TSG-RAN Working Group 1 meeting #15 ***TSGR1#15(00)0988***
Berlin, Germany
August 22 –25, 2000

Agenda item: AH 99
Source: InterDigital Communications Corporation
Title: Editorial corrections to TS25.223 CR-014

Document for: Decision

The section describing generation of synchronisation codes has incorrect indexing, the same letter is used as an index of the sequence of symbols and as an index of a word in the SCH code. This CR corrects it.
Also clarifies the description of code allocation.

3GPP TSG RAN WG1 Meeting #15
Berlin, Germany, 22-25 August, 2000

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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.

25.223	**CR**	**0014**	Current Version:	3.3.0

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

For submission to:	RAN #9	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		UTRAN / Radio	X	Core Network	

Source:	InterDigital Comm. Corp.	**Date:**	
Subject:	Synchronisation codes		
Work item:	TS 25.223		

Category:	F	Correction	X	**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			Release 98	
with an X)	D	Editorial modification			Release 99	X
					Release 00	

Reason for change:	The incorrect indexing is used in the section describing the generation of synchronization codes.
Clauses affected:	7.1, 7.2

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:	

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7 Synchronisation codes

7.1 Code Generation

The primary synchronisation code (PSC), C_p , is constructed as a so-called generalised hierarchical Golay sequence. The PSC is furthermore chosen to have good aperiodic auto correlation properties.

Define a = < x_1, x_2, x_3, …, x_{16} > = < 1, 1, 1, 1, 1, 1, -1, -1, 1, -1, 1, -1, 1, -1, -1, 1 >

The PSC is generated by repeating the sequence 'a' modulated by a Golay complementary sequence and creating a complex-valued sequence with identical real and imaginary components.

The PSC, C_p , is defined as C_p = < y(0),y(1),y(2),...,y(255) >

where $y = (1 + j) \times < a, a, a, -a, -a, a, -a, -a, a, a, a, -a, a, -a, a, a >$

and the left most index corresponds to the chip transmitted first in time.

The 12 secondary synchronization codes, {C_0, C_1, C_3, C_4, C_5, C_6, C_8, C_{10}, C_{12}, C_{13}, C_{14}, C_{15} } are complex valued with identical real and imaginary components, and are constructed from the position wise multiplication of a Hadamard sequence and a sequence z, defined as

z = $< b, b, b, -b, b, b, -b, -b, b, -b, b, -b, -b, -b, -b, -b >$, where

b = $< x_1, x_2, x_3, x_4, x_5, x_6, x_7, x_8, -x_9, -x_{10}, -x_{11}, -x_{12}, -x_{13}, -x_{14}, -x_{15}, -x_{16} >$

and x_1, x_2, x_3, …, x_{16} are the same as in the definition of the sequence 'a' above.

The Hadamard sequences are obtained as the rows in a matrix H_8 constructed recursively by:

$$H_0 = (1)$$

$$H_k = \begin{pmatrix} H_{k-1} & H_{k-1} \\ H_{k-1} & -H_{k-1} \end{pmatrix}, \quad k \geq 1$$

The rows are numbered from the top starting with row *0* (the all ones sequence).

Denote the *n*:th Hadamard sequence h_n as a row of H_8 numbered from the top, n = 0, 1, 2, …, 255, in the sequel.

Furthermore, let h_m(~~i~~l) and z(~~i~~l) denote the ~~i:~~lth symbol of the sequence h_m and *z*, respectively where ~~i~~ l = 0, 1, 2, …, 255 and ~~i~~ l= 0 corresponds to the leftmost symbol.

The i:th secondary SCH code word, C_i, i = 0, 1, 3, 4, 5, 6, 8, 10, 12, 13, 14, 15 is then defined as

$C_i = (1 + j) \times <h_m(0) \times z(0), h_m(1) \times z(1), h_m(2) \times z(2), \ldots, h_m(255) \times z(255)>$,

where $m = (16 \times i)$ and the leftmost chip in the sequence corresponds to the chip transmitted first in time.

7.2 Code Allocation

Three secondary SCH codes are QPSK modulated and transmitted in parallel with the primary synchronization code. The QPSK modulation carries the following information:

- the code group that the base station belongs to (32 code groups:5 bits; Cases 1, 2);
- the position of the frame within an interleaving period of 20 msec (2 frames:1 bit, Cases 1, 2);
- the position of the SCH slot(s) within the frame (2 SCH slots:1 bit, Case 2).

The modulated secondary SCH codes are also constructed such that their cyclic-shifts are unique, i.e. a non-zero cyclic shift less than 2 (Case 1) and 4 (Case 2) of any of the sequences is not equivalent to some cyclic shift of any other of the sequences. Also, a non-zero cyclic shift less than 2 (Case 1) and 4 (Case 2) of any of the sequences is not equivalent to itself with any other cyclic shift less than 8. The secondary synchronization codes are partitioned into two code sets for Case 1 and four code sets for Case 2. The set is used to provide the following information: