logical channels on transport channels depends on the multiplexing that is configured by RRC.

The MAC Control SAP is used to transfer Control information to each MAC entity.

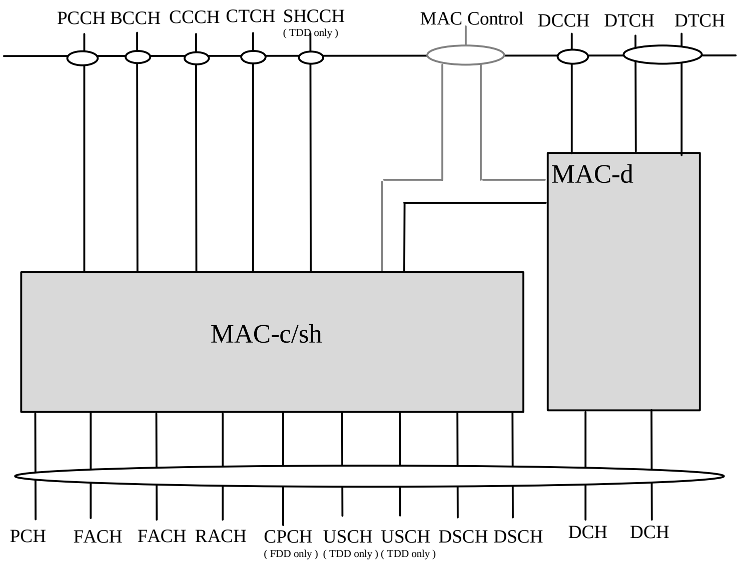


Figure 4.2.3.1: UE side MAC architecture

4.2.3.1 MAC-c/sh entity – UE Side

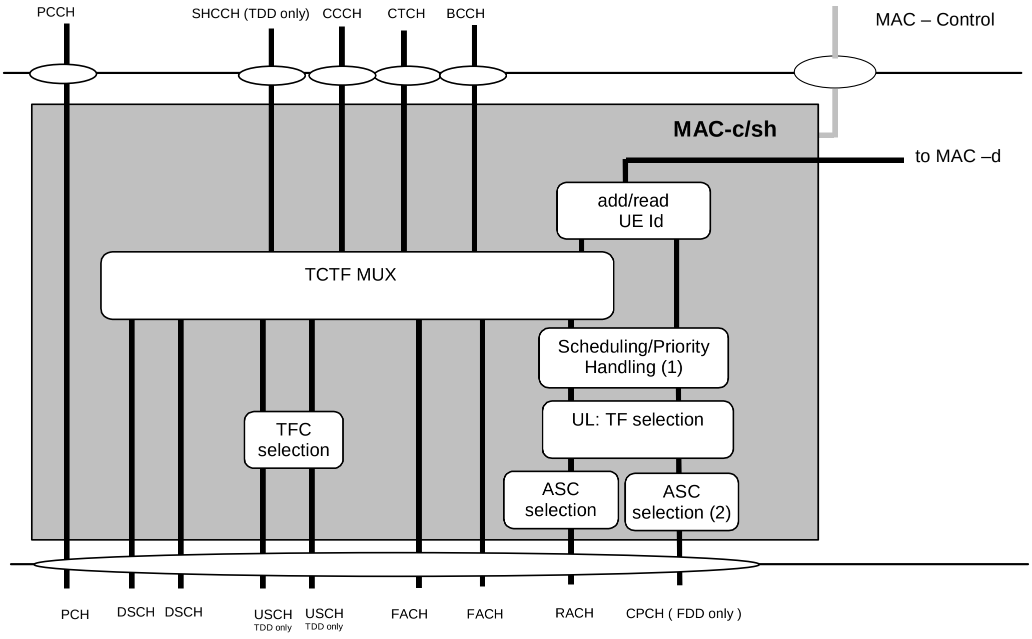
Figure 4.2.3.1.1 shows the UE side MAC-c/sh entity.

The following functionality is covered:

- TCTF MUX:
  - this function represents the handling (insertion for uplink channels and detection and deletion for downlink channels) 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;
- add/read UE Id:
  - the UE Id is added for CPCH and RACH transmissions
  - the UE Id, when present, identifies data to this UE.
- UL: TF selection:
  - in the uplink, the possibility of transport format selection exists.
    In case of CPCH transmission, a TF is selected based on TF availability determined from status information on the CSICH;
- ASC selection:
  - For RACH, MAC indicates the ASC associated with the PDU to the physical layer. For CPCH, MAC may indicate the ASC associated with the PDU to the Physical Layer. This is to ensure that RACH and CPCH messages associated with a given Access Service Class (ASC) are sent on the appropriate signature(s) and time slot(s). MAC also applies the appropriate back-off parameter(s) associated with the given ASC;
- scheduling /priority handling
  - this functionality is used to transmit the information received from MAC-d on RACH and CPCH based on logical channel priorities. This function is related to TF selection.
- TFC selection
  - transport format and transport format combination selection according to the transport format combination set (or transport format combination subset) configured by RRC is performed,

The RLC provides RLC-PDUs to the MAC, which fit into the available transport blocks on the transport channels.

There is one MAC-c/sh entity in each UE.



DL	Downlink	UE	User Equipment
TF	Transport Format	UL	Uplink
TFC	Transport Format Combination		
TCTF	Target Channel Type Field		
(1)	Scheduling /Priority handling is applicable for CPCH, details are ffs.		
(2)	In case of CPCH, ASC selection may be applicable for AP preamble.		

Figure 4.2.3.1.1: UE side MAC architecture / MAC-c/sh details

4.2.3.2 MAC-d entity – UE Side

Figure 4.2.3.2.1 shows the UE side MAC-d entity.

The following functionality is covered:

- Channel switching
  - dynamic transport channel type switching is performed by this entity, based on decision taken by RRC. This is usually related to a change of radio resources.
- C/T MUX:
  - the C/T MUX is used when multiplexing of several dedicated logical channels onto one transport channel is used. An unambiguous identification of the logical channel is included.
- Ciphering:
  - Ciphering for transparent mode data to be ciphered is performed in MAC-d. Details about ciphering can be found in [10].
- Deciphering:
  - Deciphering for ciphered transparent mode data is performed in MAC-d. Details about ciphering can be found in [10].
- UL TFC selection:
  - transport format and transport format combination selection according to the transport format combination set (or transport format combination subset) configured by RRC is performed.

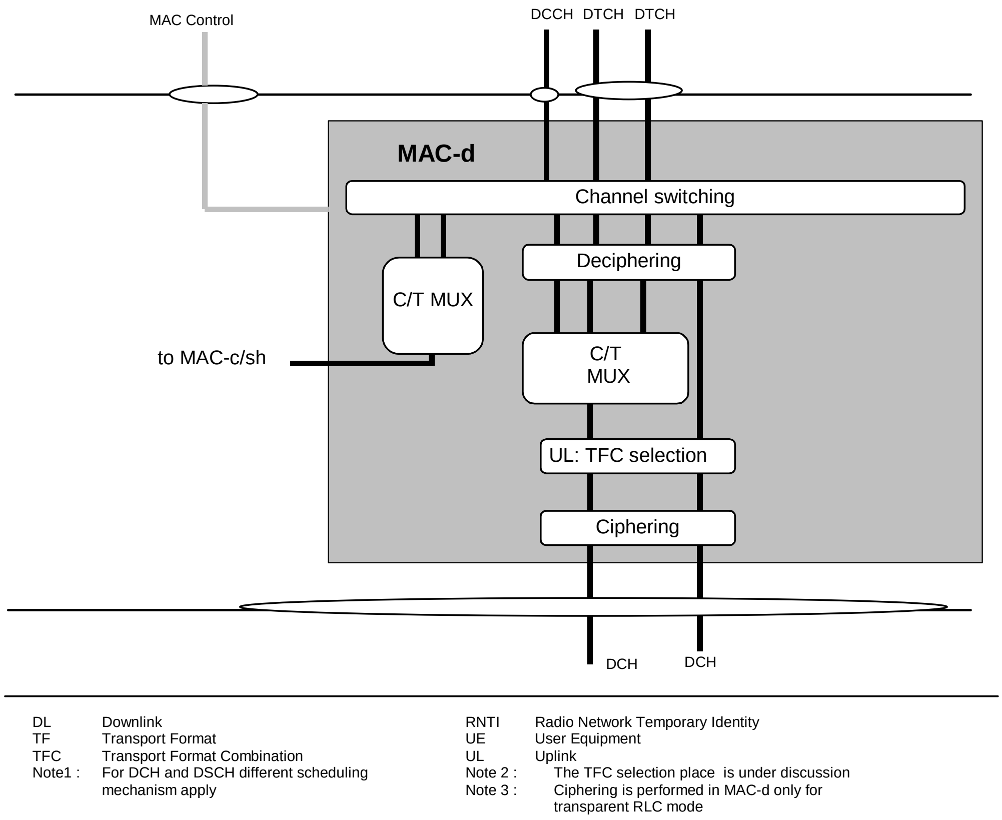
- ~~FAUSCH Handling:~~
  - ~~this function handles the FAUSCH transport channels, details are ffs.~~

The MAC-d entity is responsible for mapping dedicated logical channels for the uplink either onto dedicated transport channels or to transfer data to MAC-c/sh to be transmitted via common channels.

One dedicated logical channel can be mapped simultaneously onto DCH and DSCH;

The MAC-d entity has a connection to the MAC-c/sh entity. This connection is used to transfer data to the MAC-c/sh to transmit data on transport channels that are handled by MAC-c/sh (uplink) or to receive data from transport channels that are handled by MAC-c/sh (downlink).

There is one MAC-d entity in the UE.



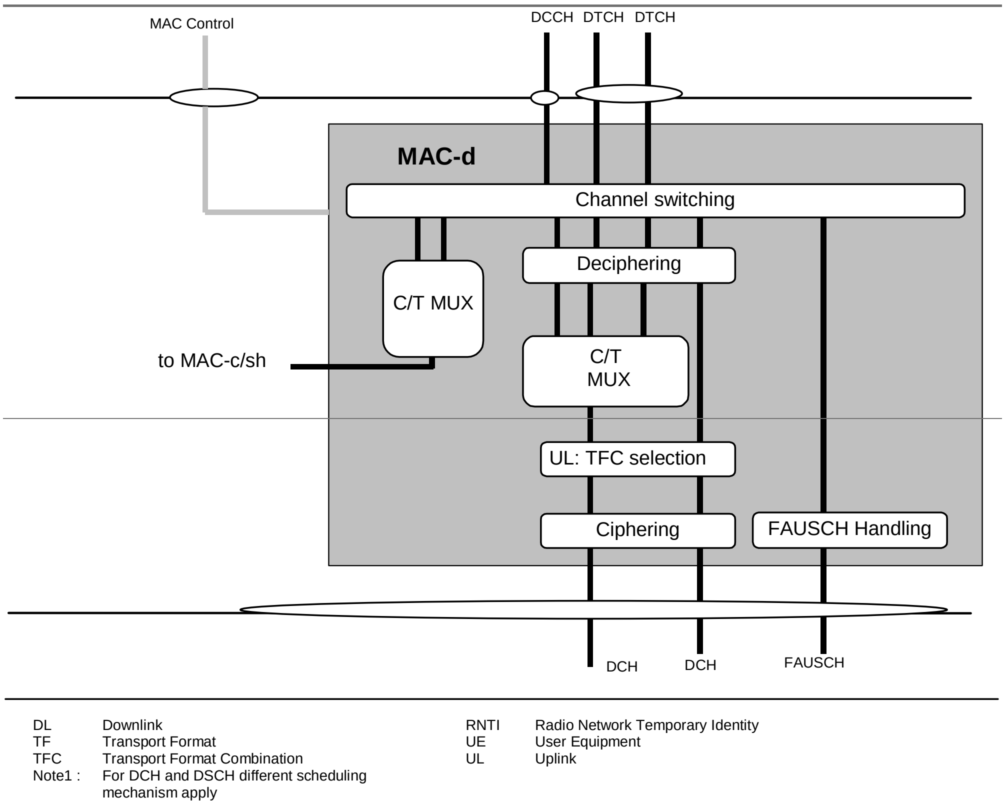


Figure 4.2.3.2.1: UE side MAC architecture / MAC-d details

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 cell's MAC-c/sh.

MAC-c/sh is 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.

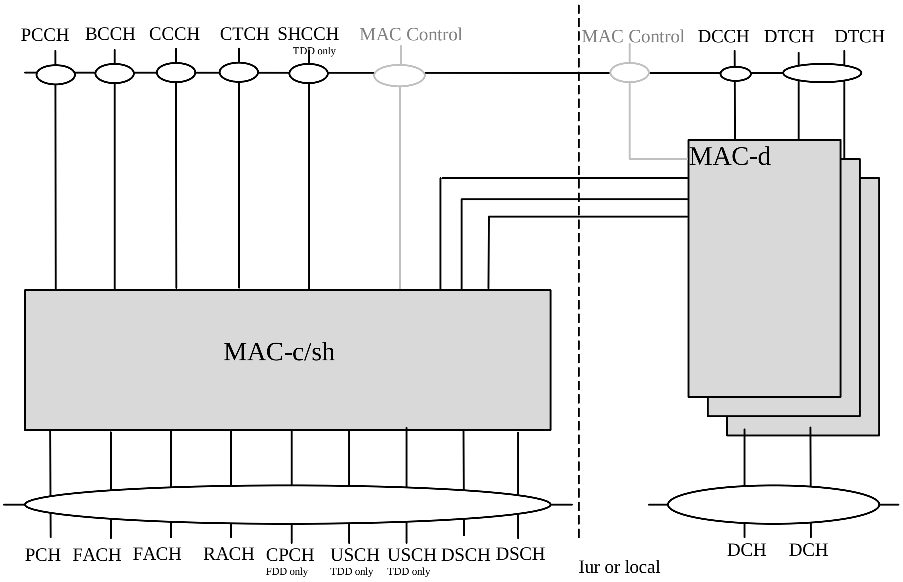


Figure 4.2.4.1: UTRAN side MAC architecture

4.2.4.1 MAC-c/sh entity – UTRAN Side

Figure 4.2.4.1.1 shows the UTRAN side MAC-c/sh entity. The following functionality is covered:

- the Scheduling – Priority Handling;
  - this function manages FACH and DSCH resources between the UE's and between data flows according to their priority.
- TCTF MUX
  - this function represents the handling (insertion for downlink channels and detection and deletion for uplink channels) 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;
- UE Id Mux;
  - for dedicated type logical channels, the UE Id field in the MAC header is used to distinguish between UEs;
- TFC selection:
  - in the downlink, transport format combination selection is done for FACH and PCH and DSCHs;
- demultiplex;
  - 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;
- DL code allocation;
  - this functionis used to indicate the code used on the DSCH;

Flow control is provided to MAC-d.

