TSG RAN #6 **TSGR#6(99)639**
Nice, France
December 13-15, 1999

Agenda item:
Source: **Golden Bridge Technology**
Title: **CR25.321-020r1, resubmitted CR for MAC Control of CPCH Transmission**
Document for: **Discussion and approval**

INTRODUCTION

At RAN2#7, RAN2 considered and approved a CR25.321-020 [1] for submission to RAN#5 for approval. CR25.321-020 specifies a new procedure for MAC control of CPCH transmission. RAN2 submitted a large Tdoc [2] with many CRs, including CR25.321-020, for RAN approval. However, RAN decided to postpone this CR25.321-020 stating that "All CRs on this issue, which impact WG1, to be issued for next RAN meeting" (verbatim from RAN Chairman's report [3]). Per RAN's stated intention, Golden Bridge Technology (GBT), one of the proponents of CPCH in RAN2, is hereby resubmitting a corrected version of this CR for RAN approval.

DISCUSSION

The following points explain the need for and provide justification for RAN approval of this CR at this time:

1. The descriptions of CPCH in TS25.302 and TS25.321 are incomplete in the current versions of these documents. Specifically, a new procedure for MAC control of CPCH transmission is needed and is not yet included in TS25.321, the MAC protocol specification. CR25.321-020r1 completes a "baseline" description for CPCH in the MAC protocol specification.
2. The CR25.321-020r1 has been modified from CR25.321-020 to align with a recent decision in RAN1#8 which did not approve a method for real-time CPCH status monitoring (GBT's proposal for collecting CPCH status). References to real-time monitoring have been deleted from CR25.321-020. With these deletions, CR25.321-020r1 agrees with the Dec 99 version of RAN1 specifications. A change-marked version of CR25.321-020 is included here to identify the deletions.
3. RAN2 had approved CR25.321-020 at RAN2#7. The CR25.321-020r1 has been modified to delete references to a minor feature which is not supported in the RAN1 specifications. As such, RAN can approve this CR25.321-020r1 based on this prior approval by RAN2.
4. Both RAN1 and RAN2 have had and continue to have open issues concerning further possible additions (such as Channel Assignment) to the baseline CPCH. For this reason, CPCH is delayed until RAN#7 in March 2000.

5. The original CR, CR25.321-020, was presented for RAN approval at RAN#5, but was postponed citing these ongoing discussions for CPCH in RAN1 and RAN2. This RAN decision, however, may not have included consideration for the need for a complete and consistent baseline description of CPCH on which to base these continuing discussions concerning CPCH additions.
6. A complete and consistent baseline description of CPCH will assist the ongoing efforts of RAN1 and RAN2 and, more importantly, will provide a complete view of the specified CPCH feature for consumers of the Dec 99 release of the RAN specifications.

For these reasons, GBT urges RAN to approve this corrected CR25.321-020r1 at this time.

PROPOSAL

The changes listed in the attached CR25.321-020r1 should be incorporated into the latest version of TS25.321, MAC Protocol.

REFERENCES

[1] TSGR2#7(99)D02, CR25.321-020, MAC Procedure for Control of CPCH Transmission, source: Ericsson.
[2] TSGR#5(99)463, CRs for TS25.321, MAC Protocol Specification, source: RAN2.
[3] TSGS#5(99)460, Status Report on RAN#5, source: TSG RAN Chairman.

CHANGE-MARKED VERSION OF CR25.321-020:

11.3 Control of CPCH Transmission

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

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

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

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

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

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

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

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

Table 11.3: CPCH Backoff Delay Timer Values

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

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

Example CPCH Channel Selection Algorithm:

The UE MAC channel selection algorithm is left to implementation and is out of the scope of this specification. However the following example is presented to show one way UE may select a CPCH channel. In this example CPCH channel selection is a 3~~4~~ step process:

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

~~4.If none of the channels selected at step 2 have a timestamped IDLE status in the availability table, the channel with the oldest BUSY status is selected.~~

