**TSG-RAN Working Group 1 meeting #7** **TSGR1#7(99) c22**
**Hanover, Germany, August 30 – September 3, 1999**

**Agenda Item** :

**Source** : Siemens

**Title** : Text Proposal for Modifications of TS25.231 for TDD According to OHG Harmonisation Agreement

**Document for** : approval

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## Introduction

This Tdoc proposes changes to the TSG RAN WG1 technical specification 'Physical layer- Measurements' 25.231 (formerly S1.31) to adopt the OHG harmonisation agreement of reducing the chip rate from 4.096Mchips/sec (40960chips/frame) to 3.84Mchips/sec (38400chips/frame).

For the TDD mode this will be achieved by reducing the number of timeslots per frame from 16 to 15 (the number of chips per slot will remain 2560, but one slot has now 666.666µs instead of 625µs and one chip has now 260.4167ns instead of 244.1406ns).

The modifications - according to the Tdoc RAN WG1 #6 (99) 854 approved on the last meeting - are based on TS25.231 version 0.3.1 (= Tdoc RAN WG1 #7 (99) a70 distributed by the editor of the specification) with all former revision marks accepted.

### 7.1.5.4.2 Monitoring GSM from TDD using idle TDD timeslots

Two kinds of UE should be distinguished: A single synthesiser UE has to switch in its idle periods from the TDD frequency to the considered GSM frequency, monitor GSM and switch back to TDD afterwards, that means two times a synthesiser switching time has to be considered. A dual synthesiser UE avoids this synthesiser switching time and the monitoring periods are equal to the idle periods.

For preparation of a handover from TDD to GSM there are two procedures possible

- To detect at first the FCCH burst and then the SCH burst (following one GSM frame later)
- or searching parallel for FCCH and SCH bursts.

*<WG1's note : the following sections reflect current working assumptions but due to their descriptive nature they should not be included in the final version of the specification>*

#### 7.1.5.4.2.1 Low data rate traffic using 1 uplink and 1 downlink slot

*<WG1's note : The section evaluates the time to acquire the FCCH if all idle slots are devoted to the tracking of a FCCH burst, meaning that no power measurements is done concurrently. The derived figures are better than those for GSM. The section does not derive though any conclusion. A conclusion may be that the use of the idle slots is a valid option. An alternative conclusion may be that this is the only mode to be used, removing hence the use of the slotted frames for low data traffic or the need for a dual receiver, if we were to considering the monitoring of GSM cells only, rather than GSM, TDD and FDD*
<u><Section 7.1.5.4.2.1 still considers a frame with 16 instead of 15 timeslots, therefore it should be updated or deleted.></u>

If a single synthesiser UE uses only one uplink and one downlink slot, e.g. for speech communication, the UE is not in transmit or receive state during 8,75 ms in each frame. According to the TS numbers allocated to the traffic, this period can be split into two continuous idle intervals A and B as shown in figure 3.

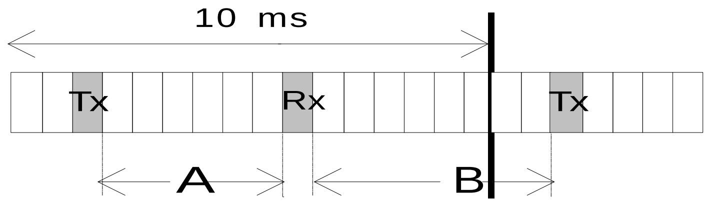


**Figure 2: possible idle periods in a 16 TS frame with two occupied TS.**

A is defined as the number of idle slots between the Tx and Rx slots and B the number of idle slots between the Rx and Tx slots. It is clear that A+B=14 time slots.

In the scope of low cost terminals, a [0.8] ms period is supposed to be required to perform a frequency jump from UMTS to GSM. As detailed in table 1, this will let free periods of A*0,625-1.6 ms and B*0,625-1.6 ms during which the mobile station can monitor GSM. In this table, the UL traffic is assumed to occupy TS0, and the duration of monitoring periods are indicated for each possible location of the DL TS.

Table- evaluates the average synchronisation time and maximum synchronisation time, where the announced synchronisation time corresponds to the time needed to find the FCCH. The FCCH is supposed to be perfectly detected meaning that the FCCH is found if it is entirely present in the monitoring window. The FCCH being found the SCH location is unambiguously known from that point.