The RLC provides RLC-PDUs to the MAC, which fit into the available transport blocks on the transport channels.

There is one MAC-c/sh entity in the UTRAN for each cell;

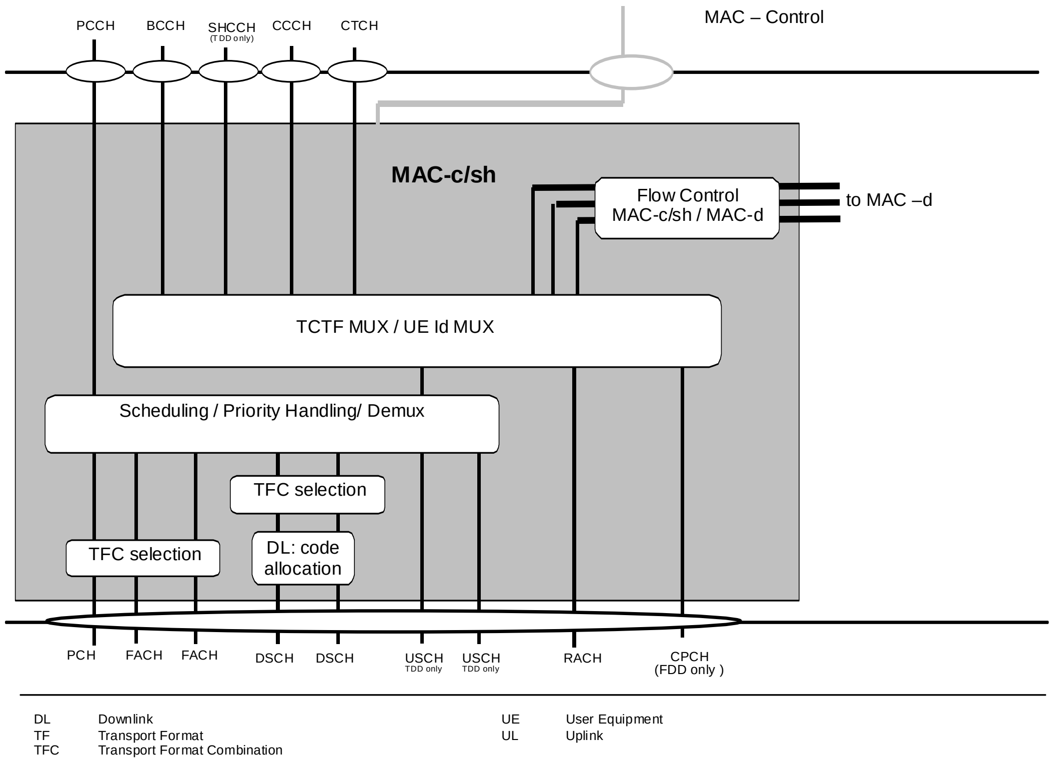


Figure 4.2.4.1.1: UTRAN side MAC architecture / MAC-c/sh details

4.2.4.2 MAC-d entity – UTRAN Side

Figure 4.2.4.2.1 shows the UTRAN side MAC-d entity.

The following functionality is covered:

- channel switching:
  - dynamic transport channel type switching is performed by this entity, based on decision taken by RRC;
- C/T MUX box;
  - the function includes the C/T field when multiplexing of several dedicated logical channels onto one transport channel is used.
- Priority setting;
  - This function is responsible for priority setting on data received from DCCH / DTCH;
- Ciphering;
  - Ciphering for transparent mode data to be ciphered is performed in MAC-d. Details about ciphering can be found in [10].
- Deciphering;
  - Deciphering for ciphered transparent mode data is performed in MAC-d. Details about ciphering can be found in [10].
- DL Scheduling/Priority handling;

- 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.

- Flow Control;

  - a flow control function exists toward MAC-c/sh to limit buffering between MAC-d and MAC-c/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. For the Iur interface this is specified in [11].

- ~~FAUSCH control;~~

  - ~~FAUSCH Handling indicates the function in the MAC-d supports the FAUSCH, details are ffs;~~

A MAC-d entity using common channels is connected to a MAC-c/sh entity that handles the scheduling of the common channels to which the UE is assigned and DL (FACH) priority identification to MAC-c/sh;

A MAC-d entity using downlink shared channel is connected to a MAC-c/sh entity that handles the shared channels to which the UE is assigned and indicates the level of priority of each PDU to MAC-c/sh;

A MAC-d entity is responsible for mapping dedicated logical channels onto the available dedicated transport channels or routing the data received on a DCCH or DTCH to MAC-c/sh.

One dedicated logical channel can be mapped simultaneously on DCH and DSCH. Different scheduling mechanisms apply for DCH and DSCH.

There is one MAC-d entity in the UTRAN for each served UE.

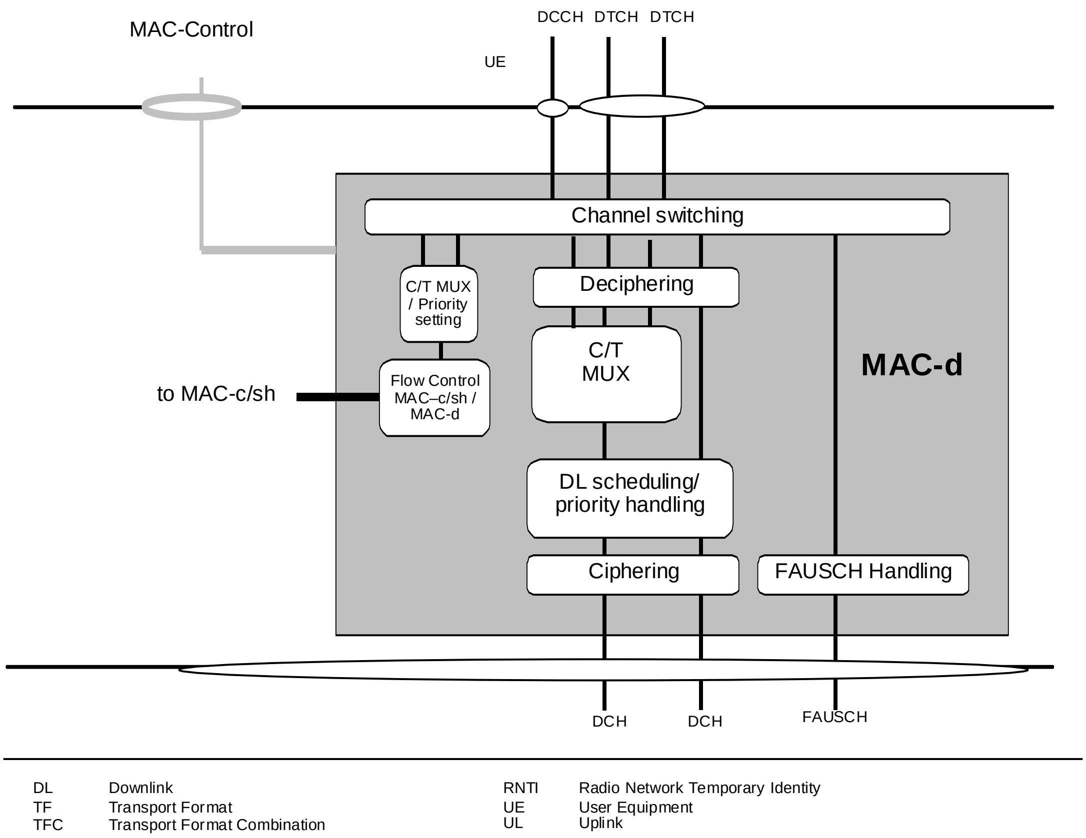


Figure 4.2.4.2.1: UTRAN side MAC architecture / MAC-d details

4.3 Channel structure

The MAC operates on the channels defined below; the transport channels are described between MAC and Layer 1, the logical channels are described between MAC and RLC.

The following subclauses provide an overview, the normative description can be found in [2] and [3] respectively.

4.3.1 Transport channels

Common transport channel types are:

- Random Access Channel(s) (RACH);
- Forward Access Channel(s) (FACH);
- Downlink Shared Channel(s) (DSCH);
- Common Packet Channel(s) (CPCH) for UL FDD operation only;
- Uplink Shared Channel(s) (USCH), for TDD operation only;
- Broadcast Channel (BCH);
- Paging Channel (PCH).

Dedicated transport channel types are:

- Dedicated Channel (DCH);
- ~~Fast Uplink Signalling Channel (FAUSCH);~~

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.

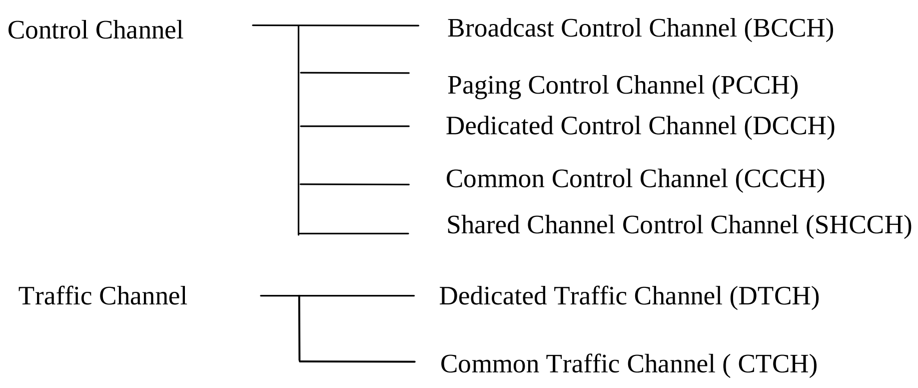


Figure 4.3.2.1: Logical channel structure

4.3.2.2 Control Channels

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

- Broadcast Control Channel (BCCH);
- Paging Control Channel (PCCH);
- Common Control Channel (CCCH);

- Dedicated Control Channel (DCCH);
- Shared Channel Control Channel (SHCCH).

4.3.2.3 Traffic Channels

Following traffic channels are used for the transfer of user plane information only:

- Dedicated Traffic Channel (DTCH);
- Common Traffic Channel (CTCH).

4.3.3 Mapping between logical channels and transport channels

The following connections between logical channels and transport channels exist:

- BCCH is connected to BCH and may also be connected to 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~~;
  DCCH and DTCH can be mapped to the USCH (TDD only);
- CTCH is connected to FACH;
- SHCCH is connected to RACH and USCH/FACH and DSCH.

3GPP TSG-RAN WG2 Meeting #17
Sophia Antipolis, France, 13-17 November 2000

***Document* R2-002398**
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25.321	**CR**	**056r2**	Current Version:	3.5.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑   *↑ CR number as allocated by MCC support team*

For submission to:	TSG-RAN #10	for approval	X	strategic		*(for SMG use only)*
list expected approval meeting # here ↑		for information		non-strategic		

Form: CR cover sheet, version 2 for 3GPP and SMG   *The latest version of this form is available from: ftp://ftp.3gpp.org/Information/CR-Form-v2.doc*

Proposed change affects: (U)SIM [ ] ME [X] UTRAN / Radio [X] Core Network [ ]
(at least one should be marked with an X)

Source: TSG-RAN WG2   **Date:** 2000-11-8

Subject: General MAC clarification

Work item:

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

F	Correction	X	
A	Corresponds to a correction in an earlier release		
B	Addition of feature		
C	Functional modification of feature		
D	Editorial modification		

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change:

1. The titles of subclause 6.2, 6.2.1, and 6.2.2 need to be corrected.

2. Alignment in subclause 9.2.1 is needed.

~~3. In subclause 11.3, the text and the corresponding figures are not aligned.~~

3. The current tables in subclause 6.2.1 and 6.2.2 are included in the CR for comparison and tracking purposes.

4. The subprocedures in 11.3 are merged and corrected to permit EOT transmission.

5. Editorial modifications are made in 11.3.

Clauses affected: 6.2, 6.2.1, 6.2.2, 9.1.1, 9.2.1, 11.3

Other specs affected:

Other 3G core specifications		→	List of CRs:
Other GSM 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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6.2 Relation between MAC Functions ~~/~~and Transport Channels ~~and UE~~

6.2.1 Relation between MAC Functions and Transport Channels in UTRAN

Table 6.2.1.1: UTRAN MAC functions corresponding to the 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		
	SHCCH	USCH						X		X
	DTCH	USCH	X					X		X
	DCCH	USCH	X					X		X
Downlink (Tx)	BCCH	BCH				X				
	BCCH	FACH	X			X		X		
	PCCH	PCH	X			X				
	CCCH	FACH	X	X		X		X		
	CTCH	FACH	X			X		X		
	DCCH	FACH	X	X		X	X	X		
	DCCH	DSCH	X	X				X		
	DCCH	DCH	X		X				X	
	DTCH	FACH	X	X		X	X	X		X
	DTCH	DSCH	X	X				X		X
	DTCH	DCH	X		X				X	X
	SHCCH	FACH	X	X		X		X		
	SHCCH	DSCH	X	X				X		X

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		
	SHCCH	USCH						X		X
	DTCH	USCH	X					X		X
	DCCH	USCH	X					X		X
Downlink (Tx)	BCCH	BCH				X				
	BCCH	FACH	X			X		X		
	PCCH	PCH	X			X				
	CCCH	FACH	X	X		X		X		
	CTCH	FACH	X			X		X		
	DCCH	FACH	X	X		X	X	X		
	DCCH	DSCH	X	X				X		
	DCCH	DCH	X		X				X	
	DTCH	FACH	X	X		X	X	X		X
	DTCH	DSCH	X	X				X		X
	DTCH	DCH	X		X				X	X
	SHCCH	FACH	X	X		X		X		
	SHCCH	DSCH	X	X				X		X

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

Table 6.2.2.1: UE MAC functions corresponding to the 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	X	X	X		
	DCCH	CPCH	X	X	X	X		X
	DCCH	DCH	X	X			X	
	DTCH	RACH	X	X	X	X		X
	DTCH	CPCH	X	X	X	X		X
	DTCH	DCH	X	X			X	X
	SHCCH	RACH				X		
	SHCCH	USCH	X	X		X		X
	DCCH	USCH	X	X		X		X
	DTCH	USCH	X	X		X		X
Downlink (Rx)	BCCH	BCH						
	BCCH	FACH				X		
	PCCH	PCH						
	CCCH	FACH				X		
	CTCH	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		
	SHCCH	DSCH				X		

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	X	X	X		
	DCCH	CPCH	X	X	X	X		X
	DCCH	DCH	X	X			X	
	DTCH	RACH	X	X	X	X		X
	DTCH	CPCH	X	X	X	X		X
	DTCH	DCH	X	X			X	X
	SHCCH	RACH				X		
	SHCCH	USCH	X	X		X		X
	DCCH	USCH	X	X		X		X
	DTCH	USCH	X	X		X		X
Downlink (Rx)	BCCH	BCH						
	BCCH	FACH				X		
	PCCH	PCH						
	CCCH	FACH				X		
	CTCH	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		
	SHCCH	DSCH				X		

9 Elements for peer-to-peer communication

9.1 Protocol data units

9.1.1 General

A MAC PDU is a bit string, with a length not necessarily a multiple of 8 bits. In the drawings in clause 9.1, bit strings are represented by tables in which the first bit is the leftmost one on the first line of the table, the last bit is the rightmost on the last line of the table, and more generally the bit string is to be read from left to right and then in the reading order of the lines.

