

Agenda Item: 7.2

Source: NEC, Telecom-MODUS, NEC Tech. UK

Title: Change requests related Random access procedure

Document for: 3GPP S2.21 (MAC protocol specification)

The last RAN WG2 meeting in Helsinki, RAN WG2 made the merged MAC protocol specification S2.21[1]. However, some descriptions still remain as annex. Therefore, RAN WG2 has to review the annex (section 14,15,16) of S2.21 and move them into the main part of the document.

We believe random access procedure should be described in S2.21 if the acknowledged preamble scheme by Acquisition Indicator would be included in the physical layer. This is because the Acquisition Indicator is only used for avoiding the collision on RACH and an acknowledgement for repetition on RACH is still required in the data link layer. We believe the repetition in MAC is better than that in RLC in order to reduce the roundtrip delay for RACH acknowledgement. Moreover, we think the repetition in MAC can provide more flexible QoS than the only repetition in RLC such as the guaranteed transmission in condition of the restricted delay time.

We have submitted the restructured S2.21 document [2] into the 3GPP_TSG_RAN_WG2 mailing list. However, in the descriptions of related random access procedure, we guess there is something to be corrected. Therefore, we propose to change the descriptions of the related random access procedure as followings.

- In section 6.1 of [2] (section 14.1 of [1]), N_{RA} is defined as the maximum number of retransmission. On the other hand, in section 11.2 of [2] (section 15.1 of [1]), N_{RA} is defined as the maximum number of transmission. We guess the suffix "RA" means Retransmission Attempt. Therefore, we think the section 11.2 of [2] should be revised.
- "Random access procedure" in section 11.2 of [2] (section 14.1 of [1]) includes some functionalities, such as FACH selection, multiple access and repetition algorithm. Therefore, we think the section 11.2 of [2] should be described more clearly.
- According to the e-mail discussions (Subject: UE-id on CCCH and Retransmission/Scheduling), we think the related figures (Figure 4.2.3.1.1.1 and 4.2.3.3.1 of [2]) should be modified.

[1] "MAC protocol specification", 3GPP S2.21 v0.0.1 1999-01.

[2] TSGR2#2(99)105 "Restructure of S2.21 (MAC protocol specification)"

11.2 Random access procedure

- FACH selection for receiving ACK: A calculation result (ex. modulo operation) is used.
- Multiple access: The Random access procedure is based on the slotted ALOHA algorithm and the Acquisition Indication Channel (AICH).
- Repetition algorithm: Stop & wait ARQ procedure is applied to RACH transmission. After an UE transmits a transport block on a RACH, UE should wait to receive an acknowledgement,(ACK) from a UTRAN on a FACH.

Figure 11.2.1 and Figure 11.2.2 show random access procedures in UTRAN and UE, respectively. Detail of the procedure is following:

- 1) UTRAN broadcasts codes of FACH, which is used in the sector, on BCCH-C. For example, C1, C2 and C3 are broadcasted in this order.
- 2) The UE selects RNTI randomly, when a transport block to be transmitted on a RACH is generated in an UE and when UE has not been assigned any RNTI by UTRAN.

- 3) In order to decide spreading code of FACH for ACK reception, the UE calculates a remainder of the RNTI value divided by the number of codes of FACHs used in the sector. But, this procedure is omitted if the maximal number of RACH retransmission, " N_{RA} " equals to ~~1~~0 (RACH retransmission is not necessary).
- 4) The UE constructs an RACH transport block with the RNTI.
- 5) The UE selects a spreading code, transmission timing and signature pattern, randomly.
- 6) The UE transmits an RACH transport block on a radio frame using a selected spreading code, transmission timing and signature pattern.
- 7) If N_{RA} equals to ~~1~~0, the UE omits following procedure and starts procedure from 2) again. UE can transmit plural RACH transport blocks using succeeding radio frames in case of $N_{RA}=\neq 0$.
- 8) The UE starts a timer, T_{MS-ACK} .
- 9) The UE waits to receive an ACK from the UTRAN on the FACH corresponding to calculation results (Ex. If the calculation result equal to 0, 1 or 2 in case that three codes are used for FACH in the sector, the UE waits to receive the ACK on FACH spread with C1, C2 or C3, respectively).
- 10) When UTRAN received RACH transport block correctly, UTRAN calculates a remainder in the same way as UE does using the RNTI received on RACH.
- 11) UTRAN constructs FACH-ACK to be transmitted on FACH. The FACH-ACK includes RNTI of correctly received RACH (see 9.2).
- 12) The UTRAN transmit the FACH-ACK on the FACH corresponding to the calculation result. (Ex. If the calculation result equal to 0, 1 or 2 in case that three codes are used for FACH in the sector, the UTRAN transmit the FACH-ACK on FACH spread with C1, C2 or C3, respectively.) UTRAN should transmit FACH-ACK within T_{BS-ACK} after correctly receiving the RACH radio frame from the UE. If UTRAN could not transmit FACH-ACK within T_{BS-ACK} because all radio frames on a FACH within T_{BS-ACK} are used for other FACH-ACK transmission, the FACH-ACK is discarded in UTRAN.
- 13) If the UE receives FACH-ACK including the corresponding RNTI and has another message to be transmitted on RACH, the UE start RACH transmission procedure from 2) again.
- 14) If the UE fails to receive the FACH-ACK within T_{MS-ACK} after transmitting the RACH transport block, the UE retransmits the RACH transport block with same RNTI after a pseudo-random delay.
- 15) If the number of transmission is equal or more than N_{RA} , UE should discard the RACH transport block.

