3GPP TSG RAN WG1#14 R1-00-0810

Oulu, Finland

July 4th – 7th, 2000

Agenda Item: **5**

Source: **Mitsubishi Electric**

Title: **CR024 for TS25.224**

Update to description of Cell search procedure in UTRA TDD

Document for: **Approval**

Summary

CR024 to TS25.224 proposes a correction to the current description of the cell search procedure in UTRA TDD:

- The description of the cell search procedure in UTRA TDD is moved to an informative annex C in TS25.224, because it cannot be mandated how the UE shall perform cell search. This is also an editorial alignment with the description of the cell search procedure in the UTRA FDD specifications. Correspondingly, the title of section 4.4 is changed from “Synchronisation and Cell Search procedures” to “Synchronisation procedures”.
- The description of the cell search procedure is entirely revised and corrected in order to reflect the changes in cell search after the modification of the SCH structure in UTRA TDD during WG1#7 and #8.

The following are the principal updates and changes that have been incorporated into the entirely revised description of the cell search procedure in the proposed informative annex C:

1. Corrections to the objectives of all 3 cell search steps. Especially step 1 is now described in terms of "PSC peak detection" rather than "slot synchronisation", as the latter one is in fact not yet achieved.
2. The description on how slot synchronisation can be achieved has moved to step 2 and how frame synchronisation can be achieved is now explicitly explained in step 3.
3. The text on where to find the following SCH slot for both case 1 and case 2 has now moved from step 2 to step 1.
4. Step 2 now explicitly states that coherent detection from PSC to SSC's is needed. Also, the periodicity of 2 frames for the QPSK-modulation on the SCH is added in it's last paragraph.
5. Step 3: The possibility of using the beacon functions for basic periodic midamble detection is now mentioned. Also, the last note on how cell search and the cell parameter cycling are compatible is expanded. A clarification is added how frame synchronisation can be achieved.

Besides this, the basic scheme for the description of each of the cell search steps now follows the annex C of 25.214 for the case of the FDD cell search procedure, e.g.

What shall the UE find during this cell search step ?

What "feature" of the SCH is used by the UE to find it ?

How can it be done ?

What information can be derived by the UE during this cell search step ?

(+ Supplementary information or notes)

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

***Document* R1-00-810**

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.

25.224 CR 024 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: (U)SIM [ ] ME [X] UTRAN / Radio [X] Core Network [ ]
(at least one should be marked with an X)

Source: Mitsubishi Electric **Date:** 26/06/2000

Subject: Update to description of cell search procedure 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:

1. The description of the cell search procedure in UTRA TDD is moved to an informative annex C in TS25.224, because it cannot be mandated how the UE shall perform cell search. This is also an editorial alignment with the description of the cell search procedure in the UTRA FDD specifications. Correspondingly, the title of section 4.4 is changed from "Synchronisation and Cell Search procedures" to "Synchronisation procedures".
2. The description of the cell search procedure is revised and corrected in order to reflect the changes in cell search after the modification of the SCH structure in UTRA TDD during WG1#7 and #8.

Clauses affected: Section 4.4.1; annex C moved to annex D; insertion of a new annex C

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:

4.4 Synchronisation ~~and Cell Search P~~procedures

4.4.1 Cell Search

During the ~~initial~~ cell search, the UE searches for a cell~~. It then~~ and determines the ~~midamble, the~~ downlink scrambling code, basic midamble code and frame synchronisation of that cell. ~~The initial cell search uses the Synchronisation Channel (SCH) described in [8]. The generation of synchronisation codes is described in [10].~~How cell search is typically done is described in Annex C.

~~This initial cell search is carried out in three steps:~~

~~Step 1: Slot synchronisation~~

~~During the first step of the initial cell search procedure the UE uses the primary synchronisation code c_p to acquire slot synchronisation to the strongest cell. Furthermore, frame synchronisation with the uncertainty of 1 out of 2 is obtained in this step. A single matched filter (or any similar device) is used for this purpose, that is matched to the primary synchronisation code which is common to all cells.~~

~~Step 2: Frame synchronisation and code-group identification~~

~~During the second step of the initial cell search procedure, the UE uses the modulated Secondary Synchronisation Codes to find frame synchronisation and identify one out of 32 code groups. Each code group is linked to a specific t_{Offset}, thus to a specific frame timing, and is containing 4 specific scrambling codes. Each scrambling code is associated with a specific short and long basic midamble code.~~

~~In Case 2 it is required to detect the position of the next synchronization slots. To detect the position of the next synchronization slots, the primary synchronization code is correlated with the received signal at offsets of 7 and 8 time slots from the position of the primary code that was detected in Step 1.~~

~~Then, the received signal at the positions of the synchronization codes is correlated with the primary synchronization Code C_p and the secondary synchronization codes $\{C_0,\ldots,C_{15}\}$. Note that the correlations can be performed coherently over M time slots, where at each slot a phase correction is provided by the correlation with the primary code. The minimal number of time slots is M=1, and the performance improves with increasing M.~~

~~Step 3: Scrambling code identification~~

~~During the third and last step of the initial cell-search procedure, the UE determines the exact basic midamble code and the accompanying scrambling code used by the found cell. They are identified through correlation over the P-CCPCH with all four midambles of the code group identified in the second step . Thus the third step is a one out of four decision. This step is taking into account that the P-CCPCH containing the BCH is transmitted using the first channelization code ($c_{Q=16}^{(h=1)}$ in [10]) and using the first midamble $\mathbf{m}^{(1)}$ (derived from basic midamble code $\mathbf{m}_P$ in [8]). Thus P-CCPCH code and midamble can be immediately derived when knowing scrambling code and basic midamble code.~~

~~NOTE: The cell parameters change from frame to frame, cf. "Table 7 Alignment of cell parameter cycling and SFN" in [10].~~

Annex C (informative): Cell search procedure

During the cell search, the UE searches for a cell and determines the downlink scrambling code, basic midamble code and frame synchronisation of that cell. The cell search is typically carried out in three steps:

Step 1: Primary synchronisation code acquisition

During the first step of the cell search procedure, the UE uses the SCH's primary synchronisation code to find a cell. This is typically done with a single matched filter (or any similar device) matched to the primary synchronisation code which is common to all cells. A cell can be found by detecting peaks in the matched filter output.

