3GPP TSG RAN WG1#14 R1-00-0865

Oulu, Finland

July 4th – 7th, 2000

Agenda Item: **5**

Source: **Mitsubishi Electric, Siemens AG**

Title: **CR022 for TS25.221**

Correction to midamble generation in UTRA TDD

Document for: **Approval**

Summary

CR022 to TS25.221 proposes a correction to formula (9) in section 5.2.3 of TS25.221 on the generation of the user midambles from the basic periodic midamble code.

The correction is needed in order to align the assumptions on not allowed burst type 1 extended midamble shifts 9 and 10 in beacon timeslots. With the current formula (9), extended midamble shifts 10 and 11 derive those user midambles which should not be allowed. As the assumption of shift 9 and 10 not being used in beacon timeslots has widely propagated throughout the specifications, a modification of formula (9) in section 5.2.3 is seen as the easiest way for a correction to this problem.

Problem

Intermediate shifts (k=9…16 for burst type 1 and k=4…6 for burst type 2) for deriving user midambles from the basic periodic midamble code allow for a trade-off between an increased number of users and the length of the available channel estimation window per user. The original intention was that after performing joint estimation, the "individual" channel estimation windows corresponding to the individual shifts would appear in the following order (or any cyclic shift of it), here given for the example of burst type 1:

1-*9***-2-***10***-3-**11**-4-**12**-5-**13**-6-**14**-7-**15**-8-**16**-**

In timeslots where a physical channel providing the beacon function is present (always using burst type 1), such as the P-CCPCH, there is the assumption that shift 1 and 2 are exclusively reserved for it and also that no other physical channel makes use of midamble shifts 9 and 10.

However, with the current formula (9) in section 5.2.3, the individual shifts are currently derived in the following order (or any cyclic shift of it), here given for the example of burst type 1:

1-*10***-2-***11***-3-**12**-4-**13**-5-**14**-6-**15**-7-**16**-8-**9**-**

Midambles derived from intermediate shifts 10 and 11 take the role of shifts 9 and 10. The case of the intermediate shifts K=4…6 for burst type 2 is analogous.

Whereas it is principally of no importance, in which order the individual midamble shifts appear, the assumption that shift 9 and 10 are aligned with midamble shifts 1 and 2 has now widely propagated throughout the specifications for the description of timeslots with physical channels providing the beacon function. A modification of formula (9) in section 5.2.3 is therefore seen as the easiest way for a correction to this problem.

3GPP TSG RAN WG1 Meeting #14
Oulu, Finland, July 4th – 7th, 2000

***Document* R1-00-865**
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.

25.221 CR 022 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
list expected approval meeting # here ↑

for approval	X	strategic		*(for SMG use only)*
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: Mitsubishi Electric, Siemens AG **Date:** 26/06/2000

Subject: Correction to midamble generation in UTRA TDD

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: The correction is needed in order to align the assumptions on not allowed burst type 1 extended midamble shifts 9 and 10 in beacon timeslots. With the current formula (9) in section 5.2.3, extended midamble shifts 10 and 11 derive those user midambles which should not be allowed. A modification of formula (9) in section 5.2.3 is necessary to derive the user midambles from the extended shifts in the correct order.

Clauses affected: Section 5.2.3

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:

5.2.3 Training sequences for spread bursts

In this subclause, the training sequences for usage as midambles in burst type 1 and burst type 2 (see subclause 5.2.2) are defined. The training sequences, i.e. midambles, of different users active in the same cell and same time slot are cyclically shifted versions of one single basic midamble code. The applicable basic midamble codes are given in Annex A.1 and A.2. As different basic midamble codes are required for different burst formats, the Annex A.1 shows the basic midamble codes $\mathbf{m}_{PL}$ for burst type 1 and Annex and A.2 shows $\mathbf{m}_{PS}$ for burst type 2. It should be noted that the different burst types must not be mixed in the same timeslot of one cell.

The basic midamble codes in Annex A.1 and A.2 are listed in hexadecimal notation. The binary form of the basic midamble code shall be derived according to table 5 below.