[note] The ACK timeouts should be related like this: $T_{MS-ACK} > T_{BS-ACK}$.

• ~~Figure 11.2.1 and Figure 11.2.2 show random access procedures in UTRAN and UE, respectively.~~

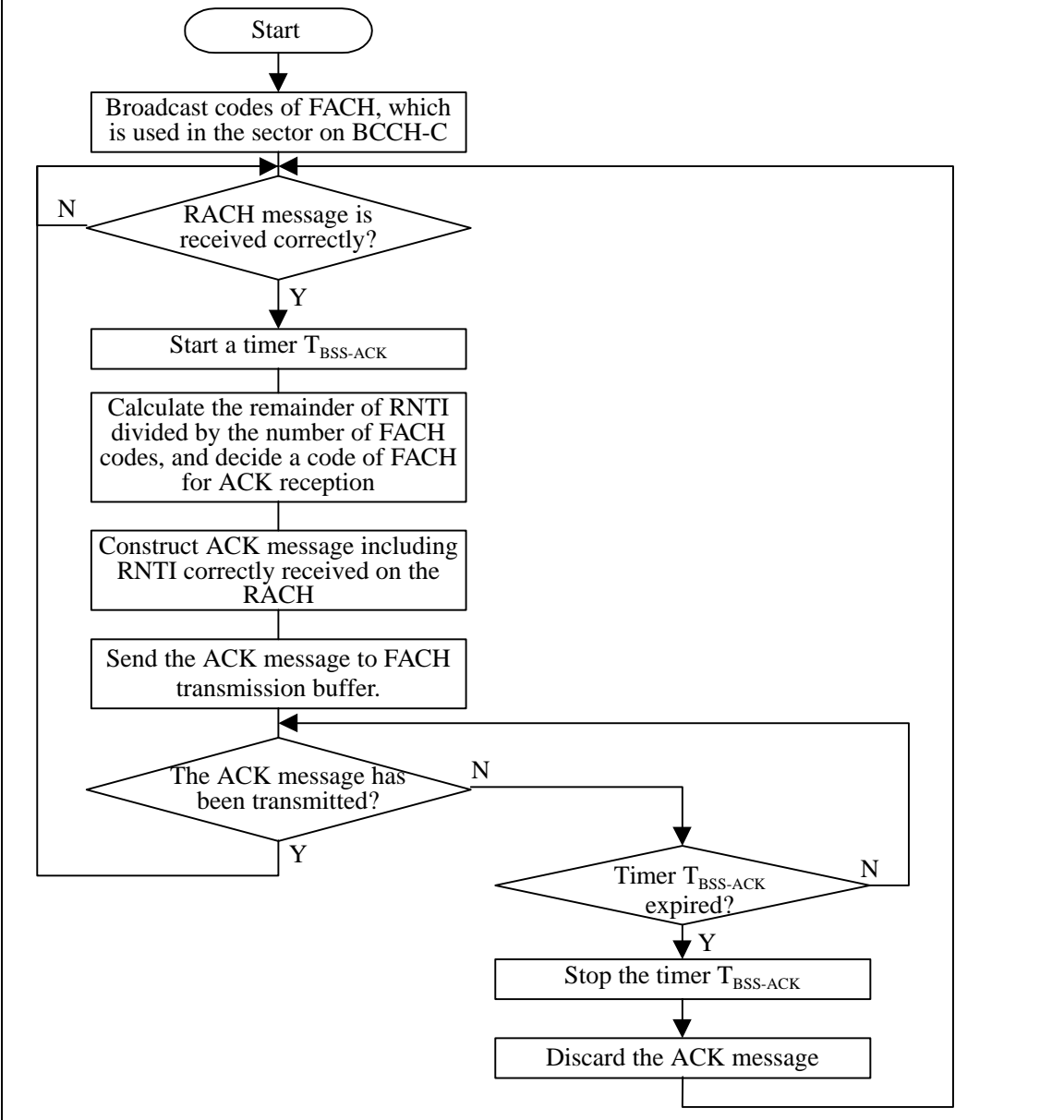


Fig. 11.2.1 Random access procedure in UTRAN

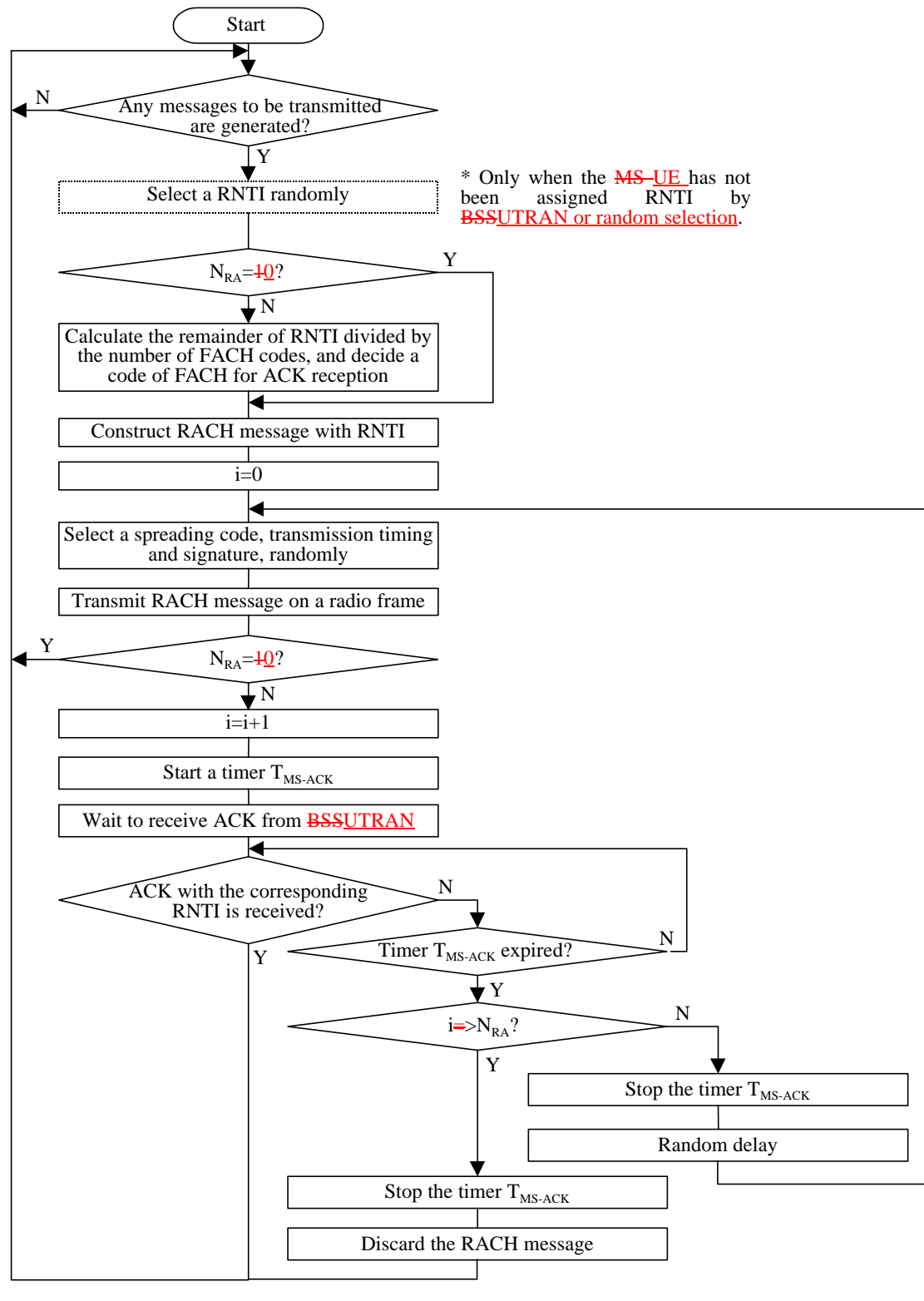


Fig. 11.2.2 Random access procedure in a UE

4.2.3.1 MAC-c entity

4.2.3.1.1 Functional Overview

Figure 4.2.3.1.1.1 shows the UE side MAC-c entity. The following functionality is covered:

- The C/D box represents the insertion and detection of the field in the MAC header, indicating whether a common or dedicated logical channel is used.
- The RNTI field in the MAC header is used to distinguish between UEs.
- In the uplink, the possibility of transport format selection exists.
- For RACH termination according S2.01 Case C retransmission/scheduling may apply.