Depending on the provided service, MAC SDUs are bit strings~~,~~ with any non null length, or bit strings with an integer number of octets in length. An SDU is included into a MAC PDU from first bit onward.

In the UE for the uplink, all MAC PDUs delivered to the physical layer within one TTI are defined as Transport Block Set (TBS). It consists of one or several Transport Blocks, each containing one MAC PDU. The Transport Blocks, shall be transmitted in the order as delivered from RLC. When multiplexing of RLC PDUs from different logical channels is performed on MAC, the order of all Transport Blocks originating from the same logical channel shall be the same as the order of the sequence delivered from RLC. The order of the different logical channels in a TBS is set by the MAC protocol.

9.1.2 MAC Data PDU

MAC PDU consists of an optional MAC header and a MAC Service Data Unit (MAC SDU), see figure 9.1.2.1. 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.

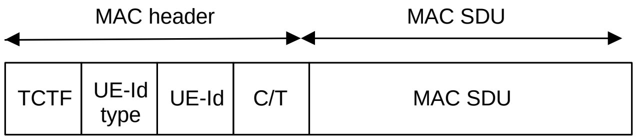


Figure 9.1.2.1: MAC data PDU

9.2 Formats and parameters

NOTE: MAC header field encodings as specified in this clause with designation "Reserved" are forbidden to be used by a sender in this version of the protocol.

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. The size and coding of TCTF for FDD and TDD are shown in tables 9.2.1.1, 9.2.1.2~~ and~~, 9.2.1.3, 9.2.1.4 and 9.2.1.5. Note that the size of the TCTF field of FACH for FDD is either 2 or 8 bits depending of the value of the 2 most significant bits and for TDD is either 3 or 5 bits depending on the value of the 3 most significant bits. The TCTF of the RACH for TDD is either 2 or 4 bits depending on the value of the 2 most significant bits.

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

TCTF	Designation
000	BCCH
001	CCCH
010	CTCH
01100	DCCH or DTCH over FACH
01101-01111	Reserved (PDUs with this coding will be discarded by this version of the protocol)
100	SHCCH
101-111	Reserved (PDUs with this coding will be discarded by this version of the protocol)

Table 9.2.1.2: Coding of the Target Channel Type Field on FACH for FDD

TCTF	Designation
00	BCCH
01000000	CCCH
01000001-01111111	Reserved (PDUs with this coding will be discarded by this version of the protocol)
10000000	CTCH
10000001-10111111	Reserved (PDUs with this coding will be discarded by this version of the protocol)
11	DCCH or DTCH over FACH

Table 9.2.1.3: Coding of the Target Channel Type Field on USCH or DSCH (TDD only)

TCTF	Designation
0	SHCCH
1	DCCH or DTCH over USCH or DSCH

Table 9.2.1.4: Coding of the Target Channel Type Field on RACH for FDD

TCTF	Designation
00	CCCH
01	DCCH or DTCH over RACH
10-11	Reserved (PDUs with this coding will be discarded by this version of the protocol)

Table 9.2.1.5: Coding of the Target Channel Type Field on RACH for TDD

TCTF	Designation
00	CCCH
0100	DCCH or DTCH Over RACH
0101-0111	Reserved (PDUs with this coding will be discarded by this version of the protocol)
10	SHCCH
11	Reserved (PDUs with this coding will be discarded by this version of the protocol)

11.3 Control of CPCH transmissions for FDD

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. 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 CPCH Message transmission each TTI transmission 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:

- persistence values, P (transmission probability for each Transport Format (TF));
- N_access_fails, maximum number of preamble ramping cycles;
- NF_max, maximum number of frames for CPCH transmission for each TF;
- N_EOT (Number of EOT for release of CPCH transmission);
- Backoff control timer parameters;
- Transport Format Set;
- Initial Priority Delays;
- Channel Assignment Active indication.

The MAC procedure for transmission control of initial CPCH access 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 get all UL transmit parameters (CPCH Set Info, P values, Initial Priority Delays, N_access_fails, NF_max, N_EOT etc) from RRC;
2. the UE shall reset counter M, EOT counter and Frame Count Transmitted (FCT) upon entry to the initial access procedure;
3. the UE shall send a PHY-CPCH_Status-REQ to Layer 1 to obtain CPCH TF subset status. If Layer 1 returns an error message, the UE shall increment counter M. If if counter M is equal to N_access_fails, the UE shall execute an access failure error procedure and the CPCH access procedure ends. If counter M is less than N_access_fails, the UE shall send a PHY-CPCH_Status-REQ to Layer 1 to obtain CPCH TF subset status. If Layer 1 returns an error message, the UE shall increment counter M and the procedure shall continue from step 3. If Layer 1 returns a PHY-CPCH_Status-CNF message, which includes a TF subset indicating the currently available TFs of the requested TF subset, the procedure shall continue from step 4;
4. the UE shall initialise the Busy Table with the CPCH TF subset status from Layer 1. Those TFs in the TF subset of the Layer 1 PHY-CPCH_Status-CNF response will be marked available. All other TFs will be marked busy;
5. if all TFs are not marked busy, the procedure shall proceed from step 6. ifIf all TFs are marked busy, the UE shall reset and start timer Tboc1, wait until timer expiry, and increment counter M. If counter M is equal to N_access_fails, the UE shall execute an access failure error procedure and the CPCH access procedure ends. If counter M is less than N_access_fails, theThe procedure shall continue from step 3;
6. the UE shall update all UL transmit parameters from RRC;
7. UE shall select a TF from the set of available TFs listed in the Busy Table. UE shall use the CPCH channel capacity (transport block set size, NF_max, and TTI interval), and Busy Table information to select one CPCH TF for L1 to access. The UE may select a TF, which uses a lower data rate and a lower UL Tx power than the maximum UL Tx power allowed.;

8. UE shall implement a test based on the Persistence value (P) to determine whether to attempt access to the selected CPCH TF. If access is allowed, the procedure shall continue from step 9.the UE may implement an

initial delay based on ASC of the data to be transmitted, then shall send a PHY-Access-REQ with the selected TF to L1 for CPCH access . If the P test does not allow access, the procedure shall continue from step 8;

8. the selected CPCH TF shall be marked busy in the Busy Table. If all TFs are marked busy, the UE shall reset and start timer Tboc1, wait until timer expiry, and increment counter M., If counter M is equal to N_access_fails, the UE shall execute an access failure error procedure and the CPCH access procedure ends. If counter M is less than N_access_fails, the The procedure shalland continue from step 3. If all TFs are not marked busy, the UE shall resume the procedure from step 6;

9. the UE may implement an initial delay based on ASC of the data to be transmitted, then shall send a PHY-Access-REQ with the selected TF to L1 for CPCH access . after After the UE has sent the access request to L1 , L1 shall return a PHY-Access-CNF including one of five access indications to MAC as shown in figure 11.3.1. If the L1 access indication is that access is granted, then UE shall continue from step 14.execute the transmission control procedure for the Nth TTI using the selected TF and the initial access procedure ends.; For the cases of the other Layer 1 responses, the procedure shall continue from step 10, 11, or 12 respectively.

10. if L1 access indication 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 M. If counter M is equal to N_access_fails, the UE shall execute an access failure error procedure and the CPCH access procedure ends. If counter M is less than N_access_fails, the The UE shall proceed from step 3;

11. if L1 access indication is AP-AICH_nak received, the UE shall reset and start timer Tboc2, wait until timer expiry. and If Channel Assignment (CA) is active, the UE shall proceed from step 13. If L1 access indication is AP-AICH_nak received and Channel Assignment (CA) is not active, the procedure shall continue from step 8; the UE shall reset and start timer Tboc2, wait until 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 M. If counter M is equal to N_access_fails, the UE shall execute an access failure error procedure and the CPCH access procedure ends. If counter M is less than N_access_fails, the procedure shall continue from step 3. If all channels are not marked busy, the UE shall resume the procedure from step 6;

12. if L1 access indication is CD-AICH signature mismatch, the UE shall reset and start timer Tboc4, wait until timer expiry, and increment counter M. If counter M is equal to N_access_fails, the UE shall execute an access failure error procedure and the CPCH access procedure ends. If counter M is less than N_access_fails, theThe procedure shall continue from step 3;

13. the UE shall reset and start timer Tboc2, wait until timer expiry, and increment counter M. If counter M is equal to N_access_fails, the UE shall execute an access failure error procedure and the CPCH access procedure ends. If counter M is less than N_access_fails, the The procedure shall continue from step 3;.

The MAC procedure for transmission control of Nth TTI 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:

14. the UE shall build a transport block set for the next TTI;

152. if the sum of the Frame Count Transmitted counter plus N_TTI (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 N_TTIthe number of frames in the next TTI is less than or equal to NF_max, the UE shall send a PHY-Data-REQ with the transport block set to L1 to continue transmission on the CPCH channel which has previously been accessed;

3. theUE shall builds the next TTI transport block set with zero sized transport block. if the UE has no data to transmit and If the sum of the Frame Count Transmitted counter plus N_TTIthe number of frames in the next TTI is less than or equal to NF_max and the sum of the EOT counter plus N_TTI is less than or equal to N_EOT, the UE shall send a PHY-Data-REQ with zero sized transport block to L1 to stop transmission on the CPCH channel which has previously been accessed,. the EOT counter shall be incremented by N_TTI and the procedure shall continue from step 4. Otherwise, the procedure is stopped;

164. if the L1 returns PHY-Status-IND indicating normal transmission, the procedure shall continue from step 175. if If L1 returns PHY-Status-IND indicating abnormal situation, the UE shall execute an abnormal situation handling procedure and the CPCH Nth TTImessage transmission procedure ends. Reasons for abnormal situation may include the following:

- emergency stop was received;

- start of Message Indicator was not received;
- L1 hardware failure has occurred;
- out of synch has occurred;

175. if the L1 returns PHY-Status-IND indicating normal transmission, then the UE shall increment the Frame Count Transmitted (FCT) counter by the length of the N_TTI just transmitted. If the UE has more data to transmit, the procedure shall continue from step 14; and the procedure ends.

18. the UE shall builds the next TTI transport block set with zero sized transport block set. If the sum of the Frame Count Transmitted counter plus N_TTI is less than or equal to NF_max and if the sum of the EOT counter plus N_TTI is less than or equal to N_EOT, the procedure shall continue from step 19. Otherwise, the procedure ends;

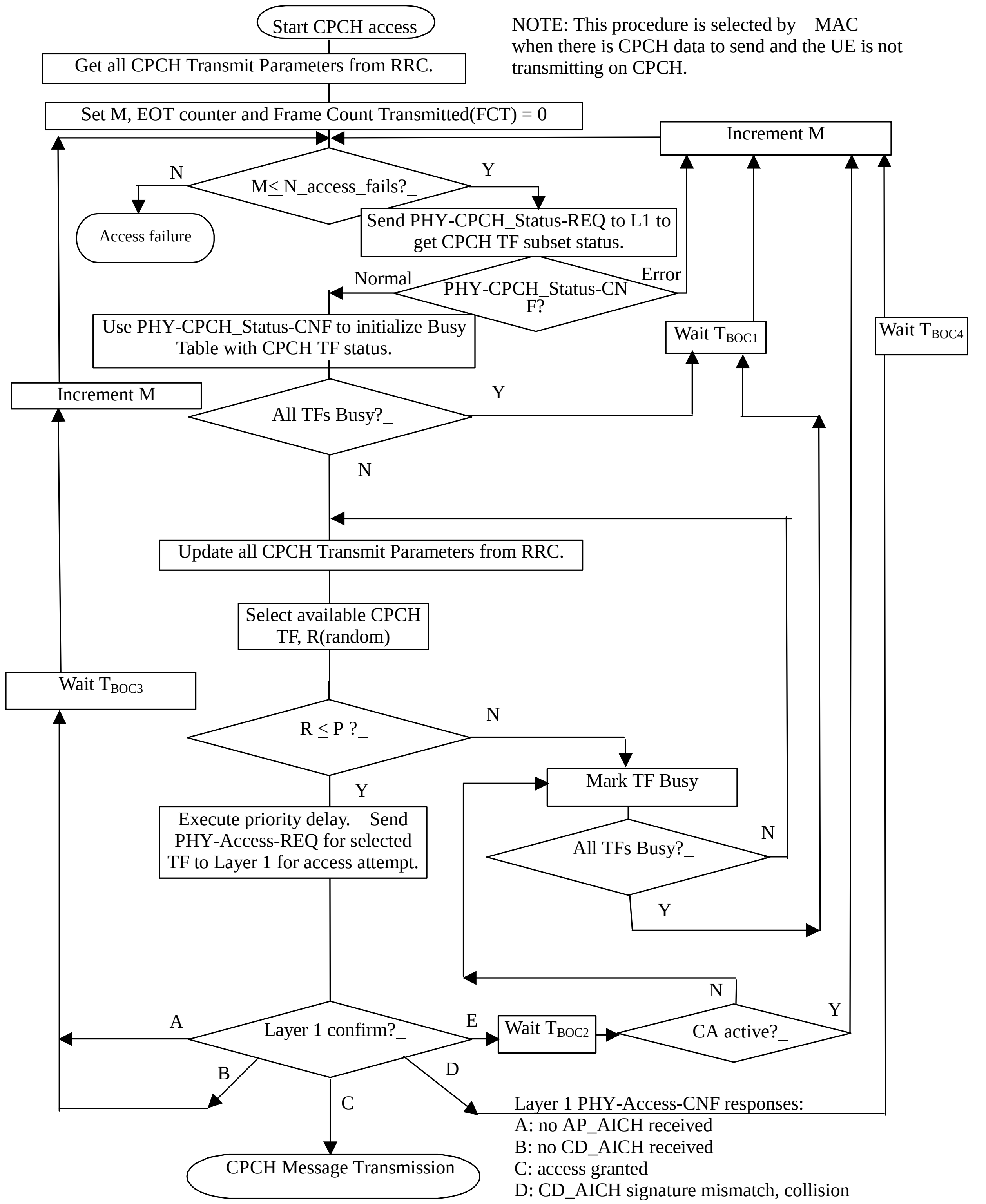
19. UE shall send a PHY-Data-REQ with zero sized transport block set to L1 to stop transmission on the CPCH channel which has previously been accessed, both the EOT and the FCT counters shall be incremented by N_TTI and the procedure shall continue from step 18.

