TSG-RAN Meeting #11
Palm Springs, CA, U.S.A., 13-16 March 2001

RP-010064

Title: **Agreed CRs to TS 25.223**

Source: **TSG-RAN WG1**

Agenda item: 5.1.3

No.	R1 T-doc	Spec	CR	Rev	Subject	Cat	V_old	V_new
1	R1-01-0020	25.223	015	1	Code specific phase offsets for TDD	F	3.4.0	3.5.0

CR-Form-v3

CHANGE REQUEST

| ⌘ | **TS25.223** | CR | **015** | ⌘ | rev | **1** | ⌘ | Current version: | **3.4.0** | ⌘ |

*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:	⌘	TSG RAN WG1
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 $\left\{e^{j\pi/2 \cdot p_k}\right\}$, 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 $\underline{\mathbf{v}} = \left(\underline{v}_1, \underline{v}_2, ..., \underline{v}_{16}\right)$. The elements $\underline{v}_i; i = 1,...,16$ of the complex valued scrambling codes shall be taken from the complex set

$$\underline{V}_v = \{1, j, -1, -j\}$$

(4)

In equation 4 the letter j denotes the imaginary unit. A complex scrambling code $\underline{\mathbf{v}}$ is generated from the binary scrambling codes $v = \left(v_1, v_2, ..., v_{16}\right)$ of length 16 shown in Annex A. The relation between the elements $\underline{\mathbf{v}}$ and $\mathbf{v}$ is given by:

$$\underline{v}_i = (j)^i \cdot v_i \qquad v_i \in \{1, -1\}; \ i = 1,...,16$$

(5)

Hence, the elements $\underline{v}_i$ of the complex scrambling code $\underline{\mathbf{v}}$ 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.
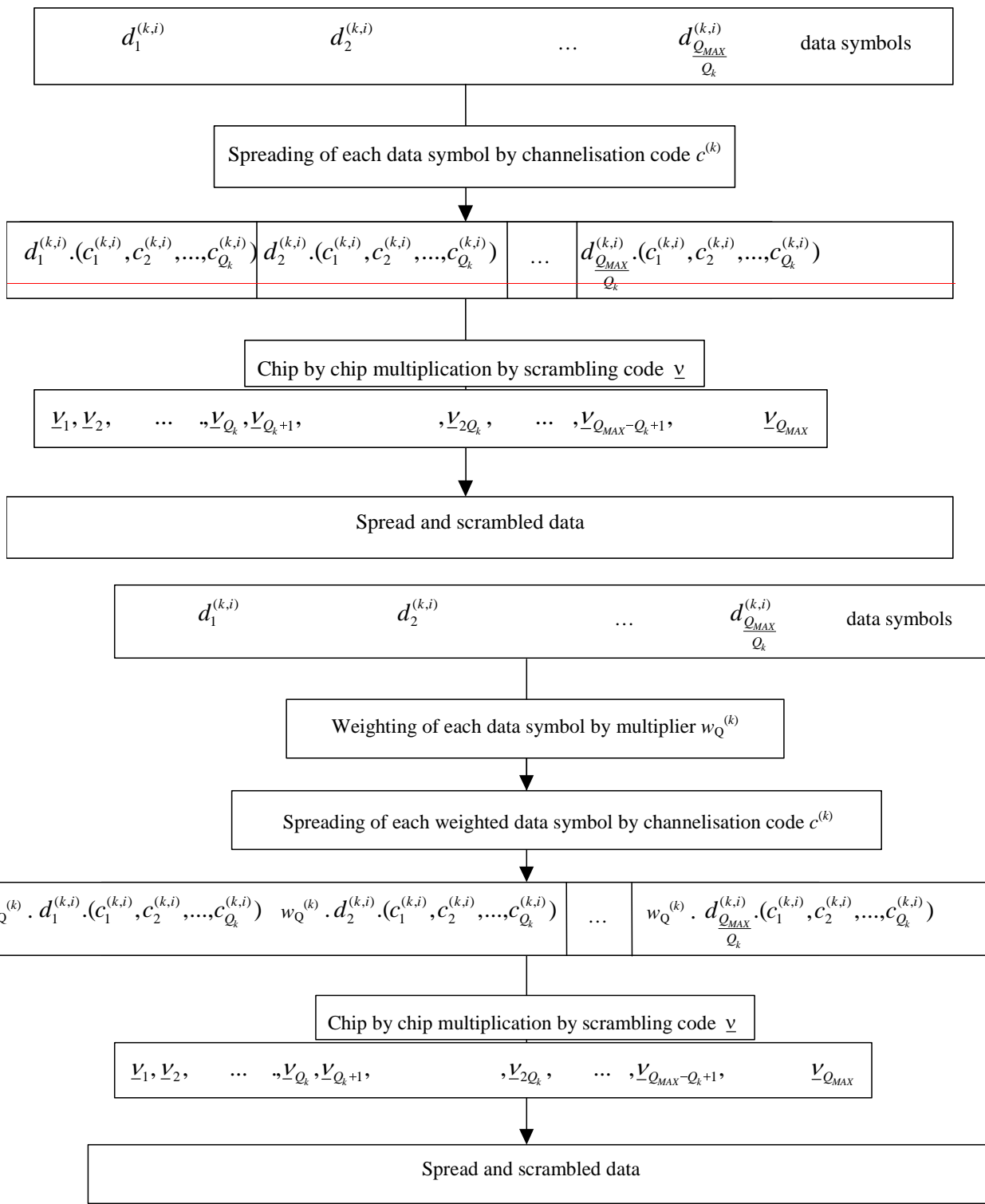
$d_1^{(k,i)}$	$d_2^{(k,i)}$	...	$d_{\frac{Q_{MAX}}{Q_k}}^{(k,i)}$	data symbols