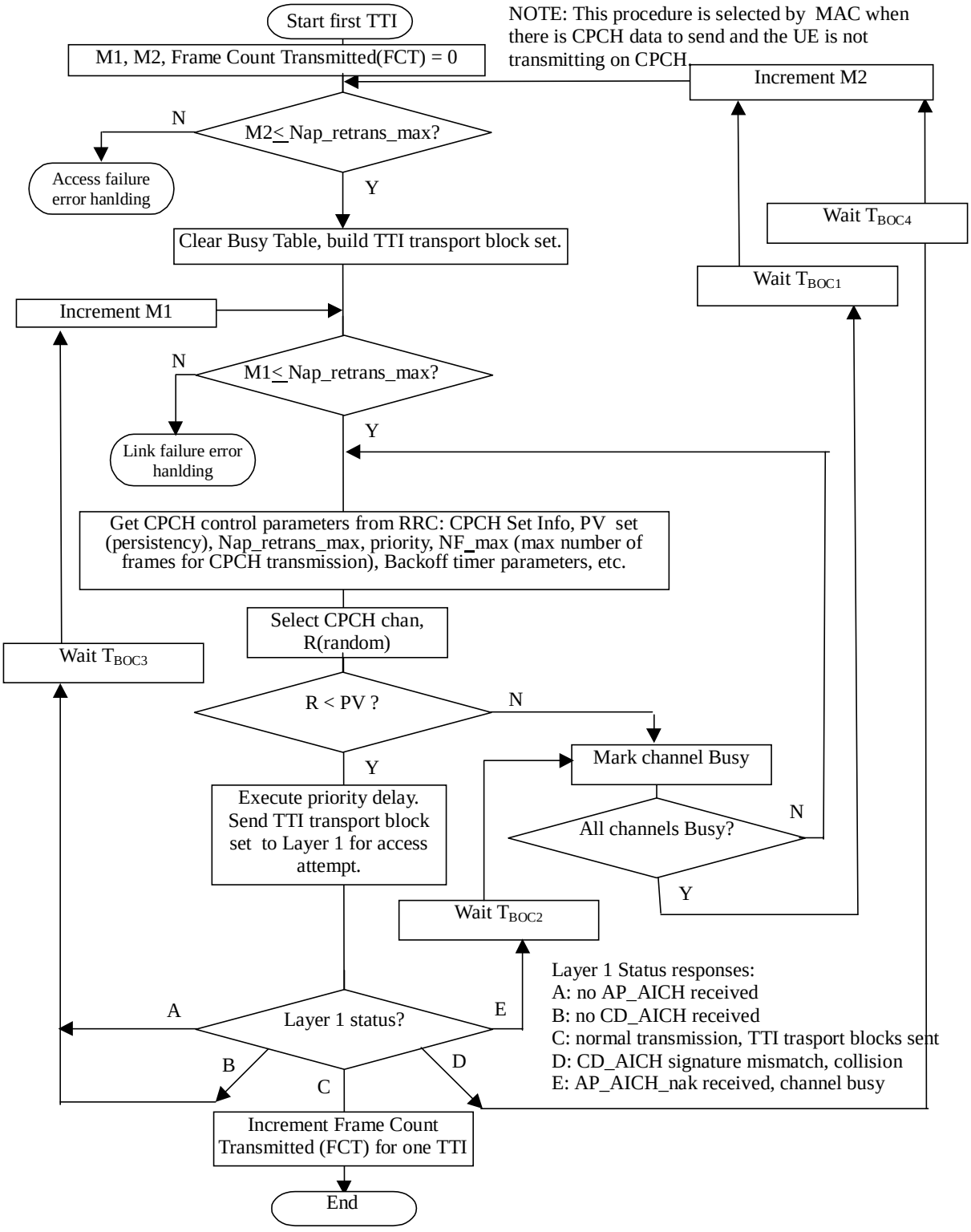
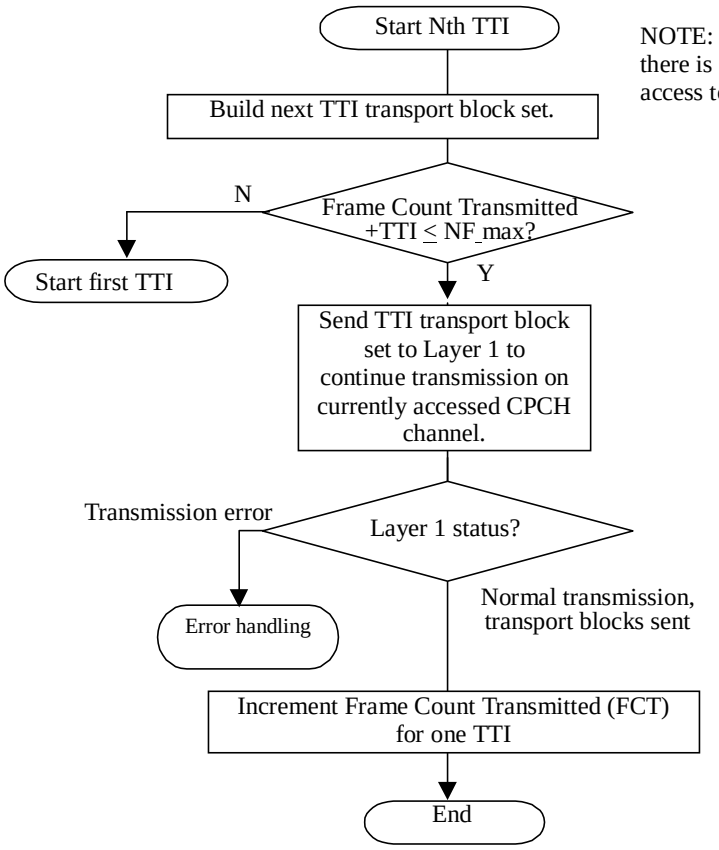