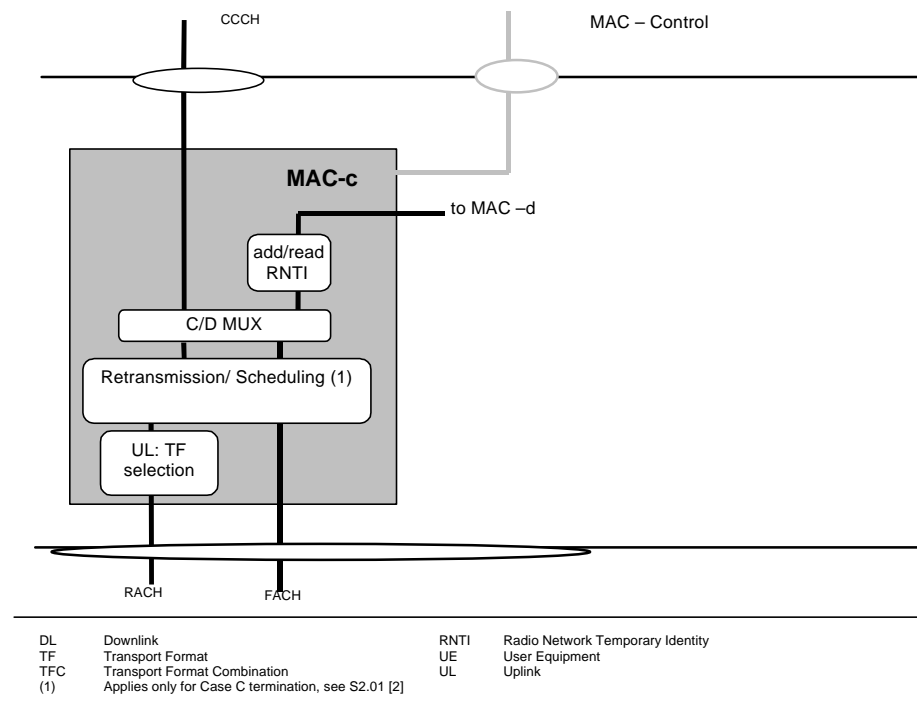


Figure 4.2.3.1.1.1. UE side MAC architecture / MAC-c details

4.2.4.1 MAC-c entity

4.2.4.1.1 Functional Overview

Figure 4.2.4.1.1.1 shows the UTRAN side MAC-c entity. The following functionality is covered:

- The C/D box represents the insertion and detection of the field in the MAC header, indicating whether a common or dedicated logical channel is used.
- For dedicated type logical channels, the RNTI field in the MAC header is used to distinguish between UEs.
- In the downlink, transport format selection might be done if FACH is variable rate.
- For RACH termination according S2.01 Case C retransmission/scheduling may apply.

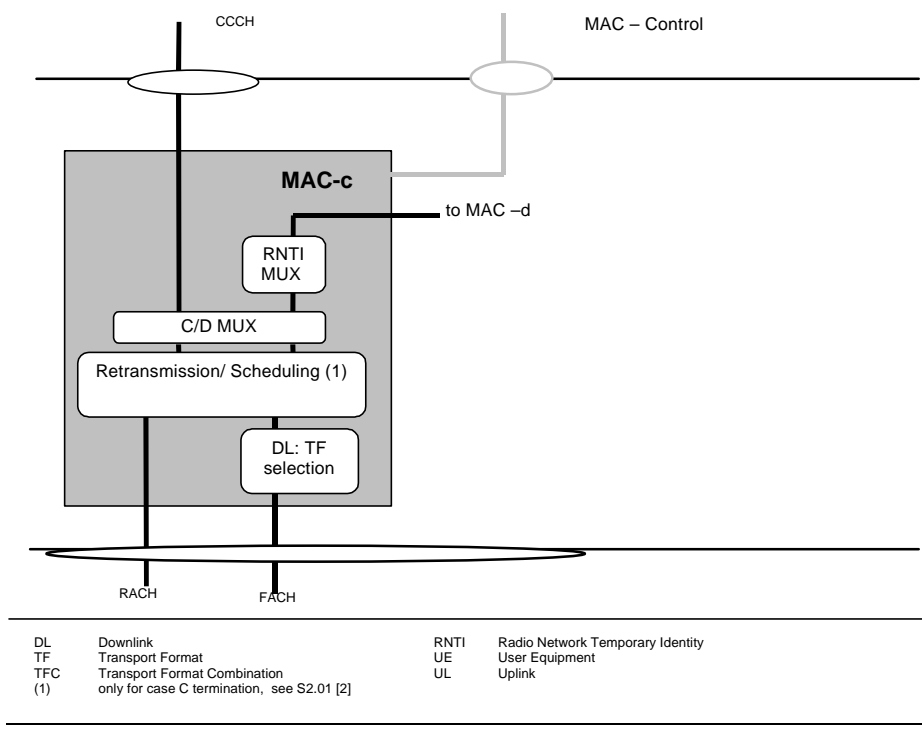


Figure 4.2.4.1.1.1 UTRAN side MAC architecture / MAC-c details