Spreading of each data symbol by channelisation code $c^{(k)}$

$d_1^{(k,i)}.(c_1^{(k,i)},c_2^{(k,i)},...,c_{Q_k}^{(k,i)})$	$d_2^{(k,i)}.(c_1^{(k,i)},c_2^{(k,i)},...,c_{Q_k}^{(k,i)})$	...	$d_{\frac{Q_{MAX}}{Q_k}}^{(k,i)}.(c_1^{(k,i)},c_2^{(k,i)},...,c_{Q_k}^{(k,i)})$

Chip by chip multiplication by scrambling code $\underline{v}$

$\underline{v}_1,\underline{v}_2,\quad...\ ..,\underline{v}_{Q_k},\underline{v}_{Q_k+1},\quad\quad,\underline{v}_{2Q_k},\quad...\ ,\underline{v}_{Q_{MAX}-Q_k+1},\quad\quad\underline{v}_{Q_{MAX}}$

Spread and scrambled data

$d_1^{(k,i)}$	$d_2^{(k,i)}$	...	$d_{\frac{Q_{MAX}}{Q_k}}^{(k,i)}$	data symbols

Weighting of each data symbol by multiplier $w_Q^{(k)}$

Spreading of each weighted data symbol by channelisation code $c^{(k)}$

$w_Q^{(k)}.d_1^{(k,i)}.(c_1^{(k,i)},c_2^{(k,i)},...,c_{Q_k}^{(k,i)})$	$w_Q^{(k)}.d_2^{(k,i)}.(c_1^{(k,i)},c_2^{(k,i)},...,c_{Q_k}^{(k,i)})$	...	$w_Q^{(k)}.d_{\frac{Q_{MAX}}{Q_k}}^{(k,i)}.(c_1^{(k,i)},c_2^{(k,i)},...,c_{Q_k}^{(k,i)})$

Chip by chip multiplication by scrambling code $\underline{v}$

$\underline{v}_1,\underline{v}_2,\quad...\ ..,\underline{v}_{Q_k},\underline{v}_{Q_k+1},\quad\quad,\underline{v}_{2Q_k},\quad...\ ,\underline{v}_{Q_{MAX}-Q_k+1},\quad\quad\underline{v}_{Q_{MAX}}$

Spread and scrambled data

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

$$s_p^{(k)} = c_{1+[(p-1)\bmod Q_k]}^{(k)} \cdot \underline{v}_{1+[(p-1)\bmod Q_{MAX}]}, \quad k=1,...,K,\ p=1,...,N_kQ_k.$$

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

$$\underline{d}^{(k,1)}(t) = \sum_{n=1}^{N_k} \underline{d}_n^{(k,1)} \sum_{q=1}^{Q_k} s_{(n-1)Q_k+q}^{(k)} \cdot Cr_o(t-(q-1)T_c-(n-1)Q_kT_c)$$

$$d^{(k,1)}(t) = \sum_{n=1}^{N_k} d_n^{(k,1)} w_{Q_k}^{(k)} \sum_{q=1}^{Q_k} s_{(n-1)Q_k+q}^{(k)} \cdot Cr_0(t-(q-1)T_c-(n-1)Q_kT_c) \tag{6}$$

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

$$\underline{d}^{(k,2)}(t) = \sum_{n=1}^{N_k} \underline{d}_n^{(k,2)} \sum_{q=1}^{Q_k} s_{(n-1)Q_k+q}^{(k)} \cdot Cr_0(t-(q-1)T_C-(n-1)Q_kT_c-N_kQ_kT_c-L_mT_c).$$

$$d^{(k,2)}(t) = \sum_{n=1}^{N_k} d_n^{(k,2)} w_{Q_k}^{(k)} \sum_{q=1}^{Q_k} s_{(n-1)Q_k+q}^{(k)} \cdot Cr_0(t-(q-1)T_c-(n-1)Q_kT_c-N_kQ_kT_c-L_mT_c) \tag{7}$$

where L_m is the number of midamble chips.

