TSG-RAN Working Group 1 meeting #10
Beijing, China
January 18 – 21, 2000

TSGR1#10(00)0102

Agenda item:

Source: Ericsson

Title: CR 25.213-023: Number of RACH scrambling codes

Document for: Decision

In the RRC specification, TS 25.331, the RACH preamble scrambling codes are assumed to be numbered 0, 1, …, 255. This is probably based on some old WG1 assumptions. WG1 currently defines all 2^{24} possible RACH preamble codes. This is a big overkill, which will cost some additional signalling over the radio interface, something that should be avoided.

However, limiting the number of scrambling codes to 256 may be a bit too restrictive, considering that the amount of posssible codes are much higher than that. The downlink code planning resource (the downlink scrambling code) has the size 512. Assuming the same planning effort for the RACH in uplink, and further assuming two RACH codes per cell on the average, leads to a need of 1024 RACH preamble codes. This number is seen as a reasonable trade-off between signalling overhead and future-proofness.

This CR introduces the necessary changes to TS 25.213. Further, WG2 will need to update the value range of the parameter in the RRC specification.

3GPP TSG RAN WG1 Meeting #10
Beijing, China, January 18 – 21, 2000

Document ???99???
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.

25.213	**CR**	**023**	Current Version:	3.1.0

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

For submission to:	TSG-RAN #7	for approval	X	strategic		(for SMG use only)
list expected approval meeting # here ↑		for information		non-strategic		

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:**	2000-01-12
Subject:	Number of RACH scrambling codes		
Work item:			

Category:	F	Correction		**Release:**	Phase 2	
	A	Corresponds to a correction in an earlier release			Release 96	
(only one category	B	Addition of feature			Release 97	
shall be marked	C	Functional modification of feature	X		Release 98	
with an X)	D	Editorial modification			Release 99	X
					Release 00	

Reason for change:	There is a mismatch between the WG1 and WG2 specifications on the number of RACH preamble scrambling codes. It is proposed that 1024 different RACH preamble codes are defined, as a reasonable trade-off between signalling overhead and future-proofness. Further, the connection between RACH preamble scrambling codes and RACH message part scrambling codes are clarified.
Clauses affected:	

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:	

4.3.2.5 PRACH message part scrambling code

The scrambling code used for the PRACH message part is 10 ms long., cell-specific and has a one-to-one correspondence to the scrambling code used for the preamble part.

The *n*:th PRACH message part scrambling code, denoted $S_{r\text{-}msg,n}$,is based on the long scrambling sequence and is defined as

$S_{r\text{-}msg,n}(i) = C_{long,n}(i + 4096),\ \ i = 0, 1, \ldots, 38399$

where the lowest index corresponds to the chip transmitted first in time and $C_{long,n}$ is defined in section 4.3.2.2.

The message part scrambling code has a one-to-one correspondence to the scrambling code used for the preamble part. For one PRACH, the same code number is used for both scrambling codes, i.e. if the PRACH preamble scrambling code used is $S_{r\text{-}pre,m}$ then the PRACH message part scrambling code is $S_{r\text{-}msg,m}$, where the number *m* is the same for both codes.

4.3.2.6 PCPCH message part scrambling code

The set of scrambling codes used for the PCPCH message part are 10 ms long, cell-specific and have a one-to-one correspondence to the signature sequences and the access sub-channels used by the access preamble part. Both long or short scrambling codes can be used to scramble the CPCH message part.

The *n*:th PCPCH message part scrambling code, denoted $S_{c\text{-}msg,n}$, is based on the scrambling sequence and is defined as

In the case when the long scrambling codes are used,

$S_{r\text{-}msg,n}(i) = C_{long,n}(i + 8192),\ \ i = 0, 1, \ldots, 38399$

where the lowest index corresponds to the chip transmitted first in time and $C_{long,n}$ is defined in section 4.3.2.2.

