TSG-RAN WORKING GROUP 1 MEETING NO. 18 *TSGR1-01-0021*

BOSTON, USA, 15-18 JAN. 2001

Agenda Item:	AH99
Source:	Siemens AG
Title:	Alteration of SCH Offsets to Avoid Overlapping Midamble
Document for:	Approval

Background

Interference between the SCH and the midamble may cause interference problems in generating the channel estimates. Also, it will be a generally desirable thing to do anyhow as it could affect measurements of inter-cell interference power. It is therefore proposed to alter the SCH offsets so that, for none of them does the SCH overlap the midamble. The proposed offsets are as follows:-

$$t_{offset,n} \; ? \; \begin{cases} n.T_c \left? \dfrac{976 \; ? \; 256}{15} \right? & n \; ? \; 16 \\ \left? 976 \; ? \; 512 \; ? \; ?n \; ? \; 16 ? \left? \dfrac{976 \; ? \; 256}{15} \right? ? \right? T_c & n \; ? \; 16 \end{cases}$$

$$t_{offset,n} \; ? \; \begin{cases} n.48.T_c & n \; ? \; 16 \\ ?720 \; ? \; n.48 ? T_c & n \; ? \; 16 \end{cases}$$

Thus the minimum offsets are shrunk from 71 chips to 48 chips. The reason for introducing the offsets originally was to allow the strongest path SCH to be correctly demodulated without unacceptable interference from the SCH transmitted by other NodeBs by discrimination in time. We run a simulation in order to determine whether such a reduction in offset is acceptable.

Simulation of SCH Offsets

The scenario for simulation is shown below:-

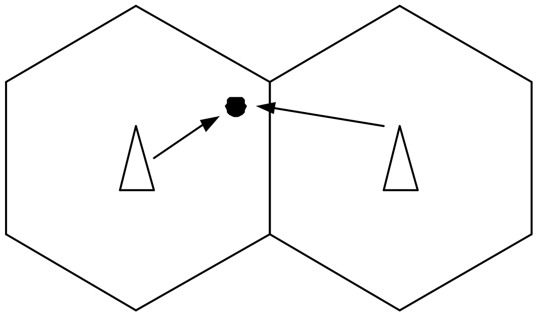


Figure 1 Scenario for Simulation

The UE is place at random with uniform distribution over the left hand cell. Both Node Bs transmit SCHs with adjacent offsets. The reason for showing only two Node Bs is that code planning can ensure that only one of a NodeB's neighbours uses an adjacent offset. The path loss between the UE is computed according to an inverse fourth power law with uncorrelated lognormal shadowing having a standard deviation of 8 dB. The absolute transmit powers and receiver noise levels are not considered important since we are interested only in the relative interference levels.

The multipath fading model is based on the T1P1 channel models.

For each UE deployment the paths losses are computed and a fresh channel model created for the paths to the two Node Bs. The maximum path power over all paths and both NodeBs is determined to obtain the affiliate NodeB. The other NodeB is then considered as an interferer. The total interference from the SCH on the interfering NodeB is measured by taking into account the gains of the paths and their timing differences relative to the overall maximum path. When the latter code position is correlated against, interference will arise at this position from the interfering NodeB according to the path time differences, the sync errors and the SCH offsets as applied to the raised cosine impulse response function.

We then repeat the measurements to obtain a cumulative density function of the maximum (i.e. wanted) path power relative to the interference from the paths from the other NodeB. In the majority of cases the strongest path will come from the nearest (left hand) NodeB. In order to reflect the worst case situation, the SCH offset for the right hand NodeB is *negative* with respect to the left hand NodeB. The effect of this is that the relatively larger propagation delay from the right hand NodeB to the UE tends to diminish the relative time offset between the SCH signals.

The effect of NodeB synchronisation error is also included. The maximum sync error is specified as ± 2.5 µs. The pdf of error is likely to peak around the zero error case. However, in order to provide a conservative model the error was modelled with a uniform distribution over the range -2.5 to +2.5 µs independently for both NodeBs.