Table 11.3: CPCH Backoff Delay Timer Values

Timer	Based on parameter	Fixed/random
T_{BOC1} (all Busy)	NF_bo_all_busy	Random
T_{BOC2} (channel Busy)	NS_bo_busy	Fixed
T_{BOC3} (no AICH)	NF_bo_no_aich	Fixed
T_{BOC4} (mismatch)	NF_bo_mismatch	Random

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 [0, NF_bo_mismatch]. 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 [0, NF_bo_all busy].

NOTE: Backoff parameter range and units are specified in TS 25.331, RRC Protocol Specification.


Start CPCH access
NOTE: This procedure is selected by MAC when there is CPCH data to send and the UE is not transmitting on CPCH.
Get all CPCH Transmit Parameters from RRC.
Set M, EOT counter and Frame Count Transmitted(FCT) = 0
Increment M
N
M≤ N_access_fails?_
Y
Access failure
Send PHY-CPCH_Status-REQ to L1 to get CPCH TF subset status.
Normal
PHY-CPCH_Status-CNF?_
Error
Use PHY-CPCH_Status-CNF to initialize Busy Table with CPCH TF status.
Wait T_BOC1
Wait T_BOC4
Increment M
All TFs Busy?_
Y
N
Update all CPCH Transmit Parameters from RRC.
Select available CPCH TF, R(random)
Wait T_BOC3
R ≤ P ?_
N
Mark TF Busy
Y
Execute priority delay. Send PHY-Access-REQ for selected TF to Layer 1 for access attempt.
All TFs Busy?_
N
Y
N
A
Layer 1 confirm?_
E
Wait T_BOC2
CA active?_
Y
B
D
C
CPCH Message Transmission
Layer 1 PHY-Access-CNF responses:
A: no AP_AICH received
B: no CD_AICH received
C: access granted
D: CD_AICH signature mismatch, collision
E: AP_AICH_nak received

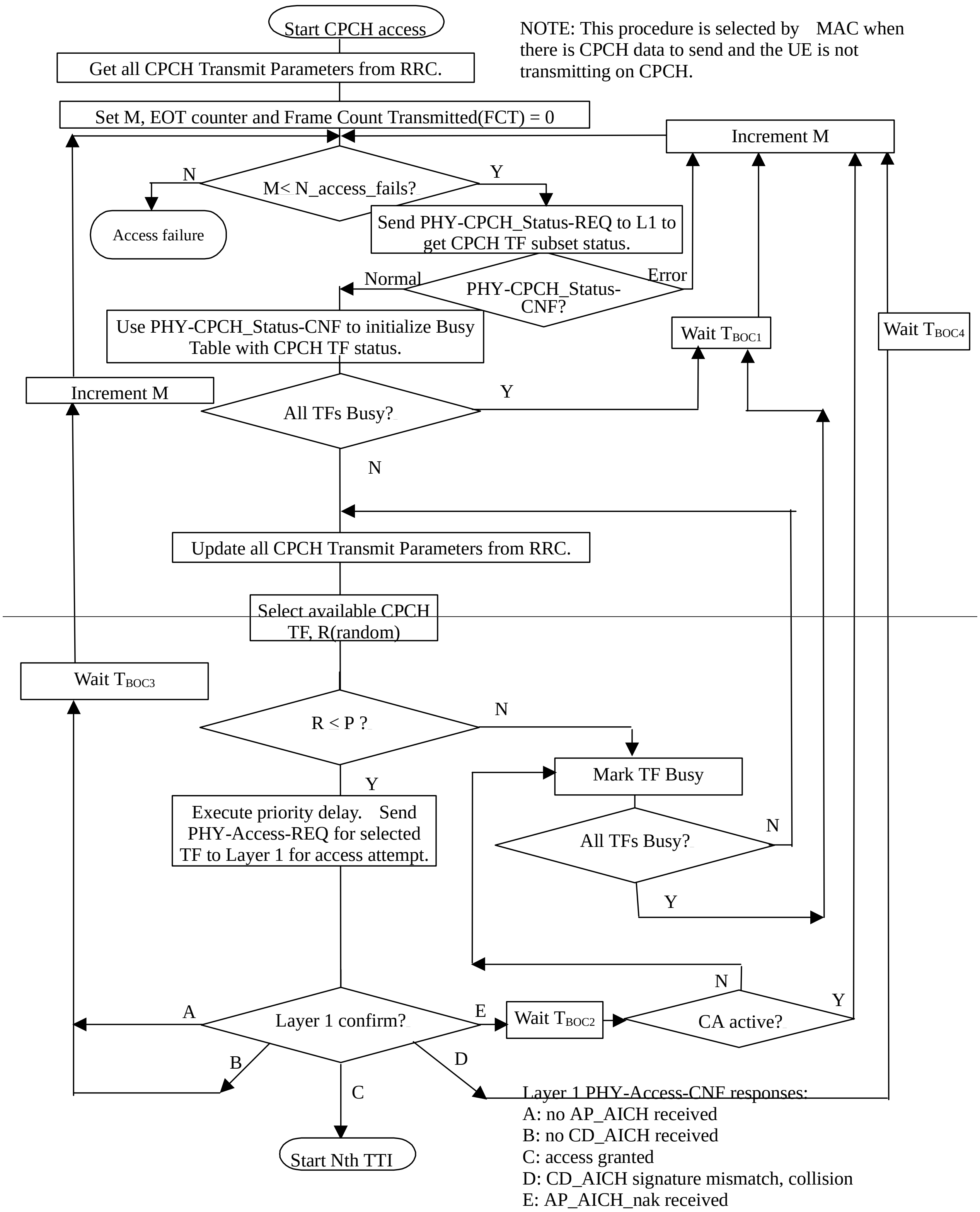
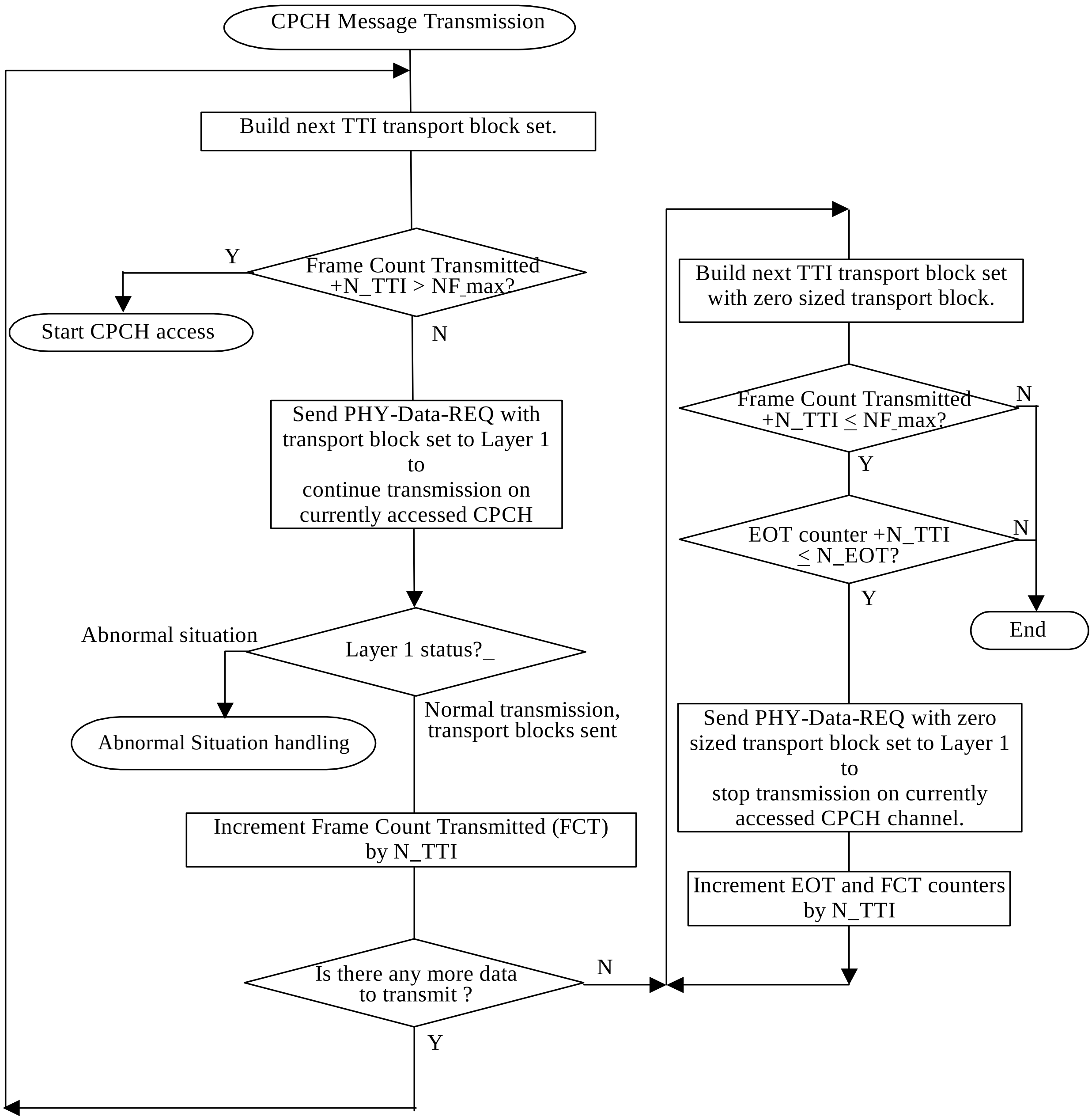


Figure 11.3.1: CPCH transmission control procedure for ~~initial~~ access (informative)


CPCH Message Transmission
Build next TTI transport block set.
Frame Count Transmitted +N_TTI > NF_max?
Y
Start CPCH access
N
Send PHY-Data-REQ with transport block set to Layer 1 to continue transmission on currently accessed CPCH
Abnormal situation
Layer 1 status?_
Abnormal Situation handling
Normal transmission, transport blocks sent
Increment Frame Count Transmitted (FCT) by N_TTI
Is there any more data to transmit ?
N
Y
Build next TTI transport block set with zero sized transport block.
Frame Count Transmitted +N_TTI ≤ NF_max?
N
Y
EOT counter +N_TTI ≤ N_EOT?
N
Y
End
Send PHY-Data-REQ with zero sized transport block set to Layer 1 to stop transmission on currently accessed CPCH channel.
Increment EOT and FCT counters by N_TTI