In the case when the access resources are shared between the RACH and CPCH, then $S_{c\text{-}msg,n}$ is defined as

$S_{r\text{-}msg,n}(i) = C_{long,n}(i + 4096),\ \ i = 0, 1, \ldots, 38399$

where the lowest index corresponds to the chip transmitted first in time and $C_{long,n}$ is defined in section 4.3.2.2.

In the case the short scrambling codes are used,

$S_{r\text{-}msg,n}(i) = C_{short,n}(i),\ \ i = 0, 1, \ldots, 38399$

4.2.3.7 PCPCH power control preamble scrambling code

The scrambling code for the PCPCH power control preamble is the same as for the PCPCH message part, as described in section 4.2.3.6 above. The phase of the scrambling code shall be such that the end of the code is aligned with the frame boundary at the end of the power control preamble.

4.3.3 PRACH preamble codes

4.3.3.1 Preamble code construction

The random access preamble code $C_{pre,n,}$ is a complex valued sequence. It is built from a preamble scrambling code $S_{r\text{-}pre,n}$ and a preamble signature $C_{sig,s}$ as follows:

$$C_{pre,n,s}(k) = S_{r\text{-}pre,n}(k) \times C_{sig,s}(k) \times e^{j\left(\frac{\pi}{4}+\frac{\pi}{2}k\right)},\ k = 0, 1, 2, 3, \ldots, 4095,$$

where k=0 corresponds to the chip transmitted first in time and $S_{r\text{-}pre,n}$ and $C_{sig,s}$ are defined in 4.3.3.2 and 4.3.3.3 below respectively.

4.3.3.2 Preamble scrambling code

The scrambling code for the PRACH preamble part is constructed from the long scrambling sequences. There are 1024 RACH preamble scrambling codes.

The *n*:th preamble scrambling code, $n = 0, 1, \ldots, 1023$, is defined as:

$$S_{r\text{-}pre,n}(i) = c_{long,1,n}(i),\ i = 0, 1, \ldots, 4095,$$

where the sequence $c_{long,1,n}$ is defined in section 4.3.2.2.

4.3.3.3 Preamble signature

The preamble signature corresponding to a signature s consists of 256 repetitions of a length 16 signature $P_s(n)$, n=0…15. This is defined as follows:

$$C_{sig,s}(i) = P_s(i \text{ modulo } 16),\ i = 0, 1, \ldots, 4095.$$

The signature $P_s(n)$ is from the set of 16 Hadamard codes of length 16. These are listed in table 3.

Table 3: Preamble signatures

Preamble signature	Value of *n*															
	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
$P_0(n)$	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
$P_1(n)$	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1	1	-1
$P_2(n)$	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1
$P_3(n)$	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1	1	-1	-1	1
$P_4(n)$	1	1	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1
$P_5(n)$	1	-1	1	-1	-1	1	-1	1	1	-1	1	-1	-1	1	-1	1
$P_6(n)$	1	1	-1	-1	-1	-1	1	1	1	1	-1	-1	-1	-1	1	1
$P_7(n)$	1	-1	-1	1	-1	1	1	-1	1	-1	-1	1	-1	1	1	-1
$P_8(n)$	1	1	1	1	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1
$P_9(n)$	1	-1	1	-1	1	-1	1	-1	-1	1	-1	1	-1	1	-1	1
$P_{10}(n)$	1	1	-1	-1	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1
$P_{11}(n)$	1	-1	-1	1	1	-1	-1	1	-1	1	1	-1	-1	1	1	-1
$P_{12}(n)$	1	1	1	1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	1
$P_{13}(n)$	1	-1	1	-1	-1	1	-1	1	-1	1	-1	1	1	-1	1	-1
$P_{14}(n)$	1	1	-1	-1	-1	-1	1	1	-1	-1	1	1	1	1	-1	-1
$P_{15}(n)$	1	-1	-1	1	-1	1	1	-1	-1	1	1	-1	1	-1	-1	1