The results for the existing 71 chip offset are shown below:-

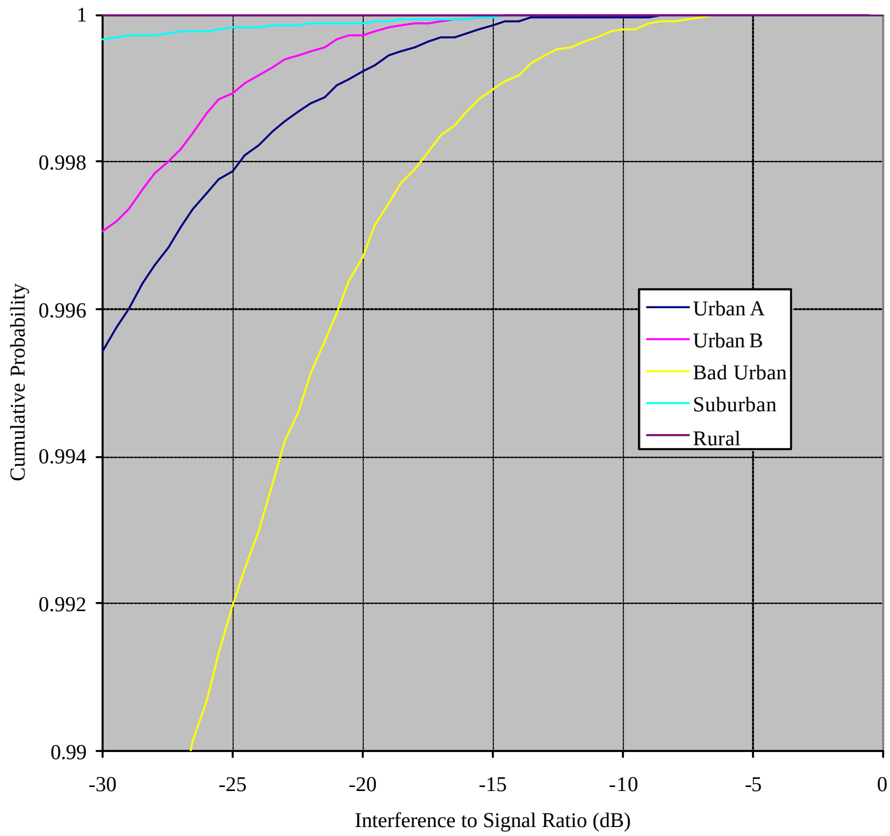


Figure 2 Cumulative Distribution for Interference with Sync Offset of 71 chips

Here we see that, even for the bad urban case, the signal to interference ratio is greater than 25 dB for 99% of the time. We now consider the case where the sync offset is reduced to 48 chips.