6.6 Modulation

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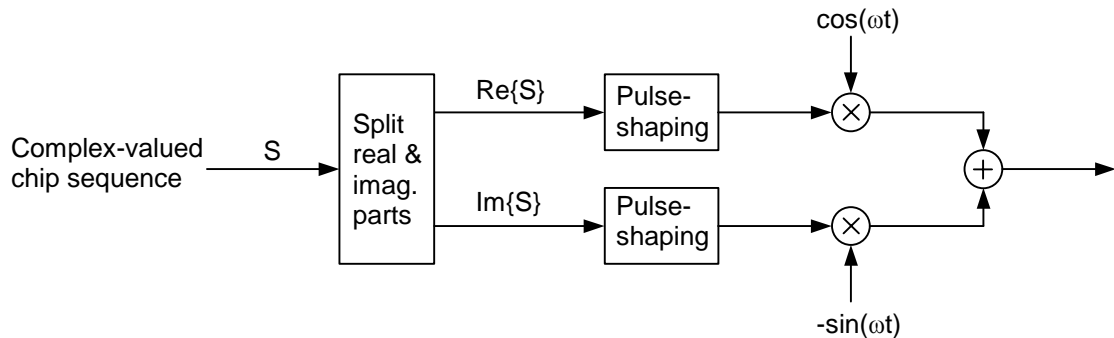

Figure 3: Modulation of complex valued chip sequences

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

6.6.1 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 γ_i and combined using complex addition. After combination of Physical Channels the gain factor β_j is applied, depending on the actual TFC as described in [10].

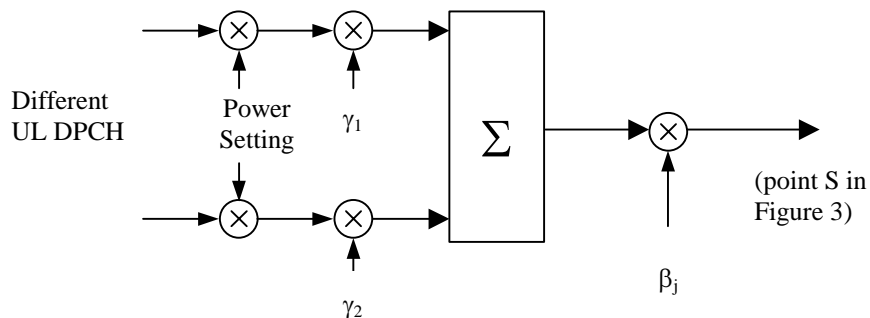In case of different CCTrCH, principle shown in Figure 4 applies to each CCTrCH separately.

Figure 4: Combination of different physical channels in uplink

The values of weight factors γ_i are depending on the spreading factor SF of the corresponding DPCH:

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

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

Signalling value for β_j	Quantized value β_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.
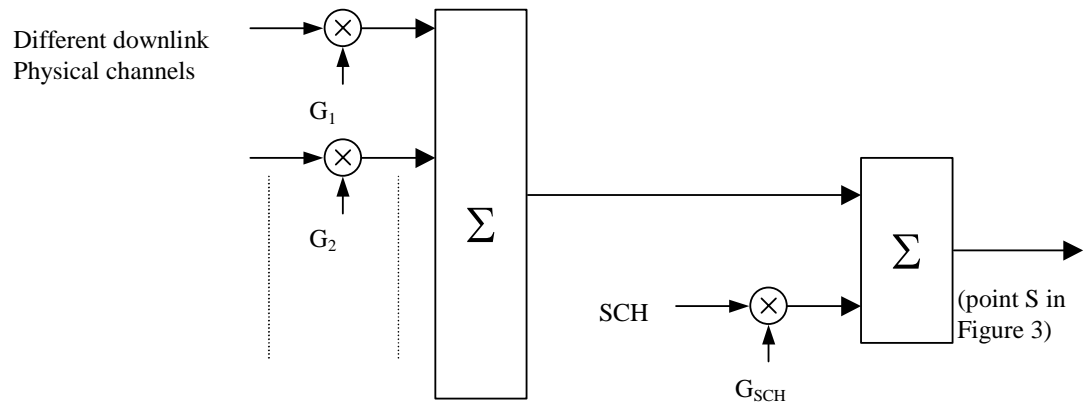
Figure 5: Combination of different physical channels in downlink in case of SCH timeslot