Note that for a cell of SCH slot configuration case 1, the SCH can be received periodically every 15 slots. In case of a cell of SCH slot configuration case 2, the following SCH slot can be received at offsets of either 7 or 8 slots from the previous SCH slot.

Step 2: Code group identification and slot synchronisation

During the second step of the cell search procedure, the UE uses the SCH's secondary synchronisation codes to identify 1 out of 32 code groups for the cell found in the first step. This is typically done by correlating the received signal with the secondary synchronisation codes at the detected peak positions of the first step. The primary synchronisation code provides the phase reference for coherent detection of the secondary synchronisation codes. The code group can then uniquely be identified by detection of the maximum correlation values.

Each code group indicates a different t_{offset} parameter and 4 specific cell parameters. Each of the cell parameters is associated with one particular downlink scrambling code and one particular long and short basic midamble code. When the UE has determined the code group, it can unambiguously derive the slot timing of the found cell from the detected peak position in the first step and the t_{offset} parameter of the found code group in the second step.

Note that the modulation of the secondary synchronisation codes also indicates the position of the SCH slot within a 2 frames period, e.g. a frame with even or odd SFN. Additionally, in the case of SCH slot configuration following case 2, the SCH slot position within one frame, e.g. first or last SCH slot, can be derived from the modulation of the secondary synchronisation codes.

Step 3: Downlink scrambling code, basic midamble code identification and frame synchronisation

During the third and last step of the cell search procedure, the UE determines the exact downlink scrambling code, basic midamble code and frame timing used by the found cell. The long basic midamble code can be identified by correlation over the P-CCPCH (or any other physical channels providing the beacon function) with the 4 possible long basic midamble codes of the code group found in the second step. A P-CCPCH (or any other physical channels providing the beacon function) always uses the first midamble shift in order to derive its midamble from the long basic midamble code and always uses a fixed and pre-assigned channelisation code.

When the long basic midamble has been identified, downlink scrambling code and cell parameter are also known. The UE can read system and cell specific BCH information and acquire frame synchronisation.

Note that even for an initial cell parameter assignment, a cell cycles through a set composed of 2 different cell parameters according to the SFN of a frame, e.g. the downlink scrambling code and the basic midamble code of a cell alternate for frames with even and odd SFN. Cell parameter cycling leaves the code group of a cell unchanged.

If the UE has received information about which cell parameters or SCH configurations to search for, cell search can be simplified.

Annex ~~C~~ D (informative): Change history

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**
14/01/00	RAN_05	RP-99594	-		Approved at TSG RAN #5 and placed under Change Control	-	3.0.0
14/01/00	RAN_06	RP-99698	001	01	Primary and Secondary CCPCH in TDD	3.0.0	3.1.0
14/01/00	RAN_06	RP-99698	002	-	Measurement procedure of received reference power for OL-TPC in TDD	3.0.0	3.1.0
14/01/00	RAN_06	RP-99699	004	1	STTD capability for P-CCPCH, TDD component	3.0.0	3.1.0
14/01/00	RAN_06	RP-99697	005	1	Alignment of Terminology Regarding Spreading for TDD Mode	3.0.0	3.1.0
14/01/00	-	-	-		Change history was added by the editor	3.1.0	3.1.1
31/03/00	RAN_07	RP-000070	003	2	Cycling of cell parameters	3.1.1	3.2.0
31/03/00	RAN_07	RP-000070	007	2	Clarifications on the UL synchronisation and Timing advance	3.1.1	3.2.0
31/03/00	RAN_07	RP-000070	008	-	Modification of SIR threshold on setting TPC	3.1.1	3.2.0
31/03/00	RAN_07	RP-000070	009	1	New section describing the random access procedure	3.1.1	3.2.0
31/03/00	RAN_07	RP-000070	011	-	Removal of Synchronisation Case 3 in TDD	3.1.1	3.2.0
31/03/00	RAN_07	RP-000070	012	1	Clarifications on power control procedures	3.1.1	3.2.0
31/03/00	RAN_07	RP-000070	013	-	Signal Point Constellation	3.1.1	3.2.0
31/03/00	RAN_07	RP-000070	014	2	Out-of-sync handling for UTRA TDD	3.1.1	3.2.0
31/03/00	RAN_07	RP-000070	015	-	Removal of ODMA from the TDD specifications	3.1.1	3.2.0
26/06/00	RAN_08	RP-000274	016	-	Editorial correction for the power control section in 25.224	3.2.0	3.3.0
26/06/00	RAN_08	RP-000274	017	-	Power control for TDD during DTX	3.2.0	3.3.0
26/06/00	RAN_08	RP-000274	018	1	Power Control for PDSCH	3.2.0	3.3.0
26/06/00	RAN_08	RP-000274	020	1	Editorial modification of 25.224	3.2.0	3.3.0
26/06/00	RAN_08	RP-000274	021	-	Clarifications on TxDiversity for UTRA TDD	3.2.0	3.3.0
26/06/00	RAN_08	RP-000274	022	1	Introduction of the TDD DSCH detection procedure in TS 25.224	3.2.0	3.3.0
26/06/00	RAN_08	RP-000274	023	-	Downlink power control on timeslot basis	3.2.0	3.3.0