TSG-RAN WORKING GROUP 1 MEETING NO. 18 *TSGR1-01-0020*

BOSTON, USA, 15-18 JAN. 2001

Agenda Item:	AH99
Source:	Siemens AG
Title:	Code Specific Phase Offsets for TDD
Document for:	Approval

1 INTRODUCTION

Code Specific Phase Offsets for TDD have been proposed at RAN WG1 #17 to overcome the potential problem of high peak-to-average power ratios in specific situations [1]. In the discussion concerns were raised on the usage of Code Specific Phase Offsets for the UL.

1. Is a Code Specific Phase Offset necessary if clipping is performed before pulse-shaping?

2. Code Specific Phase offsets affect the signal point constellation that currently uses I or Q constellations only.

3. Is a Code Specific Phase Offset necessary for the UL because the effect of regular peaks occurs in the case of the same data on multiple parallel codes only?

The following answers can be given to these concerns:

1. It is correct that for the case of the same data on all codes clipping will prevent the spectrum being degraded if it is applied before the FIR filter, as the waveform is a single peak every symbol. However, the amount of clipping required would be equal to the additional back-off that would be needed if clipping were not applied, and this would directly reduce the received signal power. The amount of additional back-off required to achieve the ACLR specification is dependent upon the PA used. Using the PA model of our simulations would require to back-off by at least 3dB to achieve the ACLR specification. Thus, the received bit energy would be halved.

2. For the proposed offsets 2pi/SF this is correct. If we used offsets pi/2 the signal points would be the same except for some code specific offset. A minor drawback of pi/2 offsets is that for a specific small subset of codes they all may add up, which would lead to the same effect as for applying no offsets. However, the effect is much smaller and is acceptable.

3. Since there are only 2 codes on the UL Code Specific Phase Offsets doesn't really improve matters for the UL. The only reason to use them for the UL as well would be to retain the same modulation scheme for DL and UL. Since the offsets pi/2 doesn't affect implementation really, see 2., we propose to keep this symmetry.

2 PROPOSAL

With respect to the above mentioned items, we propose to use Code Specific Phase Offsets of pi/2 both for the UL and the DL. A corresponding CR for TS25.223 is attached to this TDoc.

3 REFERENCES

[1] TDoc R1-00-1341, 'Transmission of Same Data on all Active Codes in a Downlink Time Slot', Siemens AG, 3GPP TSG RAN WG1#17 meeting, Stockholm, Sweden, 24-27 Nov. 2000

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CR-Form-v3

CHANGE REQUEST

✍	**TS25.223**	**CR 015**	✍	rev **1**	✍	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: ✍	Code Specific Phase Offsets for TDD			
Source: ✍	Siemens AG			
Work item code: ✍			***Date:*** ✍	11.01.01
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: ✍	Due to the particular construction of the channelisation codes a large peak to average power ratios may occur in specific case when the same data is transmitted on multiple codes.
Summary of change: ✍	Code Specific Phase Offsets are introduced with an offset of pi/2
Consequences if not approved: ✍	Not tolerable spectrum degradation due to clipping.

Clauses affected: ✍	6.3-6.6	
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.

6.3 Channelisation Code Specific Multiplier

Associated with each channelisation code is a multiplier $w_{Q_k}^{(k)}$ taking values from the set $?e^{j?/2?p_k}?$, where p_k is a permutation of the integer set {0, ..., Q_k -1} and Q_k denotes the spreading factor. The multiplier is applied to the data sequence modulating each channelisation code. The values of the multiplier for each channelisation code are given in the table below:

k	$w_{Q?1}^{(k)}$	$w_{Q?2}^{(k)}$	$w_{Q?4}^{(k)}$	$w_{Q?8}^{(k)}$	$w_{Q?16}^{(k)}$
1	1	1	-j	1	-1
2		+j	1	+j	-j
3			+j	+j	1
4			-1	-1	1
5				-j	+j
6				-1	-1
7				-j	-1
8				1	1
9					-j
10					+j
11					1
12					+j
13					-j
14					-j
15					+j
16					-1