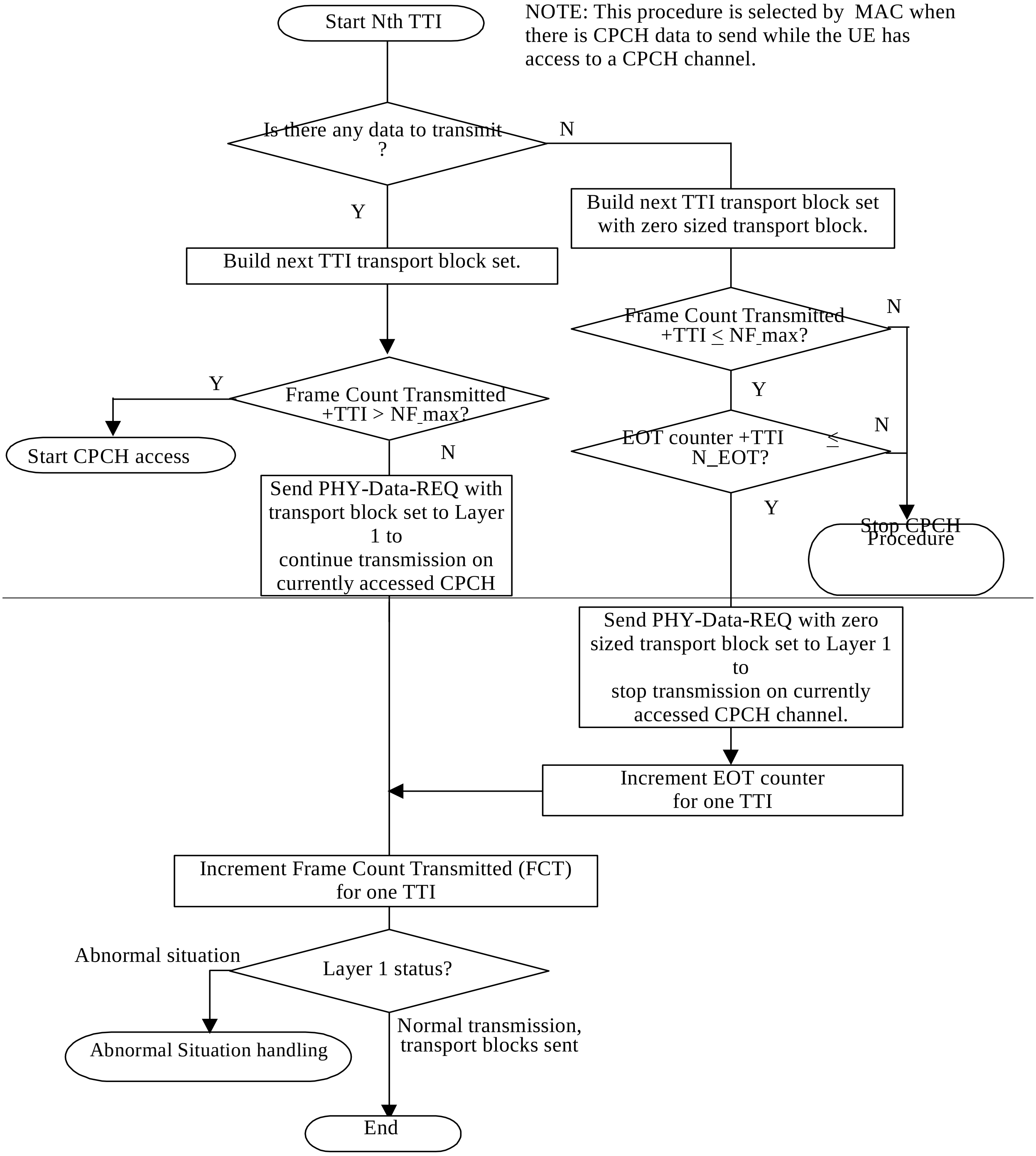


Figure 11.3.2: CPCH transmission control procedure for CPCH Message Transmission~~Nth TTI~~ (informative)

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e.g. for 3GPP use the format TP-99xxx or for SMG, use the format P-99-xxx

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25.321	**CR**	**057r1**	Current Version:	3.5.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to:	TSG-RAN #10	for approval	X	strategic		*(for SMG*
list expected approval meeting # here ↑		for information		non-strategic		*use only)*

Form: CR cover sheet, version 2 for 3GPP and SMG *The latest version of this form is available from:* ftp://ftp.3gpp.org/Information/CR-Form-v2.doc

Proposed change affects: *(at least one should be marked with an X)*	(U)SIM		ME	X	UTRAN / Radio	X	Core Network	

Source:	TSG-RAN WG2	**Date:**	November 15, 2000

Subject:	Error Handling in MAC
Work item:	

Category:	F	Correction	X	**Release:**	Phase 2	
	A	Corresponds to a correction in an earlier release			Release 96	
(only one category	B	Addition of feature			Release 97	
shall be marked	C	Functional modification of feature			Release 98	
with an X)	D	Editorial modification			Release 99	X
					Release 00	

Reason for change:

1. Requirement for error handling are not described in detail. They have been added.
2. Editorial correction on the title of one reference document.

Clarification on error case a) after comments.

Clauses affected:	2, 10

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

Other comments:	

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2 References

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

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies.

[1] 3GPP TR 21.905: "Vocabulary for 3GPP Specifications".

[2] 3GPP TS 25.301: "Radio Interface Protocol Architecture".

[3] 3GPP TS 25.302: "Services provided by the Physical Layer".

[4] 3GPP TS 25.303: "Interlayer Procedures in Connected Mode".

[5] 3GPP TS 25.304: "UE Procedures in Idle Mode and Procedures for Cell Reselection in Connected Mode".

[6] 3GPP TS 25.322: "RLC Protocol Specification".

[7] 3GPP TS 25.331: "RRC Protocol Specification".

[8] 3GPP TR~~S~~ 25.921: "Guidelines and Principles for Protocol Description and Error Handling".

[9] 3GPP TR 25.990: "Vocabulary for the UTRAN".

[10] 3GPP TS 33.102: "Security architecture".

[11] 3GPP TS 25.425: "UTRAN Iur Interface User Plane Protocols for Common Transport Channel Data Streams"

10 Handling of unknown, unforeseen and erroneous protocol data

~~Basic requirements for handling unknown, unforeseen and erroneous protocol data are described in [8].~~

The list of error cases is reported below:

a) Use of reserved coding in the MAC header

If the MAC entity receives a Data PDU with a header field using a value marked as reserved for this version of the protocol reserved coding, it shall discard the PDU, unless explicitly mentioned otherwise..

b) Inconsistent MAC header

If the MAC entity receives a data PDU with a header inconsistent with the configuration received from RRC, it shall discard the PDU. E.g.: In case DTCH is mapped to RACH/FACH, the MAC entity shall discard a PDU with a C/T field indicating a logical channel number that is not configured.

3GPP RAN WG2#16
Sophia Antipolis, France, 13 – 17 November, 2000

***Document* R2-002358**
e.g. for 3GPP use the format TP-99xxx
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Proposed change affects: (U)SIM [ ] ME [X] UTRAN / Radio [ ] Core Network [ ]
(at least one should be marked with an X)

Source: TSG-RAN WG2 **Date:** 2000-11-15

Subject: Error handling for MAC RACH and CPCH transmission control procedure

Work item:

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

			Release:	
F	Correction	X	Phase 2	
A	Corresponds to a correction in an earlier release		Release 96	
B	Addition of feature		Release 97	
C	Functional modification of feature		Release 98	
D	Editorial modification		Release 99	X
			Release 00	

Reason for change:

A correction of the error handling procedure is proposed for the case that the maximum number of preamble ramping cycles is exceeded. Currently, this error case is indicated to RRC for RACH. For CPCH a currently unspecified error handling procedure on MAC shall be executed.

In this CR it is proposed that indication of transmission status ("successful" or "unsuccessful") shall be passed to RLC for logical channels using UM and AM RLC, where the appropriate actions are performed. For logical channels using TM RLC (i.e. for uplink CCCH) transmission status shall be indicated to and handled by the RRC protocol.

Transmission status indication is also included for TDD mode.

Clauses affected: 8.2.1, 8.2.2, 8.3.2, 11.2.2, 11.2.3, 11.3

Other specs affected:

Other 3G core specifications	X	→ List of CRs:	25.322 CR 087, 25.331 CR 597
Other GSM 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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8.2 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.

Table 8.2.1.1: Primitives between MAC layer and RLC layer

Generic Name	Type				Parameters
	Request	Indication	Response	Confirm	
MAC-DATA	X	X			Data, Number of transmitted RLC PDUs, BO, UE-ID type indicator, TD (note)
MAC-STATUS		X	X		No_PDU, PDU_Size, BO, tTx_status
NOTE: TDD only.					

MAC-DATA-Req/Ind:

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

MAC-STATUS-Ind/Resp:

- MAC-STATUS-Ind primitive indicates to RLC for each logical channel the rate at which it may transfer data to MAC. Parameters are the number of PDUs that can be transferred in each transmission time interval and the PDU size; it is possible that MAC would use this primitive to indicate that it expects the current buffer occupancy of the addressed logical channel in order to provide for optimised TFC selection on transport channels with long transmission time interval. At the UE, MAC-STATUS-Ind primitive shallis also be used to indicate from MAC to RLC that MAC has requested data transmission by PHY (i.e. PHY-DATA-REQ has been sentsubmitted, see Fig. 11.2.2.1), or that transmission of an RLC PDU on RACH or CPCH has failed due to exceeded preamble ramping cycle counter.
- MAC-STATUS-Resp primitive enables RLC to acknowledge a MAC-STATUS-Ind. 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 or to indicate the current buffer occupancy to MAC.

8.2.2 Parameters

a) Data:

- it contains the RLC layer messages (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.

c) Buffer Occupancy (BO):

- the parameter Buffer Occupancy (BO) indicates for each logical channel the amount of data that is currently queued for transmission (or retransmission) in RLC layer.

d) 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.

e) Number of PDU (No_PDU):

- specifies the number of PDUs that the RLC is permitted to transfer to MAC within a transmission time interval.

f) PDU Size (PDU_Size):

- specifies the size of PDU that can be transferred to MAC within a transmission time interval.

g) UE-ID Type Indicator:

- indicates the UE-ID type to be included on MAC for a DCCH when it is mapped onto a common transport channel (i.e. FACH, RACH or CPCH).

h) tTXx Sstatus:

- when set to value “transmission unsuccessful” this parameter indicates to RLC that transmission of an RLC PDU failed in the previous Transmission Time Interval, when set to value “transmission successful” this parameter indicates to RLC that the requested RLC PDU(s) has been submitted for transmissiontted by the physical layer.

8.3 Primitives between MAC and RRC

8.3.1 Primitives

The primitives between MAC and RRC are shown in table 8.3.1.1.

Table 8.3.1.1: Primitives between MAC sub-layer and RRC

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 (for Request), Measurement result (for Indication)
CMAC-STATUS		X			Status info.

CMAC-CONFIG-Req:

- CMAC-CONFIG-Req is used to request for setup, release and configuration of a logical channel, e.g. RNTI allocation, 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 measurements;

- 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 TS 25.331 for a detailed description of the UE, RB and TrCH information elements.

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

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

c) TrCH information elements
Transport Format Combination Set

d) Measurement information elements
Mode (periodic, event-triggered or both)
TH_U
TH_L
Measurement quantity identifiers
Report Interval

e) Measurement result
Mode
Reporting Quantities
Event ID (4a or 4b)

f) Status info
when set to value "transmission unsuccessful" this parameter indicates to RRC that transmission of a TM RLC PDU failed (due to e.g. Maximum number of preamble ramping cycles reached for RACH in FDD), when set to value "transmission successful" this parameter indicates to RRC that the requested TM RLC PDU(s) has been submitted for transmission~~tted~~ by the physical layer.

g) RACH transmission control elements
Set of ASC parameters (identifier for PRACH partitions, persistence values)
Maximum number of preamble ramping cycles M_{max}
Minimum and maximum number of time units between two preamble ramping cycles, N_{BO1min} and N_{BO1max}

h) Ciphering elements
Ciphering mode
Ciphering key
Ciphering sequence number

i) CPCH transmission control elements
CPCH persistency value, P for each Transport Format
Maximum number of preamble ramping cycles $N_{\_access\_fails}$
NF_max (Maximum number of frames for CPCH transmission for each Transport Format)
N_EOT (Number of EOT for release of CPCH transmission)
Backoff control timer parameters
Transport Format Set
Initial Priority Delays
Channel Assignment Active indication

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 Access Service Class selection

The physical RACH resources (i.e. access slots and preamble signatures for FDD, timeslot and channelisation code for TDD) may be divided between different Access Service Classes in order to provide different priorities of RACH usage. It is possible for more than one ASC or for all ASCs to be assigned to the same access slot/signature space.

Access Service Classes are numbered in the range $0 \le i \le$ NumASC ≤ 7 (i.e. the maximum number of ASCs is NumASC+1 = 8). An ASC is defined by an identifier i that defines a certain partition of the PRACH resources and an associated persistence value P_i. A set of ASC parameters consists of NumASC+1 such parameters (i, P_i), i = 0, …, NumASC. The PRACH partitions and the persistence values P_i are derived by the RRC protocol from system information (see TS 25.331 [7]). The set of ASC parameters is provided to MAC with the CMAC-Config-REQ primitive. The ASC enumeration is such that it corresponds to the order of priority (ASC 0 = highest priority, ASC 7 = lowest priority). ASC 0 shall be used in case of Emergency Call or for reasons with equivalent priority.

At radio bearer setup/reconfiguration each involved logical channel is assigned a MAC Logical channel Priority (MLP) in the range 1,…,8. When the MAC sublayer is configured for RACH transmission in the UE, these MLP levels shall be employed for ASC selection on MAC.

The following ASC selection scheme shall be applied, where NumASC is the highest available ASC number and MinMLP the highest logical channel priority assigned to one logical channel:

- in case all TBs in the TB set have the same MLP, select ASC = min(NumASC, MLP);
- in case TBs in a TB set have different priority, determine the highest priority level MinMLP and select ASC = min(NumASC, MinMLP).

11.2.2 Control of RACH transmissions for FDD mode

The RACH transmissions are controlled by the UE MAC sublayer as outlined in figure 11.2.2.1.

NOTE: 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~~CONFIG-~~REQ~~ Req primitive:

- a set of Access Service Class (ASC) parameters, which includes for each ASC, i=0,…,NumASC an identification of a PRACH partition and a persistence value P_i (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 10 ms time intervals N_{BO1max} and N_{BO1min}, applicable when negative acknowledgement on AICH is received.

When there is data to be transmitted, MAC selects the ASC from the available set of ASCs, which consists of an identifier i of a certain PRACH partition and an associated persistence value P_i. The procedure to be applied for ASC selection is described in subclause 11.2.1.

Based on the persistence value P_i, the UE decides whether to start the L1 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-ACCESS-REQ primitive. MAC then waits for access information from L1 via PHY-ACCESS-CNF 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.

When the preamble has been acknowledged on AICH, L1 access information with parameter value "ready for data transmission" is indicated to MAC with PHY-ACCESS-CNF primitive. Then data transmission is requested with PHY-DATA-REQ primitive, and the PRACH transmission procedure shall be completed with transmission of the PRACH message part according to L1 specifications. Successful completion (tTXx status) of the MAC transmission control procedure shall be indicated to higher layer.