Table 5: Mapping of 4 binary elements m_i on a single hexadecimal digit

4 binary elements m_i	Mapped on hexadecimal digit
-1 -1 -1 -1	0
-1 -1 -1 1	1
-1 -1 1 –1	2
-1 -1 1 1	3
-1 1 -1 –1	4
-1 1 -1 1	5
-1 1 1 –1	6
-1 1 1 1	7
1 -1 -1 –1	8
1 -1 -1 1	9
1 -1 1 –1	A
1 -1 1 1	B
1 1 -1 –1	C
1 1 -1 1	D
1 1 1 –1	E
1 1 1 1	F

For each particular basic midamble code, its binary representation can be written as a vector $\mathbf{m}_{\mathrm{P}}$:

$$\mathbf{m}_{\mathrm{P}} = \left(m_1, m_2, \ldots, m_P\right) \tag{1}$$

According to Annex A.1, the size of this vector $\mathbf{m}_{\mathrm{P}}$ is P=456 for burst type 1. Annex A.2 is setting P=192 for burst type 2. As QPSK modulation is used, the training sequences are transformed into a complex form, denoted as the complex vector $\underline{\mathbf{m}}_{\mathrm{P}}$:

$$\underline{\mathbf{m}}_{\mathrm{P}} = \left(\underline{m}_1, \underline{m}_2, \ldots, \underline{m}_P\right) \tag{2}$$

The elements $\underline{m}_i$ of $\underline{\mathbf{m}}_{\mathrm{P}}$ are derived from elements m_i of $\mathbf{m}_{\mathrm{P}}$ using equation (3):

$$\underline{m}_i = (\mathrm{j})^i \cdot m_i \text{ for all } i = 1, \ldots, P \tag{3}$$

Hence, the elements $\underline{m}_i$ of the complex basic midamble code are alternating real and imaginary.

To derive the required training sequences, this vector $\underline{\mathbf{m}}_{\mathrm{P}}$ is periodically extended to the size:

$$i_{\max} = L_m + (K'-1)W + \lfloor P/K \rfloor \tag{4}$$

Notes on equation (4):

- K', W and P taken from Annex A.1 or A.2 according to burst type and thus to length of midamble L_m
- K=2K'

- $\lfloor x \rfloor$ denotes the largest integer smaller or equal to x

So we obtain a new vector $\underline{\mathbf{m}}$ containing the periodic basic midamble sequence:

$$\underline{\mathbf{m}} = \left(\underline{m}_1, \underline{m}_2, \ldots, \underline{m}_{i_{\max}}\right) = \left(\underline{m}_1, \underline{m}_2, \ldots, \underline{m}_{L_m + (K'-1)W + \lfloor P/K \rfloor}\right) \tag{5}$$

The first P elements of this vector $\underline{\mathbf{m}}$ are the same ones as in vector $\underline{\mathbf{m}}_P$, the following elements repeat the beginning:

$$\underline{m}_i = \underline{m}_{i-P} \text{ for the subset } i = (P+1), \ldots, i_{\max} \tag{6}$$

Using this periodic basic midamble sequence $\underline{\mathbf{m}}$ for each user k a midamble $\underline{\mathbf{m}}^{(k)}$ of length L_m is derived, which can be written as a user specific vector:

$$\underline{\mathbf{m}}^{(k)} = \left(\underline{m}_1^{(k)}, \underline{m}_2^{(k)}, \ldots, \underline{m}_{L_m}^{(k)}\right) \tag{7}$$

The L_m midamble elements $\underline{m}_i^{(k)}$ are generated for each midamble of the first K' users (k = 1,...,K') based on:

$$\underline{m}_i^{(k)} = \underline{m}_{i+(K'-k)W} \text{ with } i = 1, \ldots, L_m \text{ and } k = 1, \ldots, K' \tag{8}$$

The elements of midambles for the second K' users (k = (K'+1),...,K = (K'+1),...,2K') are generated based on a slight modification of this formula introducing intermediate shifts:

$$\cancel{\underline{m}_i^{(k)} = \underline{m}_{i+(K-k)W+\lfloor P/K \rfloor} \text{ with } i = 1, \ldots, L_m \text{ and } k = K'+1, \ldots, K} \quad \cancel{(9)}$$

$$\underline{m}_i^{(k)} = \underline{m}_{i+(K-k-1)W+\lfloor P/K \rfloor} \text{ with } i = 1, \ldots, L_m \text{ and } k = K'+1, \ldots, K-1 \tag{9}$$

$$\underline{m}_i^{(k)} = \underline{m}_{i+(K'-1)W+\lfloor P/K \rfloor} \text{ with } i = 1, \ldots, L_m \text{ and } k = K \tag{10}$$

Whether intermediate shifts are allowed in a cell is broadcast on the BCH.

The midamble sequences derived according to equations (7) to (9) have complex values and are not subject to channelisation or scrambling process, i.e. the elements $\underline{m}_i^{(k)}$ represent complex chips for usage in the pulse shaping process at modulation.

The term 'a midamble code set' or 'a midamble code family' denotes K specific midamble codes $\underline{\mathbf{m}}^{(k)}$; k=1,...,K, based on a single basic midamble code $\mathbf{m}_P$ according to (1).