6.4~~3~~ Scrambling codes

The spreading of data by a real valued channelisation code $\mathbf{c}^{(k)}$ of length Q_k is followed by a cell specific complex scrambling sequence $\underline{\mathbf{?}} ? ?\underline{?}_1, \underline{?}_2, ..., \underline{?}_{16}?$. The elements $\underline{?}_i; i ? 1,...,16$ of the complex valued scrambling codes shall be taken from the complex set

$$\underline{V}_? = ?1, j, -1, -j? \tag{4}$$

In equation 4 the letter j denotes the imaginary unit. A complex scrambling code $\underline{\mathbf{?}}$ is generated from the binary scrambling codes $? \; ? ?_1, ?_2, ..., ?_{16}?$ of length 16 shown in Annex A. The relation between the elements $\underline{\mathbf{?}}$ and $\mathbf{?}$ is given by:

$$\underline{?}_i \; ? \; (j)^i \; ? ?_i \qquad ?_i \; ? \; ?1, ?1? \quad i = 1,...,16 \tag{5}$$

Hence, the elements $\underline{?}_i$ of the complex scrambling code $\underline{\mathbf{?}}$ are alternating real and imaginary.

The length matching is obtained by concatenating Q_{MAX}/Q_k spread words before the scrambling. The scheme is illustrated in figure 2 and is described in more detail in subclause 6.4.