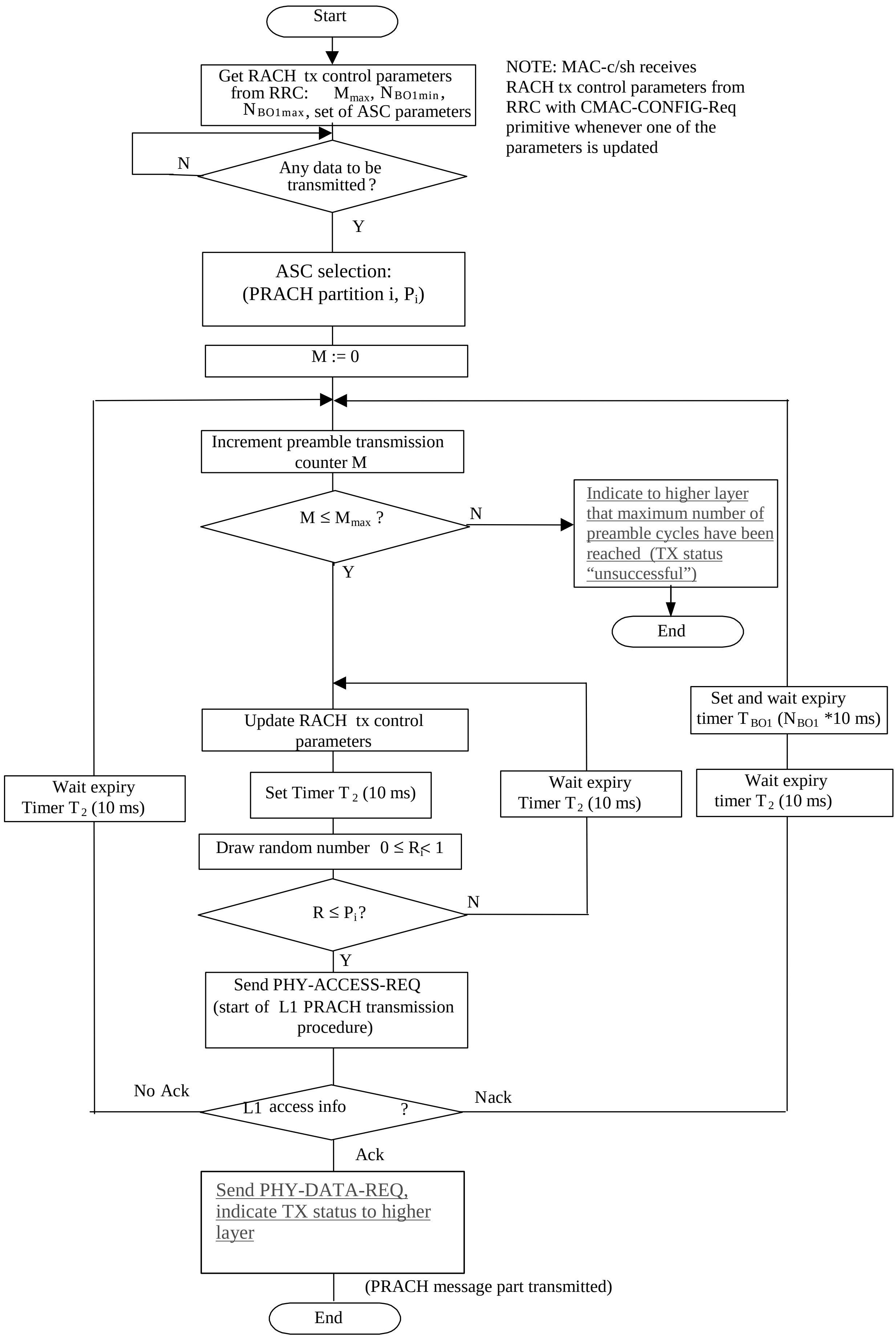
When PHY indicates that no acknowledgement on AICH is received while the maximum number of preamble retransmissions is reached (defined by parameter Preamble_Retrans_Max on L1), a new persistency test is performed in the next transmission time interval. The timer T_2 ensures that two successive persistency tests are separated by at least one 10 ms time interval.

In case that a negative acknowledgement has been received on AICH a backoff timer T_{BO1} 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 10 ms 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-ConfigCONFIG-REQ Req primitive. The latest set of RACH transmission control parameters shall be applied.

If the maximum number of preamble ramping cycles M_{max} is exceeded, failure of RACH transmission shall be reported to higher layer.

Both, transmission failure and successful completion of the MAC transmission control procedure, shall be reportedindicated individually for each logical channel of which data was included in the transport block set of that access attempt. When transparent mode RLC is employed (i.e. for CCCH), transmission status shall beis reported to RRC with CMAC-STATUS-Ind primitive. For logical channels employing acknowledged or unacknowledged mode RLC, transmission status shall beis reported to RLC with MAC-STATUS-Ind primitive.


Start
Get RACH tx control parameters from RRC: M_{max}, N_{BO1min}, N_{BO1max}, set of ASC parameters
NOTE: MAC-c/sh receives RACH tx control parameters from RRC with CMAC-CONFIG-Req primitive whenever one of the parameters is updated
Any data to be transmitted ?
N
Y
ASC selection: (PRACH partition i, P_i)
M := 0
Increment preamble transmission counter M
$M \le M_{max}$?
N
Y
Indicate to higher layer that maximum number of preamble cycles have been reached (TX status “unsuccessful”)
End
Update RACH tx control parameters
Set Timer T_2 (10 ms)
Draw random number $0 \le R_i < 1$
$R \le P_i$?
N
Y
Wait expiry Timer T_2 (10 ms)
Wait expiry Timer T_2 (10 ms)
Set and wait expiry timer T_{BO1} (N_{BO1} *10 ms)
Wait expiry timer T_2 (10 ms)
Send PHY-ACCESS-REQ (start of L1 PRACH transmission procedure)
No Ack
L1 access info ?
Nack
Ack
Send PHY-DATA-REQ, indicate TX status to higher layer
(PRACH message part transmitted)
End

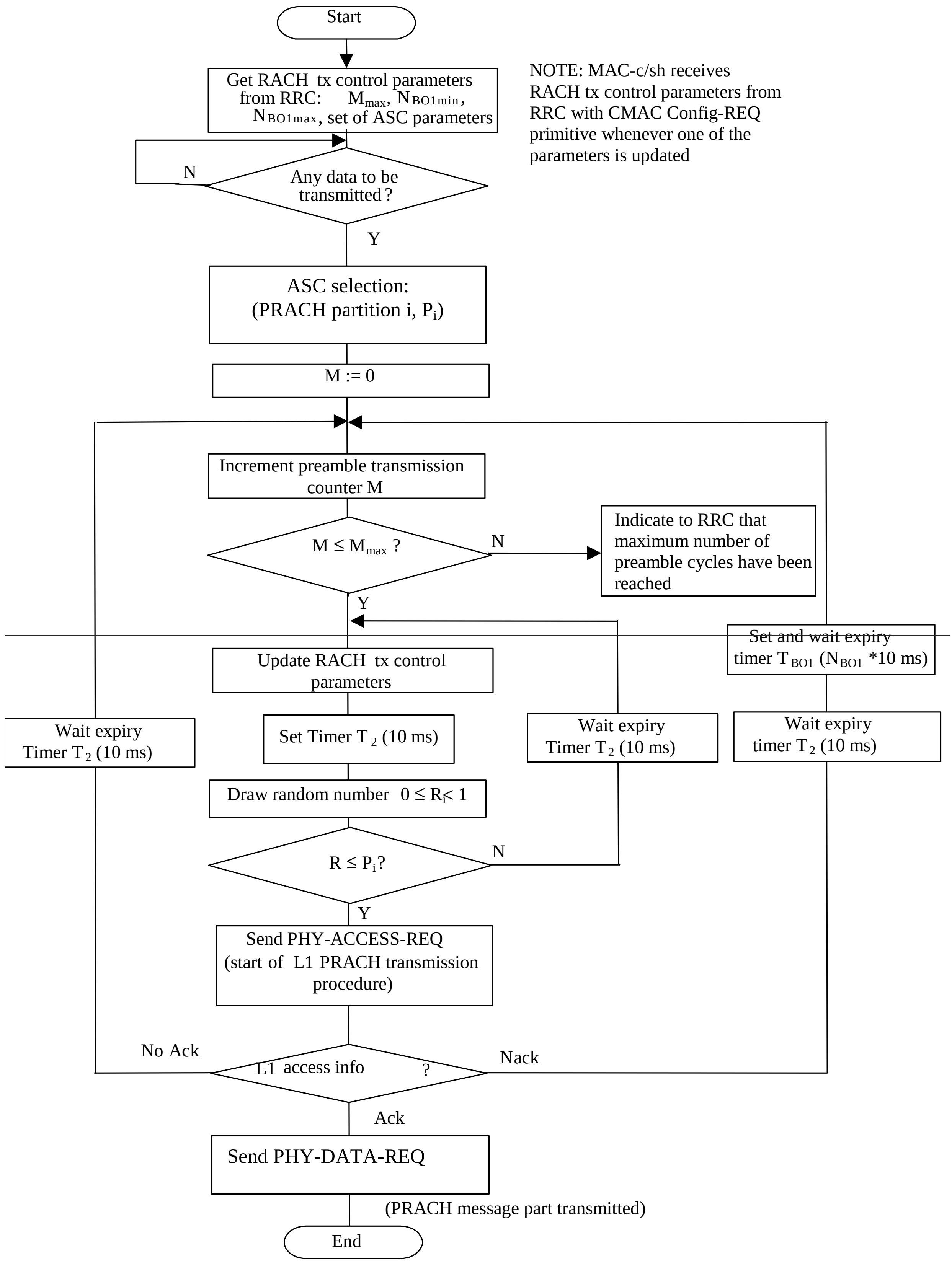


Figure 11.2.2.1: RACH transmission control procedure (UE side, informative)

11.2.3 Control of RACH transmissions for TDD

The RACH transmissions are performed by the UE as shown in figure 11.2.3.1.

NOTE: The figure shall illustrate the operation of the transmission control procedure as specified below. It shall not impose restrictions on implementation.

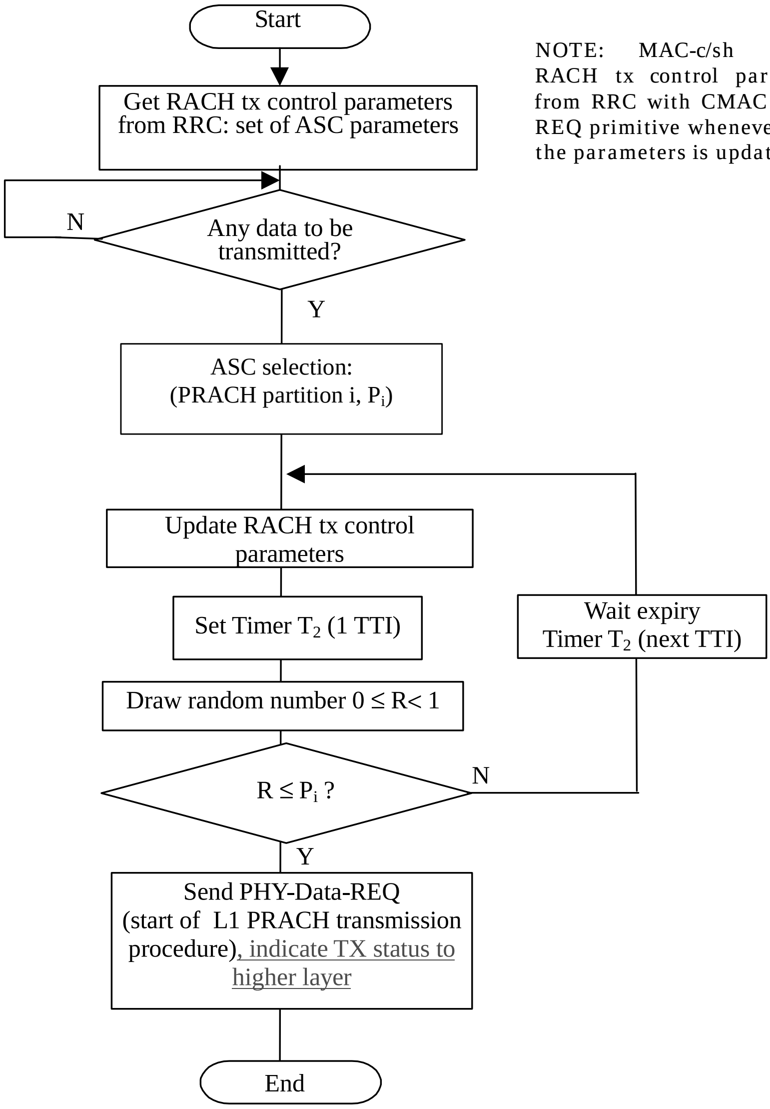
MAC receives the following RACH transmission control parameters from RRC with the CMAC-Config-REQ primitive:

- a set of Access Service Class (ASC) parameters, which includes for each ASC, i=0,…,NumASC an identification of a PRACH partition and a persistence value P_i (transmission probability).

When there is data to be transmitted, MAC selects the ASC from the available set of ASCs, which consists of an identifier *i* of a certain PRACH partition and an associated persistence value P_i. The procedure to be applied for ASC selection is described in subclause 11.2.1.

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.

Successful completion (TX status) of the MAC transmission control procedure shall be indicated to higher layer individually for each logical channel of which data was included in the transport block set of that access attempt. When transparent mode RLC is employed (i.e. for CCCH), transmission status is reported to RRC with CMAC-STATUS-Ind primitive. For logical channels employing acknowledged or unacknowledged mode RLC, transmission status is reported to RLC with MAC-STATUS-Ind primitive.



