TSG-RAN Working Group 1 meeting #17
Stockholm, Sweden
November 21 – 24, 2000

TSGR1#17(00)1363

Agenda item: AH 99

Source: Ericsson

Title: CR 25.214-139: Clarification of RACH procedure

Document for: Approval

There is some ambiguity about the RACH access service class (ASC) setting with respect to sub-channel groups in the specifications in WG1 (25.214) and WG2 (25.331).

In 25.331, certain sets of sub-channels is assigned to the RACH that can be allocated and signalled for each ASC.

In 25.214, it is stated that the "available sub-channel groups for each ASC" are signalled from RRC. Further, the term "sub-channel group" is defined as a group of sub-channels and used within 25.214. This led to questions whether one or several sub-channel groups would be allowed from WG1 or WG2.

It seems to be an assumption in WG1 that only one sub-channel group is considered to be useful per ASC. The consequence from this is that it is no longer necessary to select a RACH sub-channel group, i.e. step 1 of the RACH procedure can be skipped.

Then the procedure would start with the derivation of available access slots for the set of available RACH sub-channels. Then one of these access slots is selected randomly.

In the attached CR, we propose to simplify the description of the RACH procedure in 25.214 as follows:

1. Replace the term "RACH sub-channel group" with "set of available RACH sub-channels". This is more exact, since 25.331 is assigning only a set of available sub-channels, and not a group or several groups. The term RACH sub-channel group is not used outside 25.214.
2. Skip step 1 of the RACH procedure.
3. Introduce in step 2 the random selection of one of the access slots that are determined at the beginning of step 2. This change was basically approved in CR 25.214-133 at WG1#16.
4. In step 7.1, the next available access slot is chosen from the set of available RACH sub-channels.
5. Include some minor changes to make the terminology within the procedure more consistent.

It is proposed to update the RACH procedure in 25.214 accordingly.

3GPP TSG RAN WG1#17
Stockholm, Sweden, November 21 – 24, 2000

Document R1-00-1363
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.

25.214	CR	139	Current Version:	3.4.0

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

For submission to: RAN#10 *list expected approval meeting # here ?*

for approval [X]
for information [ ]

strategic [ ]
non-strategic [ ]
(for SMG use only)

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: *(at least one should be marked with an X)*
(U)SIM [ ] ME [X] UTRAN / Radio [X] Core Network [ ]

Source: Ericsson **Date:** 2000-11-18

Subject: Clarification of RACH procedure

Work item:

Category: *(only one category Shall be marked With an X)*

F	Correction	[X]
A	Corresponds to a correction in an earlier release	[ ]
B	Addition of feature	[ ]
C	Functional modification of feature	[ ]
D	Editorial modification	[ ]

Release:

Phase 2	[ ]
Release 96	[ ]
Release 97	[ ]
Release 98	[ ]
Release 99	[X]
Release 00	[ ]

Reason for change: There is some ambiguity about the RACH access service class (ASC) setting with respect to sub-channel groups in the specifications in WG1 (25.214) and WG2 (25.331).

Clauses affected: 6.1

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: This CR supersedes the changes with respect to section 6.1 introduced in CR 133 (R1-00-1213) that was approved at WG1#16.

Consequence if not accepted

6 Random access procedure

6.1 Physical random access procedure

The physical random access procedure described in this subclause is initiated upon request of a PHY-Data-REQ primitive from the MAC sublayer (cf. [9]).

Before the physical random-access procedure can be initiated, Layer 1 shall receive the following information from the higher layers (RRC):

- The preamble scramb ling code.
- The message length in time, either 10 or 20 ms.
- The AICH_Transmission_Timing parameter [0 or 1].
- The set of available signatures and the set of available RACH sub-channels ~~groups~~ for each Access Service Class (ASC). ~~, where a s~~Sub-channels ~~group is~~ are defined ~~as a group of some of the sub-channels defined~~ in subclause 6.1.1.
- The power-ramping factor Power_Ramp_Step [integer > 0].
- The parameter Preamble_Retrans_Max [integer > 0].
- The initial preamble power Preamble_Initial_Power.
- The power offset $\Delta P_{p\text{-}m} = P_{message\text{-}control} - P_{preamble}$, measured in dB, between the power of the last transmitted preamble and the control part of the random-access message.
- The set of Transport Format parameters. This includes the power offset between the data part and the control part of the random-access mes sage~~e~~ for each Transport Format.

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

At each initiation of the physical random access procedure, Layer 1 shall 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).

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

~~1 Randomly select the RACH sub-channel group from the available ones for the given ASC. The random function shall be such that each of the allowed selections is chosen with equal probability.~~

~~2~~1 Derive the available uplink access slots, in the next full access slot set, for the ~~selected~~ set of available RACH sub-channels ~~group~~ within the given ASC with the help of subclauses 6.1.1. and 6.1.2. Randomly select one access slot among the ones previously determined. If there is no access slot available in the selected set, randomly select one uplink access slot corresponding to the ~~selected~~ set of available RACH sub-channels ~~group~~ within the given ASC ~~-~~from the next access slot set. The random function shall be such that each of the allowed selections is chosen with equal probability.