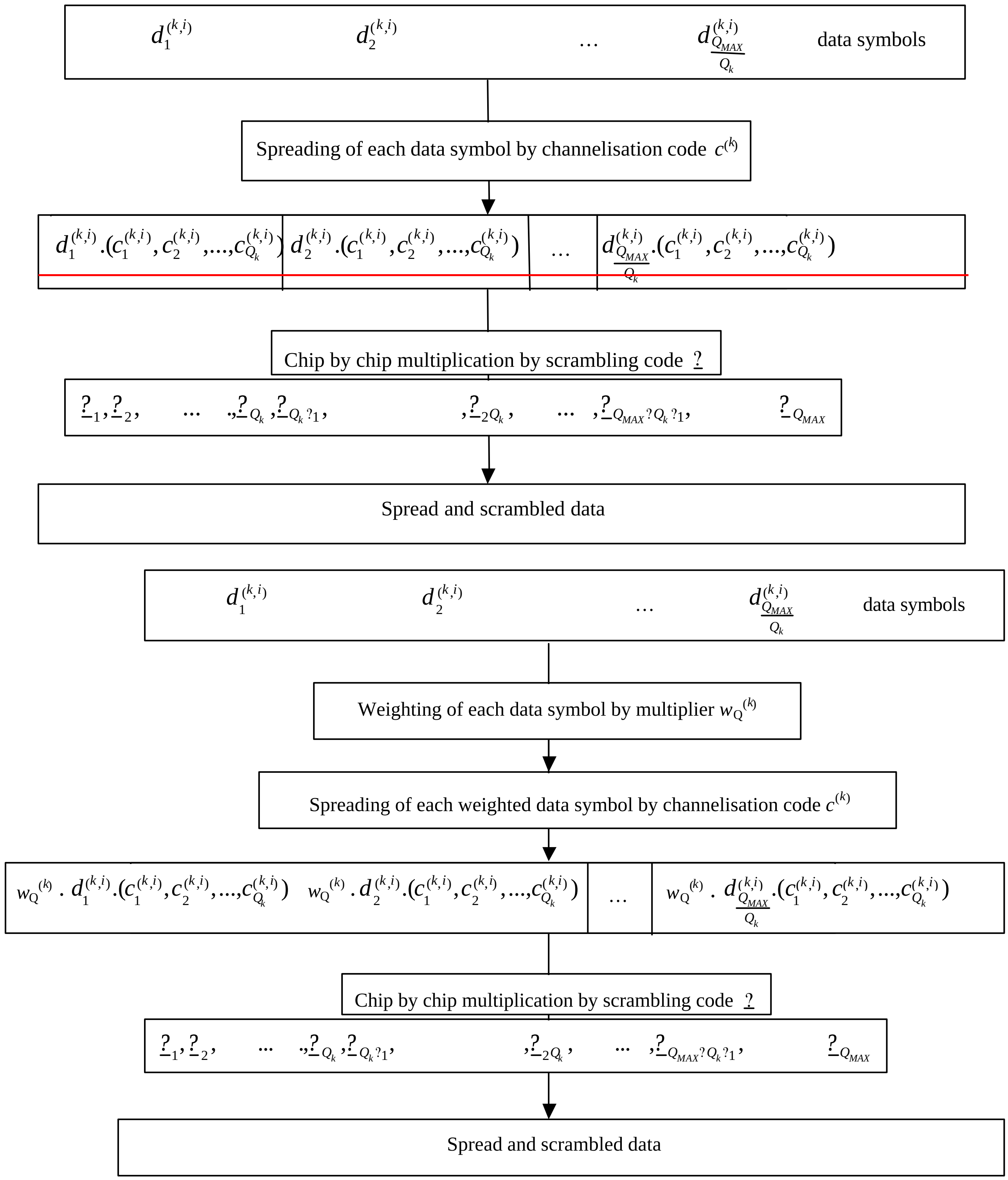

Figure 2: Spreading of data symbols

6.54 Spread signal of data symbols and data blocks

The combination of the user specific channelisation and cell specific scrambling codes can be seen as a user and cell specific spreading code $\mathbf{s}^{(k)} = \left(s_p^{(k)}\right)$ with

$$s_p^{(k)} = c^{(k)}_{1+[(p-1)\bmod Q_k]} \cdot \underline{v}_{1+[(p-1)\bmod Q_{MAX}]}$$

, k=1,…,K, p=1,…,N_kQ_k.

With the root raised cosine chip impulse filter $Cr_0(t)$ the transmitted signal belonging to the data block $\underline{\mathbf{d}}^{(k,1)}$ of equation 1 transmitted before the midamble is

$$\cancel{\underline{d}^{(k,1)}(t) ? \mathop{?}\limits_{n=1}^{N_k} \underline{d}_n^{(k,1)} \mathop{?}\limits_{q?1}^{Q_k} s^{(k)}_{(n?1)Q_k?q} ?Cr_0(t ? (q ? 1)T_c ? (n ? 1)Q_k T_c)}$$

$$d^{(k,1)}(t) ? \mathop{?}\limits_{n?1}^{N_k} d_n^{(k,1)} w_{Q_k}^{(k)} \mathop{?}\limits_{q?1}^{Q_k} s^{(k)}_{(n?1)Q_k?q} . Cr_0(t ? (q ? 1)T_c ? (n ? 1)Q_k T_c) \qquad (6)$$

and for the data block $\underline{\mathbf{d}}^{(k,2)}$ of equation 1 transmitted after the midamble

$$\cancel{\underline{d}^{(k,2)}(t) ? \mathop{?}\limits_{n=1}^{N_k} \underline{d}_n^{(k,2)} \mathop{?}\limits_{q?1}^{Q_k} s^{(k)}_{(n?1)Q_k?q} ?Cr_0(t ? (q ? 1)T_C ? (n ? 1)Q_k T_c ? N_k Q_k T_c ? L_m T_c).}$$

$$d^{(k,2)}(t) ? \mathop{?}\limits_{n?1}^{N_k} d_n^{(k,2)} w_{Q_k}^{(k)} \mathop{?}\limits_{q?1}^{Q_k} s^{(k)}_{(n?1)Q_k?q} . Cr_0(t ? (q ? 1)T_c ? (n ? 1)Q_k T_c ? N_k Q_k T_c ? L_m T_c) \qquad (7)$$

where L_m is the number of midamble chips.

6.6~~5~~ Modulation

The complex-valued chip sequence is QPSK modulated as shown in figure 3.

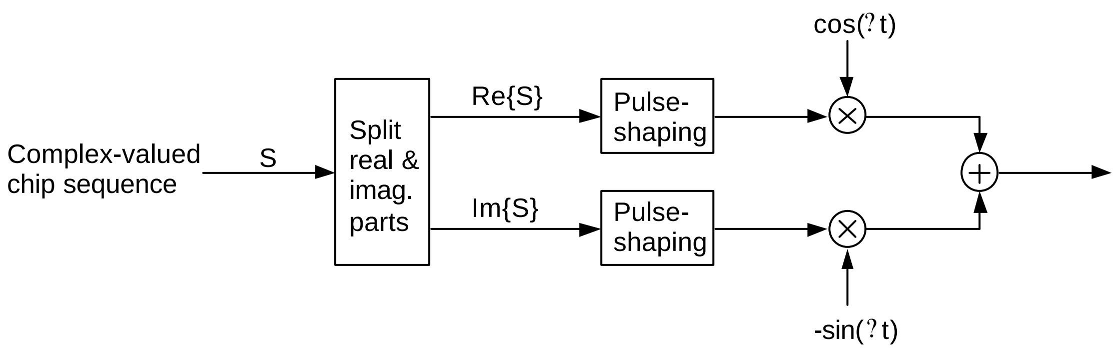

Figure 3: Modulation of complex valued chip sequences

The pulse-shaping characteristics are described in [9] and [10].

