TSG-RAN WG1 meeting #5 **TSG WG1#5 (99) 651**
Cheju 1-4, June 1999

Source: Nokia

Text proposal, for determination of available RACH access slots (method 1)

1. Introduction

This paper contains a text proposal which is based on the R1-99650, Determination of available PRACH and AICH access slots. This text proposal contains method 1 (deterministic method) for sending consecutive preambles after the first one. See R1-99650 for comparison of method 1 (deterministic) and method 2 (random). There is a separate text proposal for method 2, R1-99652. It is expected that WG1/adhoc3 will select between method 1 and method2.

Following modifications are needed for S1.11, Chapter 7, which defines the RACH timing relations. In the present version of the specs it is defined that in Chapter 7, figures 25 and 26 define the minimum values for τ_{p-p}, τ_{p-m}, τ_{p-a} and τ_{a-p} for the case where not all access slots are available. We propose that the available access slots are defined in that way that the timing requirements defined in S1.11 for parameters for τ_{p-p}, τ_{p-m}, τ_{p-a} and τ_{a-p} are always used.

Following modifications are needed for S1.14, Chapter 6, Random access procedure: the method how the available access slots are defined in BCCH, the idea of sub RACH channels, the idea how the UE randomly selects the sub RACH channel from the available ones, the idea how the UE derives the next available access slot. See the details in the text proposal below.

2. Text proposals to S1.11 and S1.14

--------------------------Following modifications to S1.11, chapter 7 ------------------------------

Figure 25 and Figure 26 illustrate the timing relation between PRACH and AICH as seen by the UE, with AICH transmission timing set to 0 and 1, respectively. ~~The timing figures define the case where all access slots are available. If not all access slots are available, Figure 25 and Figure 26 define the minimum values for~~ $\cancel{\tau_{p-p}}$, $\cancel{\tau_{p-m}}$, $\cancel{\tau_{p-a}}$ ~~and~~ $\cancel{\tau_{a-p}}$~~.~~

--------------------------Following modifications to S1.14, chapter 6-------------------------------

6 Random access procedure

Before the random-access procedure is executed, the UE should acquire the following information from the BCH :

- The preamble spreading code(s) / message scrambling code(s) used in the cell
- The available signatures
- The available access slots, defined by parameter A. A contains four bits. The A parameter values 0000≤A≤0111 are used with AICH transmission timing parameter value 0, and values 0000≤A≤1111 with AICH transmission timing parameter value 1. If a certain bit position in parameter A has value 1, it means that corresponding sub-RACH channel is available. Sub-RACH channel # can have a value

among {0,1,2,3}. The LSB of parameter A corresponds to sub-RACH channel_# = 0, and the MSB of parameter A corresponds to sub-RACH channel_# = 3. The available access slots for different sub-RACH channels are shown in tables 5 and 6 for transmission timing parameter values 0 and 1, respectively.

- The available spreading factors for the message part
- The uplink interference level in the cell
- The primary CCPCH transmit power level
- The AICH transmission timing parameter as defined in S1.11.
- The power offsets ΔP_0 (power step when no acquisition indicator is received, step 7.3) and ΔP_1 (power step when negative acquisition is received, see step 8.3)
- SFN

The random-access procedure is:

1. . The UE randomly selects a preamble spreading code from the set of available spreading codes. The random function is TBD.

2. . The UE sets the preamble transmit power to the value P_{RACH} given in Section 5.1.1. [*Editor's note: Here it is assumed that the initial power back-off is included in the "Constant Value" of 5.1.1*]

3. The UE implements the dynamic persistence algorithm by:

    3.1 Reading the current dynamic persistence value from the BCH.

    3.2 Perform a random draw against the current dynamic persistence value. The randome function is TBD.

    3.3 Defer transmission for one frame and repeat step 3 if the result of the random draw is negative, otherwise proceed to step 4.