NOTE: MAC-c/sh receives RACH tx control parameters from RRC with CMAC Config-REQ primitive whenever one of the parameters is updated

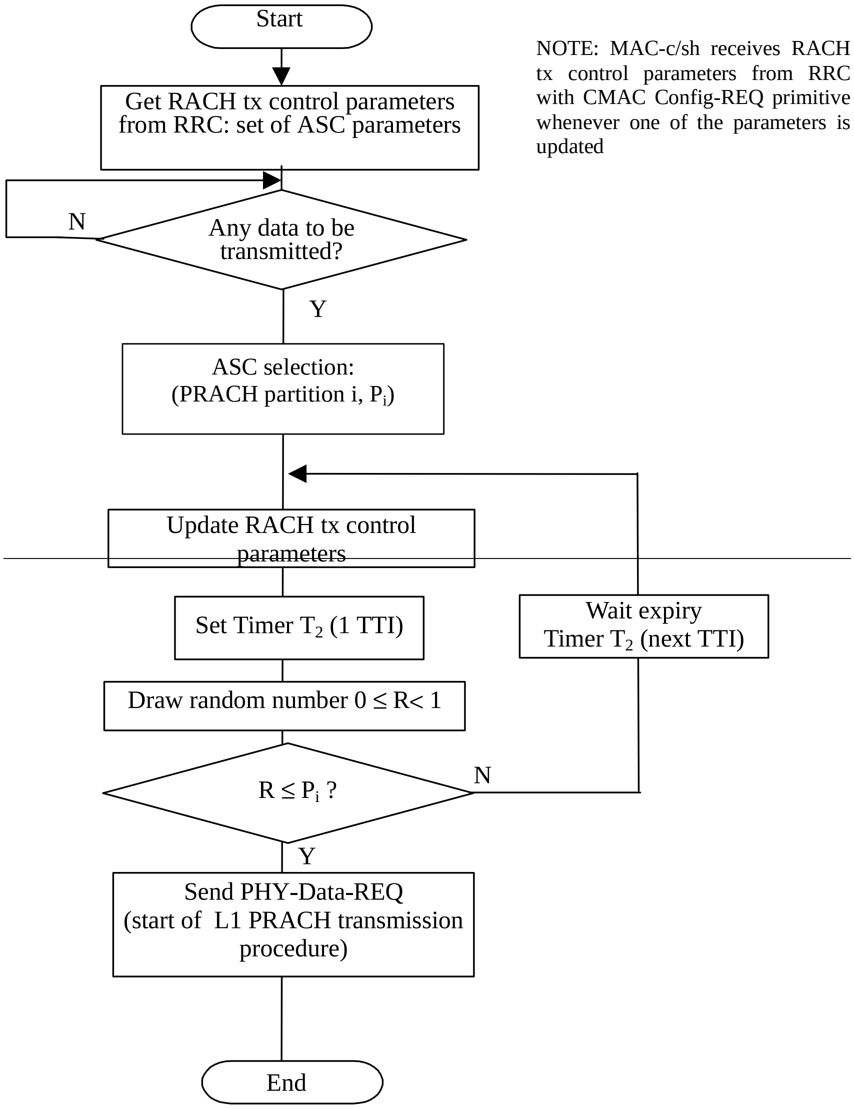


Figure 11.2.3.1: RACH transmission control procedure for TDD (UE side, informative)

11.3 Control of CPCH transmissions for FDD

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. 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 each TTI transmission 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:

- persistence values, P (transmission probability for each Transport Format (TF));
- N_access_fails, maximum number of preamble ramping cycles;
- NF_max, maximum number of frames for CPCH transmission for each TF;
- N_EOT (Number of EOT for release of CPCH transmission);
- Backoff control timer parameters;
- Transport Format Set;

- Initial Priority Delays;
- Channel Assignment Active indication.

The MAC procedure for transmission control of initial CPCH access 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 get all UL transmit parameters (CPCH Set Info, P values, Initial Priority Delays, N_access_fails, NF_max, N_EOT etc) from RRC;
2. the UE shall reset counter M, EOT counter and Frame Count Transmitted (FCT) upon entry to the initial access procedure;
3. the UE shall send a PHY-CPCH_Status-REQ to Layer 1 to obtain CPCH TF subset status. If Layer 1 returns an error message, the UE shall increment counter M. If counter M is equal to N_access_fails, the UE shall execute indicate an access failure error to higher layer procedure and the CPCH access procedure ends. Access failure is reported to RLC with MAC-STATUS-Ind primitive individually for each logical channel of which data was included in the transport block set that could not be transmitted. If counter M is less than N_access_fails, the procedure shall continue from step 3. If Layer 1 returns a PHY-CPCH_Status-CNF message, which includes a TF subset indicating the currently available TFs of the requested TF subset, the procedure shall continue from step 4;
4. the UE shall initialise the Busy Table with the CPCH TF subset status from Layer 1. Those TFs in the TF subset of the Layer 1 PHY-CPCH_Status-CNF response will be marked available. All other TFs will be marked busy;
5. if all TFs are marked busy, the UE shall reset and start timer Tboc1, wait until timer expiry, and increment counter M. If counter M is equal to N_access_fails, the UE shall execute an access failure error procedure and the CPCH access procedure ends. If counter M is less than N_access_fails, the procedure shall continue from step 3;
6. the UE shall update all UL transmit parameters from RRC;
7. UE shall select a TF from the set of available TFs listed in the Busy Table. UE shall use the CPCH channel capacity (transport block set size, NF_max, and TTI interval), and Busy Table information to select one CPCH TF for L1 to access. The UE may select a TF, which uses a lower data rate and a lower UL Tx power than the maximum UL Tx power allowed;
8. UE shall implement a test based on the Persistence value (P) to determine whether to attempt access to the selected CPCH TF. If access is allowed, the UE may implement an initial delay based on ASC of the data to be transmitted, then shall send a PHY-Access-REQ with the selected TF to L1 for CPCH access . If the P test does not allow access, the selected CPCH TF shall be marked busy in the Busy Table. If all TFs are marked busy, the UE shall reset and start timer Tboc1, wait until timer expiry, and increment counter M. If counter M is equal to N_access_fails, the UE shall execute indicate an access failure error to higher layer procedure and the CPCH access procedure ends. Access failure shall be reported to RLC with MAC-STATUS-Ind primitive individually for each logical channel of which data was included in the transport block set that could not be transmitted. If counter M is less than N_access_fails, the procedure shall continue from step 3. If all TFs are not marked busy, the UE shall resume the procedure from step 6;
9. after the UE has sent the access request to L1 , L1 shall return a PHY-Access-CNF including one of five access indications to MAC as shown in figure 11.3.1. If the L1 access indication is that access is granted, then UE shall execute the transmission control procedure for the Nth TTI using the selected TF and the initial access procedure ends;
10. if L1 access indication 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 M. If counter M is equal to N_access_fails, the UE shall execute an access failure error procedure and the CPCH access procedure ends. If counter M is less than N_access_fails, the UE shall proceed from step 3;
11. if L1 access indication is AP-AICH_nak received and Channel Assignment (CA) is active, the UE shall proceed from step 13. If L1 access indication is AP-AICH_nak received and Channel Assignment (CA) is not active, the UE shall reset and start timer Tboc2, wait until 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 M. If counter M is equal to N_access_fails, the UE shall execute an access failure error

procedure and the CPCH access procedure ends. If counter M is less than N_access_fails, the procedure shall continue from step 3. If all channels are not marked busy, the UE shall resume the procedure from step 6;

12. if L1 access indication is CD-AICH signature mismatch, the UE shall reset and start timer Tboc4, wait until timer expiry, and increment counter M. If counter M is equal to N_access_fails, the UE shall execute an access failure error procedure and the CPCH access procedure ends. If counter M is less than N_access_fails, the procedure shall continue from step 3;

13. the UE shall reset and start timer Tboc2, wait until timer expiry, and increment counter M. If counter M is equal to N_access_fails, the UE shall execute an access failure error procedure and the CPCH access procedure ends. If counter M is less than N_access_fails, the procedure shall continue from step 3.

The MAC procedure for transmission control of Nth TTI 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 less than or equal to NF_max, the UE shall send a PHY-Data-REQ with the transport block set to L1 to continue transmission on the CPCH channel which has previously been accessed;

3. if the UE has no data to transmit and the sum of the Frame Count Transmitted counter plus the number of frames in the next TTI is less than NF_max, the UE shall send a PHY-Data-REQ with zero sized transport block to L1 to stop transmission on the CPCH channel which has previously been accessed.

4. if L1 returns PHY-Status-IND indicating abnormal situation the UE shall execute an abnormal situation handling procedure and the CPCH Nth TTI procedure ends. Reasons for abnormal situation may include the following:

   - emergency stop was received;

   - start of Message Indicator was not received;

   - L1 hardware failure has occurred;

   - out of synch has occurred

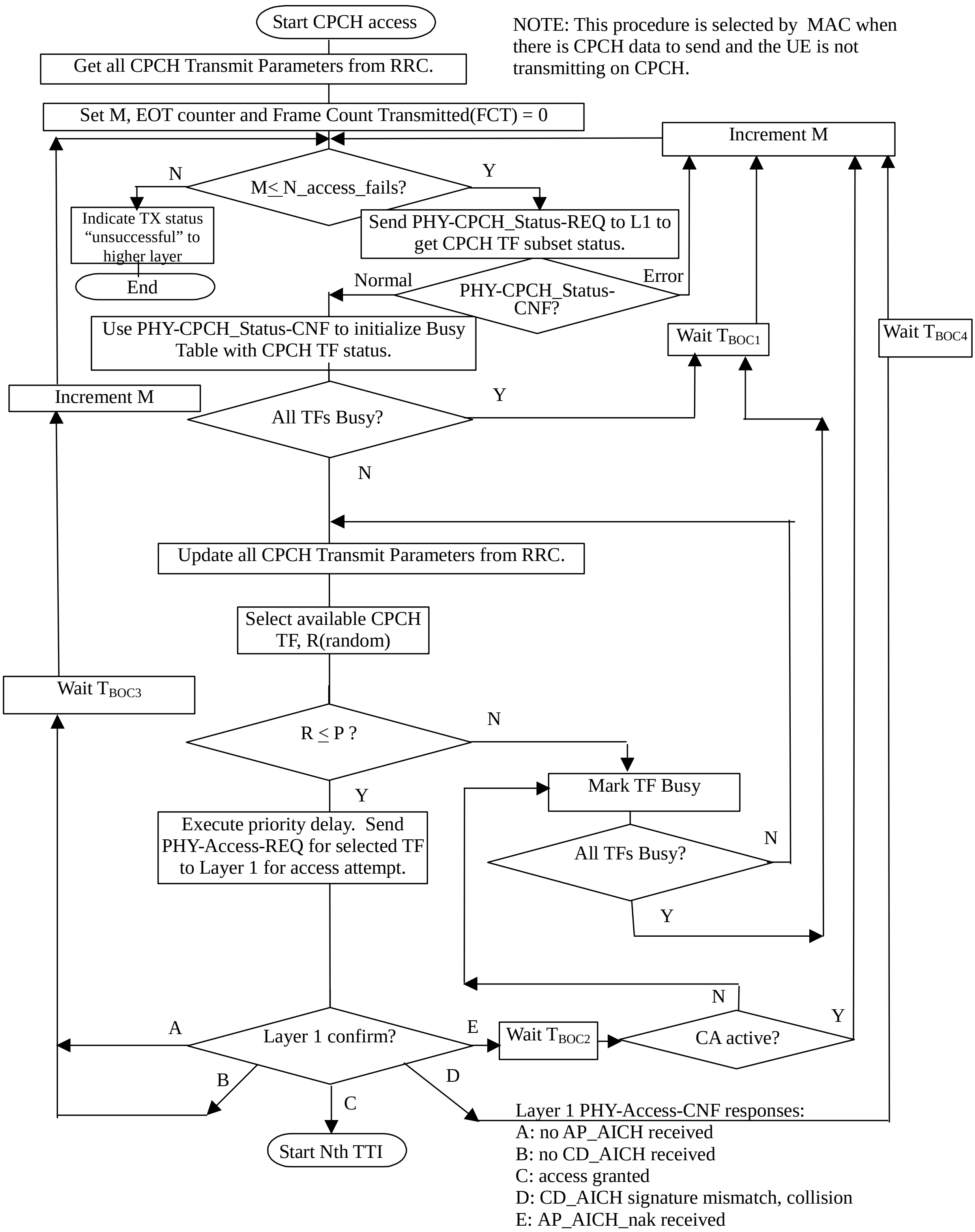
5. ~~if the L1 returns PHY-Status-IND indicating normal transmission, then~~ the UE shall increment the Frame Count Transmitted counter (FCT) by ~~the length of the~~ N_TTI just transmitted and indicate TX Status “transmission successful” to RLC individually for each logical channel of which data was included in the transport block set. ~~and the procedure ends.~~

Table 11.3: CPCH Backoff Delay Timer Values

Timer	Based on parameter	Fixed/random
T_{BOC1} (all Busy)	NF_bo_all_busy	Random
T_{BOC2} (channel Busy)	NS_bo_busy	Fixed
T_{BOC3} (no AICH)	NF_bo_no_aich	Fixed
T_{BOC4} (mismatch)	NF_bo_mismatch	Random

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 [0, NF_bo_mismatch]. 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 [0, NF_bo_all busy].

NOTE: Backoff parameter range and units are specified in TS 25.331, RRC Protocol Specification.