| DL TS n° | Number of free TS in A | Number of free TS in B | Monitoring period within A (ms) | Monitoring period within B (ms) | Synchronisation average time (ms) | Maximum synchronisation time (ms) |
|---|---|---|---|---|---|---|
| 1 | 0 | 14 | Not Used | 7,15 | 43 | 140 |
| 2 | 1 | 13 | NU | 6,525 | 48 | 187 |
| 3 | 2 | 12 | NU | 5,900 | 56 | 188 |
| 4 | 3 | 11 | NU | 5,275 | 63 | 188 |
| 5 | 4 | 10 | 0.9 | 4,65 | 68 | 189 |
| 6 | 5 | 9 | 1,525 | 4,025 | 75 | 233 |
| 7 | 6 | 8 | 2,15 | 3,4 | 74 | 189 |
| 8 | 7 | 7 | 2,775 | 2,775 | 48 | 189 |
| 9 | 8 | 6 | 3,4 | 2,15 | 73 | 189 |
| 10 | 9 | 5 | 4,025 | 1,525 | 73 | 235 |
| 11 | 10 | 4 | 4,65 | 0.9 | 66 | 186 |
| 12 | 11 | 3 | 5,275 | NU | 61 | 186 |
| 13 | 12 | 2 | 5,900 | NU | 54 | 186 |
| 14 | 13 | 1 | 6,525 | NU | 47 | 186 |
| 15 | 14 | 0 | 7,15 | NU | 43 | 139 |

**Table: example-monitoring periods and associated synchronisation time in a 16 TS frame with two busy TS and with 0.8 ms switching time (*).**

(*) All simulations have been performed with a random initial delay between GSM frames and UMTS frames

Each configuration of TS allocation described above allows a monitoring period sufficient to acquire synchronisation.

#### 7.1.5.4.2.2 Higher data rate traffic using more than 1 uplink and/or 1 downlink TDD timeslot

The minimum idle time to detect a complete FCCH burst for all possible alignments between the GSM and the TDD frame structure (called 'guaranteed FCCH detection'), assuming that monitoring happens every TDD frame, can be calculated as follows ($t_{FCCH}$ = one GSM slot):

$$t_{\min\,,\,guaranteed} = 2\times t_{synth} + t_{FCCH} + \frac{10\text{ms}}{13} = 2\times t_{synth} + \frac{35\text{ms}}{26}$$

(e.g for $t_{synth}$ =0ms: 3 TDD **consecutive** idle timeslots needed, for $t_{synth}$ =0,3ms: 3~~4~~ slots, for $t_{synth}$ =0,5ms: 4 slots, for $t_{synth}$ =0,8ms: 5 slots). Under this conditions the FCCH detection time can never exceed the time of 660ms.

(For a more general consideration $t_{synth}$ may be considered as a sum of all delays before starting monitoring is possible.)

For detecting SCH instead of FCCH (for a parallel search) the same equation applies.

In the equation before the dual synthesiser UE is included if the synthesiser switching time is 0ms.

| occupied slots= 15~~16~~-idle slots | cases | FCCH detection time in ms | |
|---|---|---|---|
| | | Average | Maximum |
| 2 | 105~~120~~ | 37 | 189 |
| 3 | 455~~560~~ | 46 | 327~~328~~ |
| 4 | 1365~~1820~~ | 58~~56~~ | 419 |
| 5 | 3003~~4368~~ | 72~~70~~ | 501~~568~~ |
| 6 | 5005~~8008~~ | 90~~87~~ | 646~~659~~ |
| 7 | 6435~~11440~~ | 114~~110~~ | 660 |
| 8 | 6435~~12870~~ | 144~~138~~ | 660 |
| 9 | 5005~~11440~~ | 175~~169~~ | 660 |
| 10 | 3003~~8008~~ | 203~~195~~ | 660 |
| 11 | 1365~~4368~~ | 228~~215~~ | 660 |
| 12 | 455~~1820~~ | 254~~227~~ | 660 |
| 13 | 105~~560~~ | - ~~229~~ | - ~~660~~ |
| 14 | 15~~120~~ | - | - |
| ~~15~~ | ~~16~~ | - | - |

**Table : FCCH detection time for a dual synthesizer UE monitoring GSM from TDD every TDD frame**

In table for a given number of occupied slots in the TDD mode all possible cases of distributions of these occupied TDD slots are considered (see 'cases'). For every case arbitrary alignments of the TDD and the GSM frame structure are taken into account for calculating the average FCCH detection time (only these cases are used which guarantee FCCH detection for all alignments; only the non-parallel FCCH search is reflected by the detection times in the table 2).

The term 'occupied slots' means that the UE is not able to monitor in these TDD slots.

For a synthesiser switching time of one or one half TDD timeslot the number of needed consecutive idle TDD timeslots is summarized in the table .

| One-way switching time for the synthesiser | Number of free consecutive TDD timeslots needed in the frame for a guaranteed FCCH detection |
|---|---|
| 1 TS (= 666625µs) | 5 |
| 0.5 TS (=333312µs) | 4 |
| 0 (dual synthesiser) | 3 |

**Table: link between the synthesiser performance and the number of free consecutive TSs for guaranteed FCCH detection , needed for GSM monitoring**

#### 7.1.5.4.2.3 Use of TDD TSs release to accommodate monitoring windows

In high data-rate, when it is not possible to free the number of TS needed for an effective monitoring to prepare a handover from UMTS to GSM, the data rate can be slightly reduced for the duration of the monitoring. This should be acceptable as in any case, the data rate needs to be adapted to the available resource in GSM before the handover can be performed.