Figure 11.3.1: CPCH transmission control procedure for first TTI (informative)



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

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

3GPP TSG-RAN meeting #6
Nice, France, 13-15 December 1999

***Document* RP-99639**
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	020r1	Current Version:	3.1.0

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

For submission to:	TSG-RAN#6	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: Golden Bridge Technology **Date:** 09 Dec 1999

Subject: MAC procedure for control of CPCH transmission

Work item:

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

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

Reason for change: Added procedure to specify MAC control of CPCH transmission.

Clauses affected: 11.3 (new clause added)

Other specs affected:

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

11.3 Control of CPCH Transmission

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

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

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

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

1. The UE shall reset counters M1, M2 and Frame Count Transmitted (FCT) upon entry to the first TTI procedure.
2. The UE shall clear the Busy Table and build a transport block set for the next TTI.
3. The UE shall update the CPCH transmission control parameters, including CPCH Set Info, Persistency PV, Nap_retrans_max, priority delays, NF_max, Backoff timer parameters, etc.
4. UE shall select a CPCH channel from the set of CPCH channels defined in the CPCH set which is assigned for use on the transport channel with data to be transmitted. UE shall use the persistence value, the CPCH channel capacity (max CPCH length and data rate), and busy table information to select one CPCH channel for L1 to access. The UE shall maintain a busy table for each CPCH intial access attempt. The busy table marks a CPCH channel as busy when a selected channel fails the persistence test or when an AP-AICH_nak is received in response to an access attempt. (an example channels selection algorithm is presented at the end of this section.)
5. UE shall implement a test based on the Persistence value (PV) to determine whether to attempt access to the selected CPCH channel. If access is allowed, the UE shall implement an initial delay based on priority of the data to be transmitted, then shall sent the TTI transport block set to L1 for CPCH access and transmission. If the PV test does not allow transmission, the selected CPCH channel shall be marked busy in the Busy Table. If all channels are marked busy, the UE shall reset and start timer Tboc1, wait until timer expiry, and increment counter M2. If counter M2 is equal to N_ap_retrans_max, the UE shall execute an access failure error procedure and the CPCH transmit procedure ends. If counter M2 is less than N_AP_retrans_max, the procedure shall continue from step 2. If all channels are not marked busy, the UE shall resume the procedure from step 3.
6. After the UE has sent the transport block set to L1 for transmission, L1 may return one of five status indications to MAC as shown in Figure 11.3.1. If the L1 status is that the TTI transport block set was sent normally, then UE shall increment the Frame Count Transmitted counter by the length of the TTI just transmitted and the procedure ends.
7. If L1 status is no AP-AICH received or no CD-AICH received, the UE shall reset and start timer Tboc3, wait until timer expiry, and increment counter M1. If counter M1 is equal to Nap_retrans_max, the UE shall execute a link failure error procedure and the CPCH transmit procedure ends. If counter M1 is less than Nap_retrans_max. UE shall select another CPCH channel and proceed from step 3.

