TSG-RAN Working Group 1 meeting #11
San Diego, CA, USA
February 29 – March 3, 2000

TSGR1#11(00)0427

Agenda item: AH 14

Source: GBT, LGIC, Samsung

Title: CR025r3.0 25.213 3.1.1:
Number of PCPCH scrambling codes per cell

Document for: Approval

This document is the revision of Tdoc #204 and #337.

This CR deals with the system-wide number of uplink scrambling codes for PCPCH.

The downlink code planning resource (the downlink primary scrambling code) has the size 512. Assuming the same planning effort for the PCPCH in uplink, and further assuming up to 64 PCPCH codes per cell on the average, leads to a need of 64×512=32768 PCPCH scrambling codes. Addressing of the codes are done using 7 bits, since the k values between 16 and 80 should be signalled for PCPCH uplink scrambling code. These codes are directly associated with one particular downlink primary scrambling code. In every cell, the followings are needed as a maximum:

1. **One Access Preamble scrambling code for CPCH set in the cell.**
2. **One CD preamble scrambling code for CPCH set in the cell**
3. **many uplink scrambling codes for the PCPCH message part [up to 62 reserved for this purpose].**

This CR introduces the necessary changes to TS 25.213. There are also some more editorial clean-ups.

Some minor editorial changes were suggested in Ad-Hoc 14 which are incorporated in this revision.

3GPP TSG RAN WG1 Meeting #11
San Diego, USA, February 29 – March 3, 2000

Document R1000427
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	025r3.0	Current Version:	3.1.1

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

Source: GBT, LGIC, Samsung **Date:** 2000-03-2

Subject: Number of PCPCH scrambling codes per cell

Work item:

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

F	Correction		**Release:**	Phase 2	
A	Corresponds to a correction in an earlier release			Release 96	
B	Addition of feature			Release 97	
C	Functional modification of feature	X		Release 98	
D	Editorial modification			Release 99	X
				Release 00	

Reason for change: It is proposed that 64 different PCPCH scrambling codes are defined per downlink primary scrambling code, as a reasonable trade-off between signalling overhead and future-proofness. Further, the connection between PCPCH access preamble scrambling code, PCPCH CD preamble scrambling code and PCPCH message part scrambling codes are clarified.

Clauses affected: 4.3.2.6; 4.3.4.1.2; 4.3.4.2.2

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.

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 each scrambling code has ~~have~~ a one-to-one correspondence to the signature sequence~~s~~ and the access sub-channel~~s~~ used by the access preamble part. Both long or short scrambling codes can be used to scramble the CPCH message part. There are 64 uplink scrambling codes defined per cell and 32768 different PCPCH scrambling codes defined in the system.

The *n*:th PCPCH message part scrambling code, denoted $S_{c\text{-}msg,n}$, where $n = 8192, 8193, \ldots, 40959$ is based on the scrambling sequence and is defined as

In the case when the long scrambling codes are used,

$S_{c\text{-}msg,n}(i) = C_{long,n}(i$ ~~+ 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,

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

The 32768 PCPCH scrambling codes are divided into 512 groups with 64 codes in each group. There is a one-to-one correspondence between the group of PCPCH preamble scrambling codes in a cell and the primary scrambling code used in the downlink of the cell. The *k*:th PCPCH scrambling code within the cell with downlink primary scrambling code *m*, $k = 16, 17, \ldots, 79$ and $m = 0, 1, 2, \ldots, 511$, is $S_{c\text{-}msg,n}$ as defined above with $n = 64 \times m + k + 8176$.

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:

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

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.

The *n*:th preamble scrambling code 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

4.3.4 PCPCH preamble codes

4.3.4.1 Access preamble

4.3.4.1.1 Access preamble code construction

Similar to PRACH access preamble codes, the PCPCH access preamble codes $C_{c\text{-}acc,n,s}$, are complex valued sequences. The PCPCH access preamble codes are built from the preamble scrambling codes $S_{c\text{-}acc,n}$ and a preamble signature $C_{sig,s}$ as follows:

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

where $S_{c\text{-}acc,n}$ and $C_{sig,s}$ are defined in section 4.3.4.1.2 and 4.3.4.1.3 below respectively.

4.3.4.1.2 Access preamble scrambling code

The access preamble scrambling code generation is done in a way similar to that of PRACH. There are 32768 PCPCH scrambling codes in total.

The *n*:th PCPCH access preamble scrambling code, where *n =8192,8193, …,40959* is defined as:

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

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

In the case when the access resources are shared between the PRACH and PCPCH, the scrambling codes used in the PRACH preamble are used for the PCPCH preamble as well.

The 32768 PCPCH scrambling codes are divided into 512 groups with 64 codes in each group. There is a one-to-one correspondence between the group of PCPCH access preamble scrambling codes in a cell and the primary scrambling code used in the downlink of the cell. The *k*:th PCPCH scrambling code within the cell with downlink primary scrambling code *m*, $k = 16,17,\ldots, 79$ and $m = 0, 1, 2, \ldots, 511$, is $S_{c\text{-}acc,\ n}$ as defined above with $n = 64\times m + k+8176$.

In case scrambling code resource is shared between PCPCH and PRACH, the index k is less than 16 and the corresponding PRACH formulae shall be used. Otherwise, if the index k is greater than or equal to 16, the formula in this section shall be used.

4.3.4.1.3 Access preamble signature

The access preamble part of the CPCH-access burst carries one of the sixteen different orthogonal complex signatures identical to the ones used by the preamble part of the random-access burst.

4.3.4.2 CD preamble

4.3.4.2.1 CD preamble code construction

Similar to PRACH access preamble codes, the PCPCH CD preamble codes $C_{c\text{-}cd,n,s}$ are complex valued sequences. The PCPCH CD preamble codes are built from the preamble scrambling codes Sc-cd,n and a preamble signature $C_{sig,s}$ as follows:

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

where $S_{c\text{-}cd,n}$ and $C_{sig,s}$ are defined in sections 4.3.4.2.2 and 4.3.4.2.3 below respectively.

4.3.4.2.2 CD preamble scrambling code

The PCPCH CD preamble scrambling code is derived from the same scrambling code used in the CPCH access preamble. . There are 32768 PCPCH scrambling codes in total.

The *n*:th PCPCH CD access preamble scrambling code-, where *n =8192,8193, …,40959,* is defined as:

$$S_{c\text{-}cd,n}(i) = c_{long,1,n}(i \text{ ~~+ 4096~~}),\ i = 0, 1, \ldots, 4095,$$

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

In the case when the access resources are shared between the RACH and CPCH, the scrambling codes used in the RACH preamble will be used for the CPCH CD preamble as well.

The 32768 PCPCH scrambling codes are divided into 512 groups with 64 codes in each group. There is a one-to-one correspondence between the group of PCPCH CD preamble scrambling codes in a cell and the primary scrambling code used in the downlink of the cell. The *k*:th PCPCH scrambling code within the cell with downlink primary scrambling code *m*, $k = 16,17, \ldots, 79$ and $m = 0, 1, 2, \ldots, 511$, is $S_{c\text{-}cd,\ n}$ as defined above with $n = 64\times m + k+8176$.

In case scrambling code resource is shared between PCPCH and PRACH, the index k is less than 16 and the corresponding PRACH formulae shall be used. Otherwise, if the index k is greater than or equal to 16, the formula in this section shall be used.

4.3.4.2.3 CD preamble signature

The CD-preamble part of the CPCH-access burst carries one of sixteen different orthogonal complex signatures identical to the ones used by the preamble part of the random-access burst.