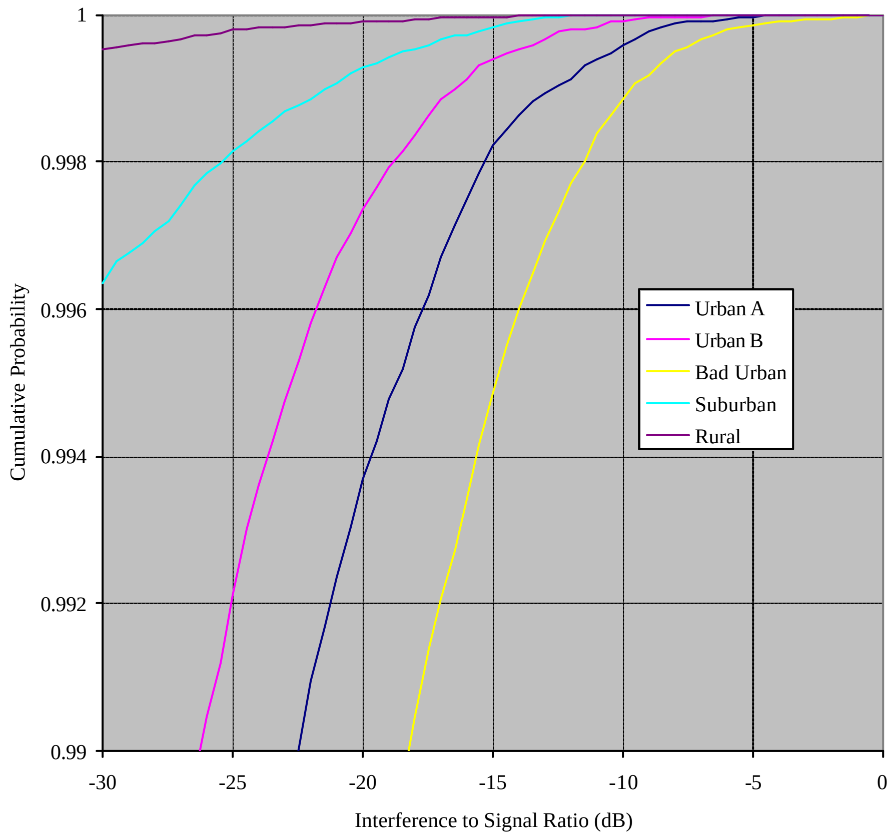


Figure 3   Cumulative Distribution for Interference with Sync Offset of 48 chips

Here the bad urban case provides 18 dB for 99% of the time. This figure is still quite large enough to support reliable detection of the sync word.

It is therefore demonstrated that the sync offsets can be altered as proposed.

CR-Form-v3

CHANGE REQUEST

✍ **TS25.221**	**CR 040** ✍	rev ✍	Current version: **3.5.0** ✍	

*For **HELP** on using this form, see bottom of this page or look at the pop-up text over the ✍ symbols.*

Proposed change affects: ✍ (U)SIM [ ] ME/UE [X] Radio Access Network [X] Core Network [ ]

Title: ✍	Alteration of SCH Offsets to Avoid Overlapping Midamble		
Source: ✍	Siemens AG		
Work item code: ✍		***Date:*** ✍	11.1.01
Category: ✍	**F**	***Release:*** ✍	R99
	Use one of the following categories: ***F*** *(essential correction)* ***A*** *(corresponds to a correction in an earlier release)* ***B*** *(Addition of feature),* ***C*** *(Functional modification of feature)* ***D*** *(Editorial modification)* Detailed explanations of the above categories can be found in 3GPP TR 21.900.		*Use one of the following releases:* *2 (GSM Phase 2)* *R96 (Release 1996)* *R97 (Release 1997)* *R98 (Release 1998)* *R99 (Release 1999)* *REL-4 (Release 4)* *REL-5 (Release 5)*

Reason for change: ✍	According to the current definition the SCH codes overlap with the midambles that will lead to inconsistent inter-cell power measurements due to crosscorrelations between midambles and SCH codes.
Summary of change: ✍	The T_offsets for the SCH codes are slightly changed.
Consequences if not approved: ✍	Non consistent measurements

Clauses affected: ✍	5.3.4	
Other specs affected: ✍	[ ] Other core specifications [ ] Test specifications [ ] O&M Specifications	✍
Other comments: ✍		

How to create CRs using this form:

Comprehensive information and tips about how to create CRs can be found at: http://www.3gpp.org/3G_Specs/CRs.htm. Below is a brief summary:

1) Fill out the above form. The symbols above marked ✍ contain pop-up help information about the field that they are closest to.

2) Obtain the latest version for the release of the specification to which the change is proposed. Use the MS Word "revision marks" feature (also known as "track changes") when making the changes. All 3GPP specifications can be downloaded from the 3GPP server under ftp://www.3gpp.org/specs/ For the latest version, look for the directory name with the latest date e.g. 2000-09 contains the specifications resulting from the September 2000 TSG meetings.

3) With "track changes" disabled, paste the entire CR form (use CTRL-A to select it) into the specification just in front of the clause containing the first piece of changed text. Delete those parts of the specification which are not relevant to the change request.

5.3.4 The synchronisation channel (SCH)

In TDD mode code group of a cell can be derived from the synchronisation channel. In order not to limit the uplink/downlink asymmetry the SCH is mapped on one or two downlink slots per frame only.

There are two cases of SCH and P-CCPCH allocation as follows:

