TSG-RAN WG1 meeting #7 **TSG WG1#7 (99) b83**
Hannover, Germany 30.8-3.9.1999

Source: Nokia

Small modifications to available RACH access slots idea

1. Introduction

In last WG1 meeting the Nokia proposal on available access slots was accepted.

This paper contains a correction to two equations, since they contained some errors. The idea of the method remains the same. Only the equations were erroneous.

We propose also that method for selecting the access slot for sending the first preamble is changed so that UE first derives the available access slots in the next frame and then selects one of them randomly.

The text proposal containing these two above changes are given at the end of this contribution.

2. Correction of typos in the equations

There are two typos in the text. We give here the correct equations that result in the access slots that are already listed in the tables.

With transmission timing =0 the equation should be :

Access= 3*N + ~~(SFN modulo2) +~~ sub RACH channel_#

With transmission timing =1 the equation should be :

Access = (4*N + ~~(SFN modulo8) +~~ ((SFN/2) modulo4) + sub RACH channel_#) modulo 16

So, the reason for this change is pure miscalculation.

3. Selection of access slot for sending first preamble

If we have understood correctly, the main concern from Nortel was that there is now not enough randomisation of transmissions when the access slot is selected for sending the first preamble. We agree that due to certain implementation reasons it could happen that every terminal will always select the first access slot in the frame. For this reason we suggest that this is changed so that for sending the first preamble, the UE selects randomly one access slot from the available access slots in the next frame.

4. Text proposal to TS 25.214, chapter 6

------------------------ text proposal starts here --

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 for each ASC
- The available sub-RACH channels, 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 25.211.
- 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)

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:

   4.1 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~~ in the next frame, defined by 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 available access slots of frame SFN are defined by Access= 3*N ~~+(SFN modulo2)~~ + sub RACH channel_#, where N has values of the range 0 ≤N≤ 4, and sub_RACH_channel_# is the selected sub_RACH_channel, with the condition that only the values between 0 ≤ Access ≤ 7 are valid in frames with even SFN and only the values between 8 ≤ Access ≤ 14 are valid in frames with odd SFN. ~~UE selects the available access slot to which there is smallest distance.~~

- If AICH transmission timing parameter value is 1, the available access slots of frame SFN are defined by Access = (4*N ~~+(SFN modulo8)~~ ((SFN/2) modulo4)+ sub RACH channel_#) modulo16, where N has values of the range 0 ≤N≤ 3, and sub_RACH_channel_# is the selected sub_RACH_channel, with the condition that only the values between 0 ≤ Access ≤ 7 are valid in frames with even SFN and only the values between 8 ≤ Access ≤ 14 are valid in frames with odd SFN. Furthermore, "/" denotes integer division, i.e. truncation. ~~UE selects the available access slot to which there is smallest distance.~~

4.3 Randomly selects one access slot from the available access slots in the next frame, defined by SFN. Random function is TBD.

~~4.3~~4.4 Randomly selects a signature from the available signatures within the ASC given by higher layers. Random function is TBD.

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 the positive or negative acquisition indicator corresponding to 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 TS 25.211, 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.

7.2 Randomly selects a new signature from the available signatures within the ASC given by higher layers. 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 the negative acquisition indicator corresponding to 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 within the ASC given by higher layers. 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 Repeats 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-access 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 2 = 0	0, 3, 6	1, 4, 7	2, 5
SFN modulo 2 = 1	9, 12	10, 13	8, 11, 14

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
SFN modulo 8 =0	0, 4	1, 5	2, 6	3, 7
SFN modulo 8= 1	8, 12	9, 13	10, 14	11
SFN modulo 8= 2	1, 5	2, 6	3, 7	0, 4
SFN modulo 8= 3	9, 13	10, 14	11	8, 12
SFN modulo 8= 4	2, 6	3, 7	0, 4	1, 5
SFN modulo 8= 5	10, 14	11	8, 12	9, 13
SFN modulo 8= 6	3, 7	0, 4	1, 5	2, 6
SFN modulo 8= 7	11	8, 12	9, 13	10, 14