    [*Editor's note: The dynamic persistence value may not be transmitted every frame, depending on the BCH scheduling, i.e step 3.1 cannot be executed every iteration.]*

4 The UE:

~~4.1Randomly selects an uplink access slot from the available uplink access slots. Random function is TBD.~~

4.1 Randomly selects the sub RACH channel from the available ones, with the help of A parameter and AICH transmission timing parameter. The A parameter values 0000≤A≤0111 are used with AICH transmission timing parameter value 0, and values 0000≤A≤1111 with AICH transmission timing parameter value 1. If a certain bit position in parameter A has value 1, it means that corresponding sub-RACH channel is available, among the possible {0,1,2,3}.The random function, for selecting the sub RACH channel from the available ones is TBD.

4.2 Derives the available access slots of frame SFN in the selected sub-RACH channel with the help of SFN and AICH transmission timing parameter value.

- If AICH transmission timing parameter value is 0, the access slots of frame SFN are defined by Access= 3*N +(SFN modulo3) + sub RACH channel_#, where N has values of the range 0 ≤N≤ 2, and sub_RACH_channel_# is the selected sub_RACH_channel, with the condition that only the values between 0 ≤ Access ≤ 7 are valid. UE selects the available access slot to which there is smallest distance.

- If AICH transmission timing parameter value is 1, the access slots of frame SFN are defined by Access = 4*N + sub RACH channel_#, where N has values of the range 0 ≤N≤ 1, and sub_RACH_channel_# is the selected sub_RACH_channel. UE selects the available access slot to which there is smallest distance.

~~4.2~~4.3 Randomly selects a signature from the available signatures. Random function is TBD.

5 ~~5.~~ The UE sets the Preamble Retransmission Counter to Preamble_Retrans_Max (value TBD).

6 The UE transmits its preamble using the selected uplink access slot, signature, and preamble transmission power..

7 If the UE does not detect and acquisition indicator with the selected signature in the downlink access slot corresponding to the selected uplink access slot, the UE:

7.1 Selects a new uplink access slot~~, ,~~ , by using the timing requirements for τ_{p-p} defined in S1.11, where it is defined that τ_{p-p} =3 access slots if AICH transmission timing value is set to 0, and τ_{p-p} =4 access slots if AICH transmission timing value is set to 1. ~~This new access slot must be one of the available access slots. There must be also a distance of three or four access slots from the uplink access slot in which the last preamble was transmitted depending on the AICH transmission timing parameter. The selection scheme of this new access slot is TBD.~~

7.2 Randomly selects a new signature from the available signatures. Random function is TBD.

7.3 Increases the preamble transmission power with the specified offset ΔP_0.

7.4 Decrease the Preamble Retransmission Counter by one.

7.5 If the Preamble Retransmission Counter > 0, the UE repeats from step 6 otherwise an error indication is passed to the higher layers and the random-access procedure is exited.

8. If the UE detects a negative acquisition indicator with the selected signature in the downlink access slot corresponding to the selected uplink access slot, the UE:

8.1 Selects a new uplink access slot as in 7.1

8.2 Randomly selects a new signature from the available signatures. Random function is TBD.

8.3 Modifies the preamble transmission power with the specified offset ΔP_1.

[*Editor's note: Note clear if the Preamble Retransmission Counter should be decremented and tested in this case*]

8.4 Reats from step 6

9. The UE transmits its 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…

10. A indication of successful random-accces transmission is passed to the higher layers.

Dynamic persistence is provided for managing interference and minimising delay by controlling access to the RACH channel. The system will publish a dynamic persistence value on the BCH, the value of which is dependent on the estimated backlog of users in the system.

Table 5. The available access slots, Access, for different sub-RACH channels, when AICH transmission timing parameter = 0.

Frame number	Sub-RACH channel_#=0 (A=001) Access	Sub-RACH channel_#=1 (A=010) Access	Sub-RACH channel_#=2 (A=100) Access

SFN modulo 3 =0	0, 3, 6	1, 4, 7	2, 5
SFN modulo 3= 1	1, 4, 7	2, 5	0, 3, 6
SFN modulo 3= 2	2,5	0, 3, 6	1, 4, 7

Table 6. The available access slots, Access , for different sub-RACH channels, when AICH transmission timing parameter = 1.

Frame number	Sub-RACH channel_#=0 (A=0001) Access	Sub-RACH channel_#=1 (A=0010) Access	Sub-RACH channel_#=2 (A=0100) Access	Sub-RACH channel_#=3 (A=1000) Access
All frames	0, 4	1, 5	2, 6	3, 7