Start CPCH access
NOTE: This procedure is selected by MAC when there is CPCH data to send and the UE is not transmitting on CPCH.
Get all CPCH Transmit Parameters from RRC.
Set M, EOT counter and Frame Count Transmitted(FCT) = 0
Increment M
N
M≤ N_access_fails?
Y
Indicate TX status "unsuccessful" to higher layer
End
Send PHY-CPCH_Status-REQ to L1 to get CPCH TF subset status.
Normal
PHY-CPCH_Status-CNF?
Error
Use PHY-CPCH_Status-CNF to initialize Busy Table with CPCH TF status.
Wait T_{BOC1}
Wait T_{BOC4}
Increment M
All TFs Busy?
Y
N
Update all CPCH Transmit Parameters from RRC.
Select available CPCH TF, R(random)
Wait T_{BOC3}
R ≤ P ?
N
Mark TF Busy
Y
Execute priority delay. Send PHY-Access-REQ for selected TF to Layer 1 for access attempt.
All TFs Busy?
N
Y
N
Y
A
Layer 1 confirm?
E
Wait T_{BOC2}
CA active?
B
D
C
Start Nth TTI
Layer 1 PHY-Access-CNF responses:
A: no AP_AICH received
B: no CD_AICH received
C: access granted
D: CD_AICH signature mismatch, collision
E: AP_AICH_nak received

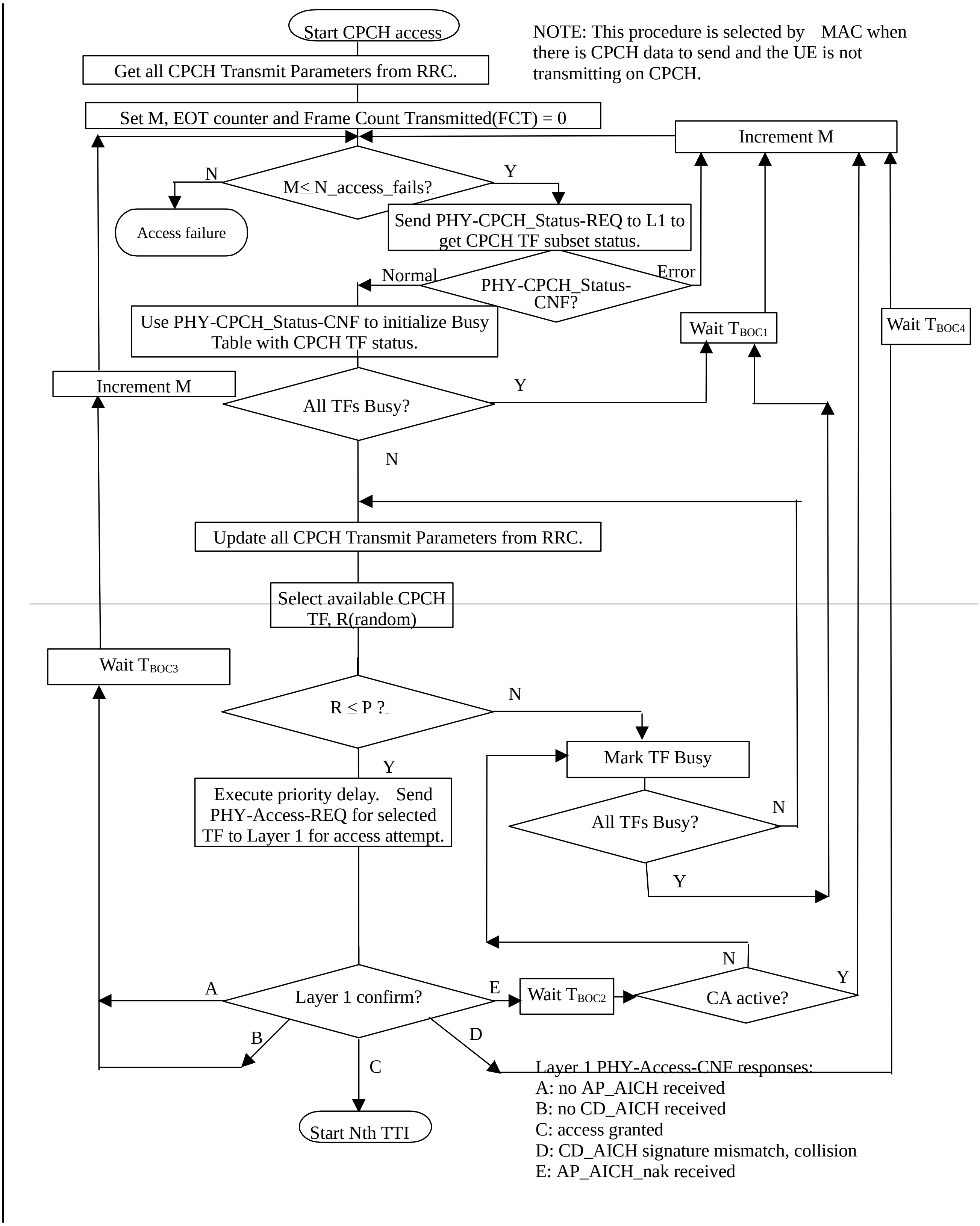
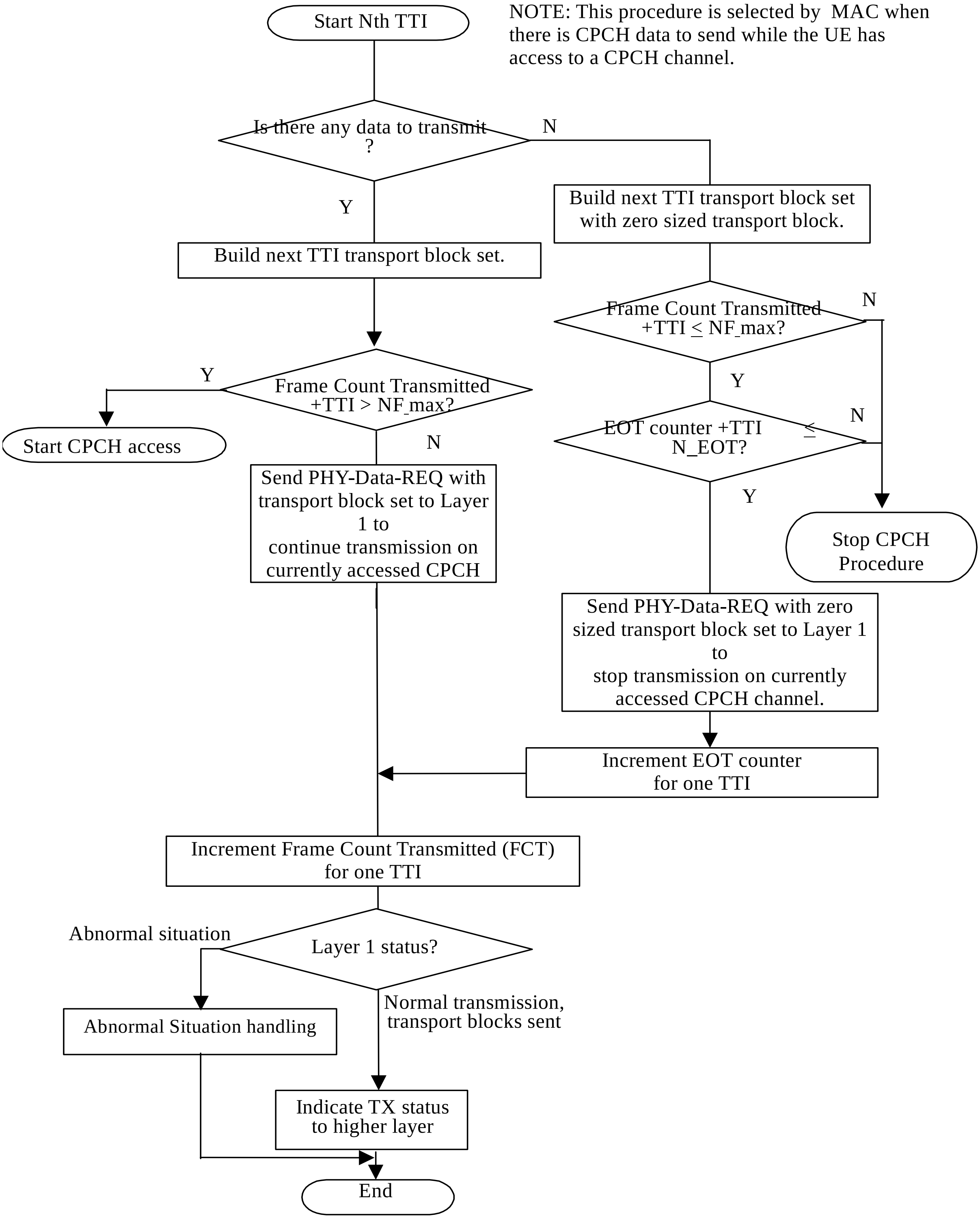


Figure 11.3.1: CPCH transmission control procedure for initial access (informative)


Start Nth TTI
NOTE: This procedure is selected by MAC when there is CPCH data to send while the UE has access to a CPCH channel.
Is there any data to transmit ?
N
Y
Build next TTI transport block set with zero sized transport block.
Build next TTI transport block set.
Frame Count Transmitted +TTI ≤ NF_max?
N
Y
Frame Count Transmitted +TTI > NF_max?
Y
N
Start CPCH access
EOT counter +TTI ≤ N_EOT?
N
Y
Stop CPCH Procedure
Send PHY-Data-REQ with transport block set to Layer 1 to continue transmission on currently accessed CPCH
Send PHY-Data-REQ with zero sized transport block set to Layer 1 to stop transmission on currently accessed CPCH channel.
Increment EOT counter for one TTI
Increment Frame Count Transmitted (FCT) for one TTI
Abnormal situation
Layer 1 status?
Normal transmission, transport blocks sent
Abnormal Situation handling
Indicate TX status to higher layer
End

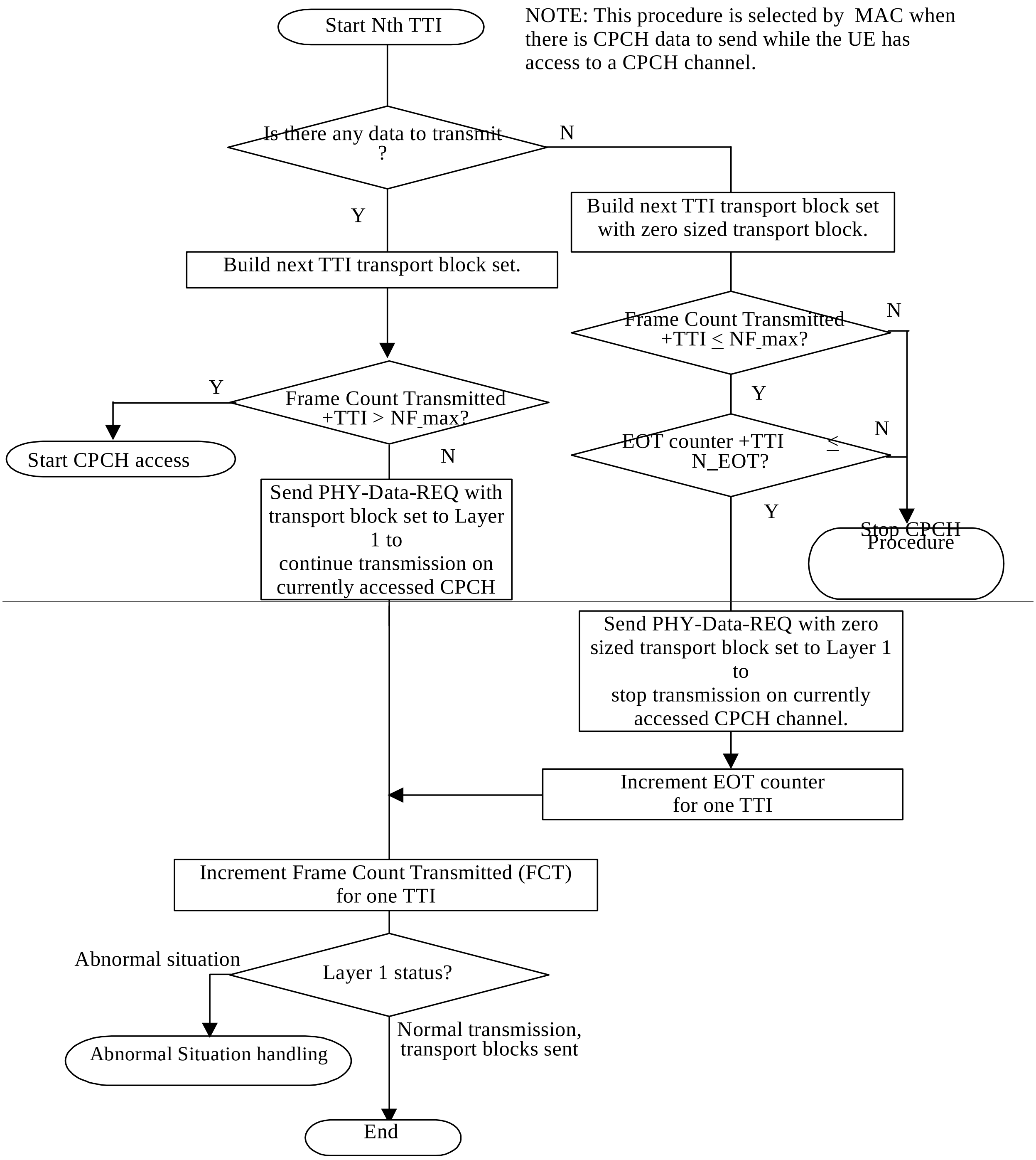


Figure 11.3.2: CPCH transmission control procedure for Nth TTI (informative)

3GPP TSG RAN WG2#17
Sophia Antipolis, France, 13th – 17th November, 2000

***Document* R2-002262**
e.g. for 3GPP use the format TP-99xxx
or for SMG, use the format P-99-xxx

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 059 Current Version: 3.5.0

GSM (AA.BB) or 3G (AA.BBB) specification number ↑ *↑ CR number as allocated by MCC support team*

For submission to: TSG-RAN #10	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑	for information		non-strategic		

Proposed change affects: (U)SIM [ ] ME [X] UTRAN / Radio [X] Core Network [ ]
(at least one should be marked with an X)

Source: TSG-RAN WG2 **Date:** 2000-11-13

Subject: Inclusion of Stage 3 for ciphering

Work item:

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

F	Correction	X
A	Corresponds to a correction in an earlier release	
B	Addition of feature	
C	Functional modification of feature	
D	Editorial modification	

Release:

Phase 2	
Release 96	
Release 97	
Release 98	
Release 99	X
Release 00	

Reason for change: Stage 3 aspects of security have been included.

Clauses affected: 11.5(new)

Other specs affected:

Other 3G core specifications		→ List of CRs:
Other GSM 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.

11. 5 Ciphering

The ciphering function is performed in MAC (ie only in MAC-d) if a radio bearer is using the transparent RLC mode. The data unit that is ciphered is the MAC SDU and this is shown in Figure 11.5.1 below.

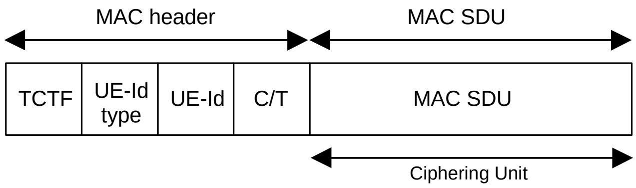


Figure 11.5.1: Ciphering unit for a MAC PDU

The ciphering algorithm and key to be used are configured by upper layers [7] and the ciphering method shall be applied as specified in [10].-

The parameters that are required by MAC for ciphering are defined in [10] and are input to the ciphering algorithm. The parameters required by MAC which are provided by upper layers [7] are listed below:

- MAC-d HFN (Hyper frame number for radio bearers that are mapped onto transparent mode RLC)
- BEARER (Radio Bearer ID)
- CK (Ciphering Key)