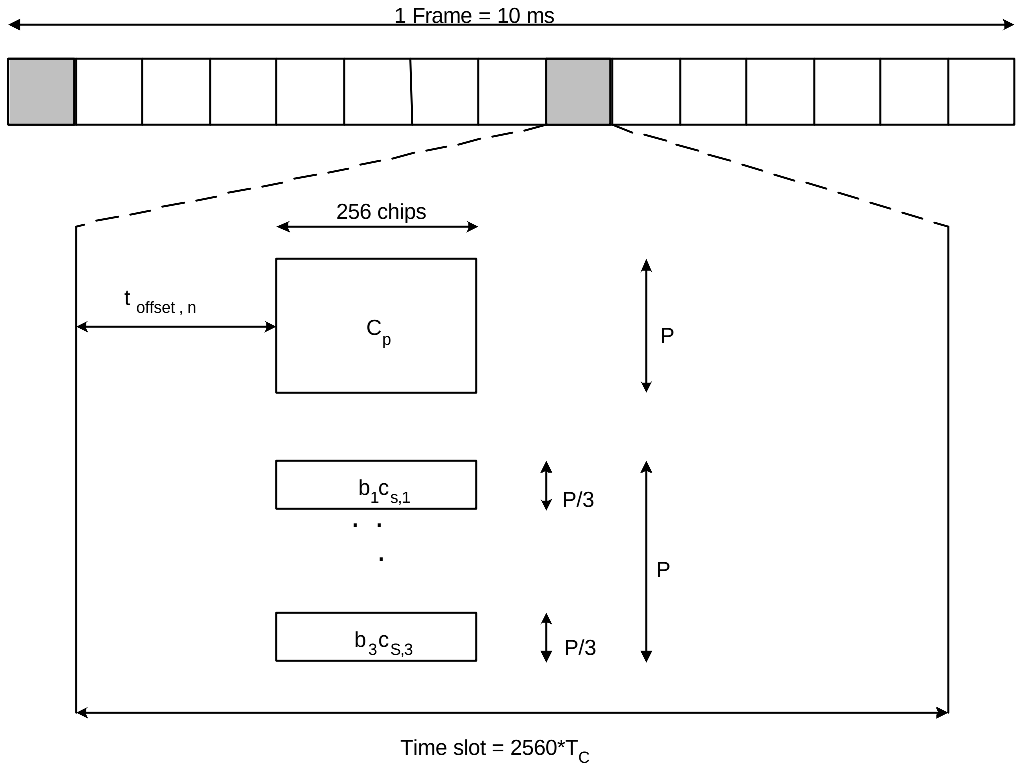
Case 1) SCH and P-CCPCH allocated in TS#k, k=0….14

Case 2) SCH allocated in two TS: TS#k and TS#k+8, k=0…6; P-CCPCH allocated in TS#k.

The position of SCH (value of k) in frame can change on a long term basis in any case.

Due to this SCH scheme, the position of P-CCPCH is known from the SCH.

Figure 14 is an example for transmission of SCH, k=0, of Case 2.



$C_{s,i}$? $\{C_0, C_1, C_3, C_4, C_5, C_6, C_8, C_{10}, C_{12}, C_{13}, C_{14}, C_{15}\}$, i=1,2,3; see [8]

Figure 14: Scheme for Synchronisation channel SCH consisting of one primary sequence C_p and 3 parallel secondary sequences $C_{s,i}$ in slot k and k+8 (example for k=0 in Case 2)

As depicted in figure 14, the SCH consists of a primary and three secondary code sequences with 256 chips length. The primary and secondary code sequences are defined in [8] clause 7 'Synchronisation codes'.

Due to mobile to mobile interference, it is mandatory for public TDD systems to keep synchronisation between base stations. As a consequence of this, a capture effect concerning SCH can arise. The time offset t_{offset} enables the system to overcome the capture effect.

The time offset t_{offset} is one of 32 values, depending on the cell parameter, thus on the code group of the cell, cf. 'table 6 Mapping scheme for Cell Parameters, Code Groups, Scrambling Codes, Midambles and t_{offset}' in [8]. Note that the cell parameter will change from frame to frame, cf. 'Table 7 Alignment of cell parameter cycling and system frame number' in [8], but the cell will belong to only one code group and thus have one time offset t_{offset}. The exact value for t_{offset}, regarding column 'Associated t_{offset}' in table 6 in [8] is given by:

$$t_{offset,n} = n \cdot T_c \left\lfloor \frac{2560 - 96 - 256}{31} \right\rfloor = n \cdot 71 T_c \; ; \quad n = 0, \ldots, 31$$

$$t_{offset,n} = \begin{cases} n \cdot 48 \cdot T_c & n < 16 \\ (720 + n \cdot 48) \cdot T_c & n \geq 16 \end{cases} ; \quad n = 0, \ldots, 31$$

Please note that $\lfloor x \rfloor$ denotes the largest integer number less or equal to x and that T_c denotes the chip duration.