6.6~~5~~.1 Combination of physical channels in uplink

Figure 4 illustrates the principle of combination of two different physical uplink channels within one timeslot. The DPCHs to be combined belong to same CCTrCH, did undergo spreading as described in sections before and are thus represented by complex-valued sequences. First, the amplitude of all DPCHs is adjusted according to UL open loop power control as described in [10]. Each DPCH is then separately weighted by a weight factor $?_i$ and combined using complex addition. After combination of Physical Channels the gain factor $?_j$ is applied, depending on the actual TFC as described in [10].

In case of different CCTrCH, principle shown in Figure 4 applies to each CCTrCH separately.

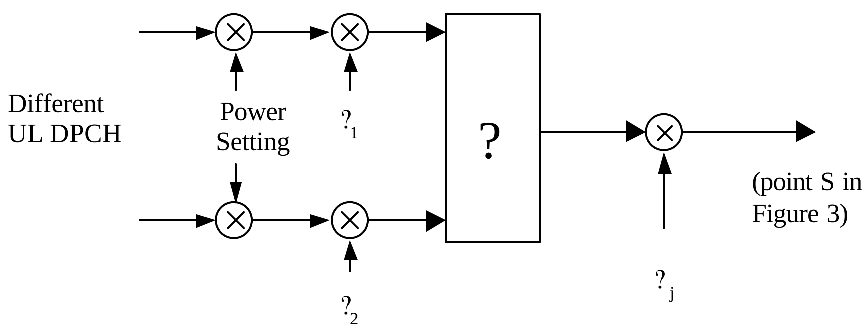

Figure 4: Combination of different physical channels in uplink

The values of weight factors ?$_i$ are depending on the spreading factor SF of the corresponding DPCH:

SF of DPCH$_i$	?$_i$
16	1
8	$\sqrt{2}$
4	2
2	$2\sqrt{2}$
1	4

The possible values for gain factors ?$_j$ (corresponding to *j*–th TFC) are listed in table below:

Signalling value for ?$_j$	Quantized value ?$_j$
15	16/8
14	15/8
13	14/8
12	13/8
11	12/8
10	11/8
9	10/8
8	9/8
7	8/8
6	7/8
5	6/8
4	5/8
3	4/8
2	3/8
1	2/8
0	1/8

6.6~~5~~.2 Combination of physical channels in downlink

Figure 5 illustrates how different physical downlink channels are combined within one timeslot. Each complex-valued spread channel is separately weighted by a weight factor G_i. If a timeslot contains the SCH, the complex-valued SCH, as described in [7] is separately weighted by a weight factor G_{SCH}. All downlink physical channels are then combined using complex addition.

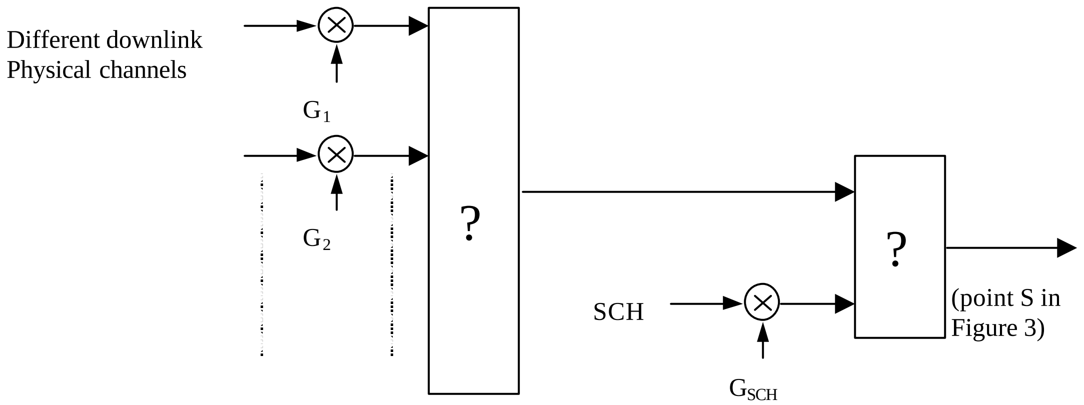

Figure 5: Combination of different physical channels in downlink in case of SCH timeslot