~~3~~2 Randomly select a signature from the set of available signatures ~~for~~ within the given ASC. The random function shall be such that each of the allowed selections is chosen with equal probability.

~~4~~3 Set the Preamble Retransmission Counter to Preamble_Retrans_Max.

~~5~~4 Set the preamble transmission power to Preamble_Initial_Power.

6~~5~~ Transmit a preamble using the selected uplink access slot, signature, and preamble transmission power.

7~~6~~ If no positive or negative acquisition indicator (AI ? +1 nor –1) corresponding to the selected signature is detected in the downlinkaccess slot corresponding to the selected uplink access slot:

7~~6~~.1 Select the next available access slot in the set of available RACH sub-channels within the given ASC. ~~group chosen in 1.~~

7~~6~~.2 Randomly selects a new signature from the set of available signatures within the given ASC. The random function shall be such that each of the allowed selections is chosen with equal probability.

7~~6~~.3 Increase the preamble transmission power by ? P_0 = Power_Ramp_Step [dB].

7~~6~~.4 Decrease the Preamble Retransmission Counter by one.

7~~6~~.5 If the Preamble Retransmission Counter > 0 then repeat from step 6. Otherwise pass L1 status ("No ack on AICH") to the higher layers (MAC) and exit the physical random access procedure.

8~~7~~ If a negative acquisition indicator corresponding to the selected signature is detected in the downlink access slot corresponding to the selected uplink access slot, pass L1 status ("Nack on AICH received") to the higher layers (MAC) and exit the physical random access procedure.

9~~8~~ 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 control part of the random access message should be ? $P_{p\text{-}m}$ [dB] higher than the power of the last transmitted preamble. Transmission power of the data part of the random access message is set according to subclause 5.1.1.2.

10~~9~~ Pass L1 status "RACH message transmitted" to the higher layers and exit the physical random access procedure.

6.1.1 RACH sub-channels

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

- Uplink access slot #i leading by ?$_{p\text{-}a}$ chips the downlink access slot #i contained within the 10 ms interval that is time aligned with P-CCPCH frames for which SFN mod 8 = 0 or SFN mod 8 = 1.
- Every 12th access slot relative to this access slot.

The access slots of different RACH sub-channels are also illustrated in Table 7.

Table 7: The available uplink access slots for different RACH sub-channels

SFN modulo 8 of corresponding P-CCPCH frame	Sub-channel number											
	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

6.1.2 RACH access slot sets

The PRACH contains two sets of access slots as shown in Figure 2. Access slot set 1 contains PRACH slots 0 – 7 and starts ?$_{p\text{-}a}$ chips before the downlink P-CCPCH frame for which SFN mod 2 = 0. Access slot set 2 contains PRACH slots 8 - 14 and starts (?$_{p\text{-}a}$ –2560) chips before the downlink P-CCPCH frame for which SFN mod 2 = 1.

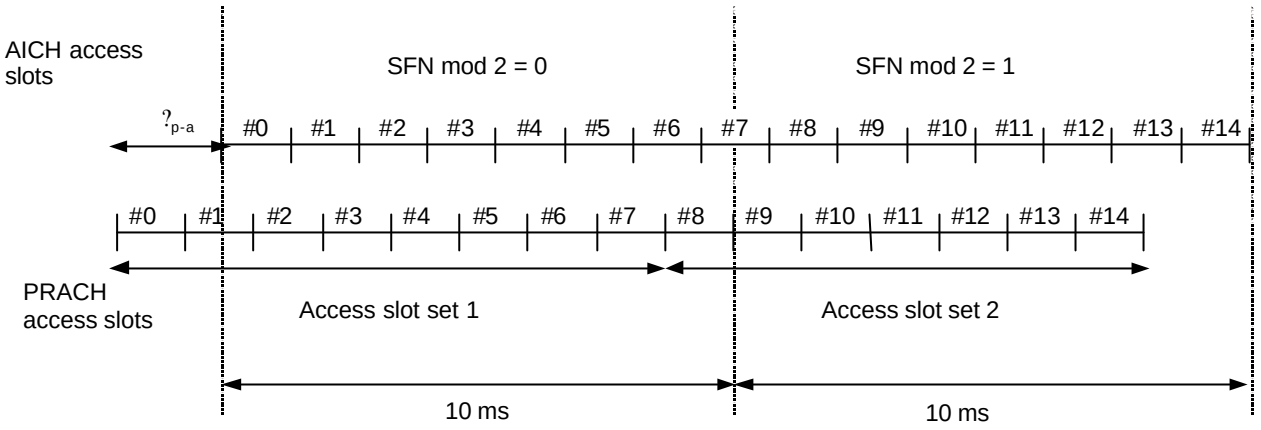

Figure 2: PRACH access slot and downlink AICH relation ($?_{p-a}$ = 7680 chips)