8. If L1 status is AP-AICH_nak received, the UE shall reset and start timer Tboc2, wait unitl timer expiry, and mark the selected channel busy in the Busy Table. If all channels are marked busy, the UE shall reset and start timer Tboc1, wait until timer expiry, and increment counter M2. If counter M2 is equal to N_ap_retrans_max, the UE shall execute an access failure error procedure and the CPCH transmit procedure ends. If counter M2 is less than N_ap_retrans_max, the procedure shall continue from step 2. If all channels are not marked busy, the UE shall resume the procedure from step 3.
9. If L1 status is CD-AICH signature mismatch, the UE shall reset and start timer Tboc4, wait until timer expiry, and increment counter M2. If counter M2 is equal to N_ap_retrans_max, the UE shall execute an access failure error procedure and the CPCH transmit procedure ends. If counter M2 is less than N_ap_retrans_max, the procedure shall continue from step 2.

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

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

Table 11.3: CPCH Backoff Delay Timer Values

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

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

Example CPCH Channel Selection Algorithm:
The UE MAC channel selection algorithm is left to implementation and is out of the scope of this specification. However the following example is presented to show one way UE may select a CPCH channel. In this example CPCH channel selection is a 3 step process:

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

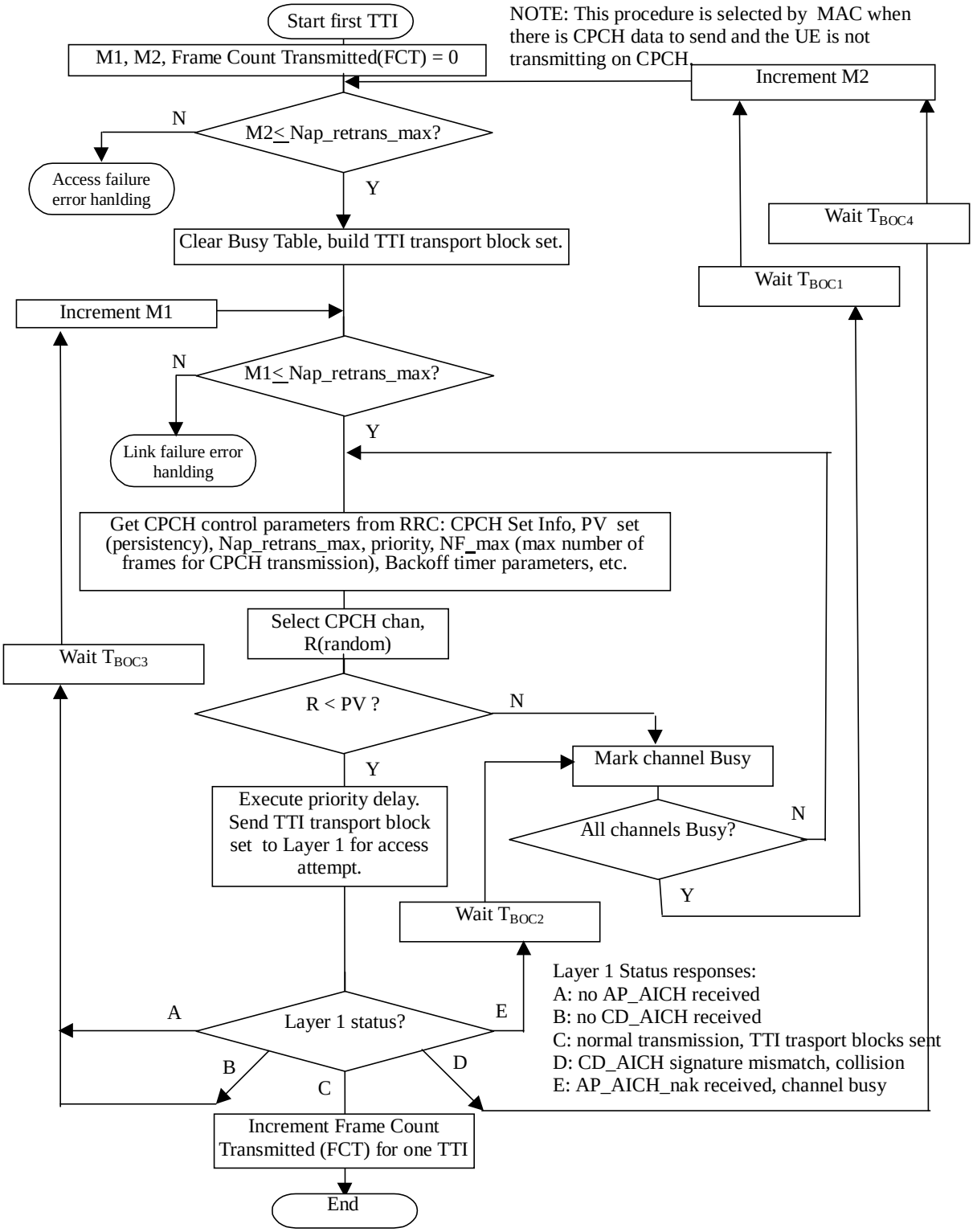
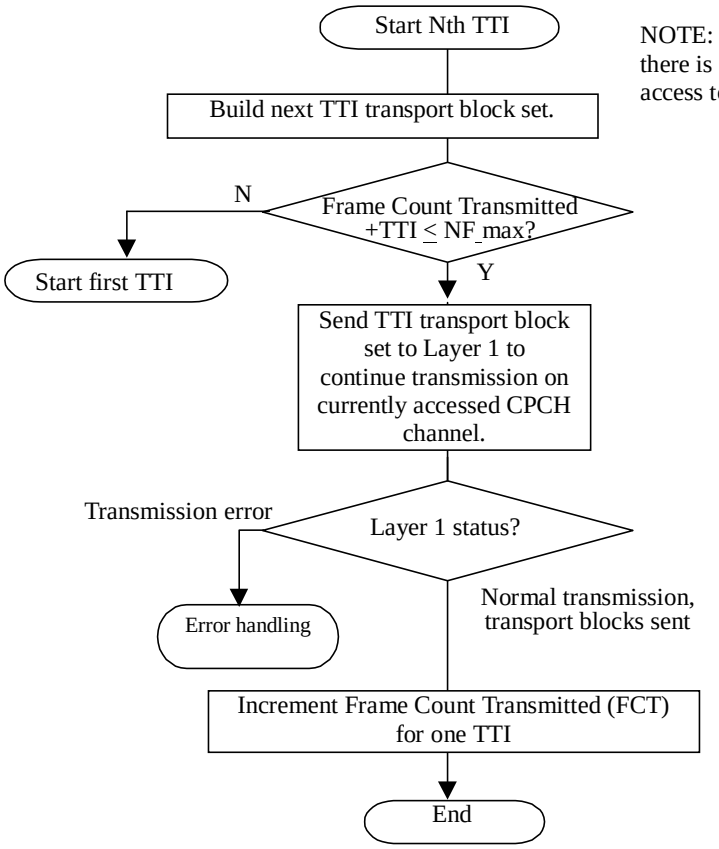


Figure 11.3.1: CPCH transmission control procedure for first TTI (informative)



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

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