TSG-RAN Working Group 1 meeting #8 **TSGR1#8(99)g26**

New York, United States

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Agenda item:

Source: Ericsson

Title: Updates to description of Random Access procedure

Document for: Decision

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1 Introduction

This paper proposes some modifications to the Physical RACH procedure as described in Section 6 of 25.214. The modifications are mainly proposed in order to align the Physical RACH procedure with WG2. Some modifications are also proposed in order to improve the overall quality of the description.

- Section 6.1 is renamed *Physical* Random Access Procedure.
- It is clarified what parameters are received from RRC, from MAC, or derived internally within Layer 1.
- The description of dynamic persistence is removed. Dynamic persistence is carried out before the Physical RACH procedure is initiated i.e. it should not a part of the Layer 1 description.
- At the reception of a negative AI, the Physical RACH procedure is terminated with no other Layer 1 activities.
- A short text that further clarifies the sub-RACH channels is also included.
- Some editorial updates are made.

2 Text proposal for TS 25.214

6.1 PHYSICAL RANDOM ACCESS PROCEDURE

The physical random access procedure specified in this section is initiated upon reception of a PHY-Data-REQ primitive from the MAC sublayer (cf. TS 25.321)

Before the PRACH procedure can be initiated, Layer 1 should receive the following information from the higher layers (RRC):

- The preamble scrambling code to be used for the PRACH transmission
- The AICH transmission timing parameter
- The available signatures and sub RACH channel groups for each ASC, where a sub-RACH channel group is defined as a sub-set of the sub-RACH channels defined in Section 6.1.1.
- The power offset ΔP_0 (power step when no acquisition indicator is received)
- The parameter Preamble_Retrans_Max

- The initial preamble power $P_{preamble\text{-}init}$ to be used for the PRACH transmission

- The set of Transport Format parameters. This includes the power offset $\Delta P_{p\text{-}m}$ between preamble and message part for each Transport Format.

Note that the above parameters may be updated from higher layers before each PRACH procedure is initiated.

At each initiation of the PRACH procedure, Layer 1 should receive the following information from the higher layers (MAC):

- The Transport Format to be used for the PRACH message part

- The ASC of the PRACH transmission

- The data to be transmitted (Transport Block Set)

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The physical random-access procedure at the UE shall be performed as follows:

1. Randomly select the sub RACH channel group from the available ones for the given ASC. The random function, for selecting the sub RACH channel group from the available ones is TBD.
2. Derive the available access slots in the next two frames, defined by SFN and SFN+1 in the selected sub-RACH channel group with the help of SFN and Table 1. Randomly select one access slot from the available access slots in the next frame, defined by SFN, if there is one available. If there is no access slot available in the next frame, defined by SFN then, randomly selects one access slot from the available access slots in the following frame, defined by SFN+1. Random function is TBD.
3. Randomly select a signature from the available signatures within the ASC given by higher layers. Random function is TBD.
4. Set the Preamble Retransmission Counter to Preamble_Retrans_Max.
5. Set the preamble transmission power to $P_{preamble\text{-}init}$
6. Transmit a preamble using the selected uplink access slot, signature, and preamble transmission power..
7. If no positive or negative acquisition indicator corresponding to the selected signature in the downlink access slot corresponding to the selected uplink access slot is detected:

    7.1 Select a new uplink access slot, as next available access slot, i.e. next slot in the sub-channel group used, as selected in 4.1

    7.2 Randomly select a new signature from the available signatures within the ASC given by higher layers. Random function is TBD.

    7.3 Increase the preamble transmission power with ΔP_0.

    7.4 Decrease the Preamble Retransmission Counter by one.

    7.5 If the Preamble Retransmission Counter > 0, repeat from step 6 otherwise pass L1 status (“no ack on AICH”) to the higher layers (MAC) and exit the random-access procedure.

8 If a negative acquisition indicator corresponding to the selected signature in the downlink access slot corresponding to the selected uplink access slot, exit the Physical Random Access procedure and pass L1 status (“Nack on AICH received”) to the higher layers (MAC).

7 Transmit the random access message three or four uplink access slots after the uplink access slot of the last transmitted preamble depending on the AICH transmission timing parameter. Transmission power of the random access message is modified from that of the last transmitted preamble with the specified offset $\Delta P_{p\text{-}m}$.

8 Exit the Physical Random Access procedure and pass L1 status (“successful random-access transmission”) to the higher layers (MAC).

6.1.1 Sub-RACH channels

A sub-RACH channel defines a sub-set of the total number of access slots. There are a total of 12 sub-RACH channels. Sub-RACH channel #i (i=0, …, 11), consists of the following access slots:

- Access slot #i in the frame pairs that include frames for which SFN mod 8 = 0
- Every 12th access slot relative to this access slot

The access slots of different sub-RACH channels are also illustrated in Table 1.

Table 1 The available access slots, for different sub-RACH channels dependent on SFN

	Sub-RACH channel Number											
SFN modulo 8	0	1	2	3	4	5	6	7	8	9	10	11
0	0	1	2	3	4	5	6	7				
1	12	13	14						8	9	10	11
2				0	1	2	3	4	5	6	7	
3	9	10	11	12	13	14						8
4	6	7					0	1	2	3	4	5
5			8	9	10	11	12	13	14			
6	3	4	5	6	7					0	1	2
7						8	9	10	11	12	13	14