

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

**RP-010075**

**Title:** Agreed CRs (Release 4) for WI "Technical Small Enhancement and Improvements"  
Work Item Code : *TEI4*

**Source:** TSG-RAN WG1

**Agenda item:** 6.8

No.	R1 T-doc	Spec	CR	Rev	Subject	Cat	V_old	V_new
1	R1-01-0347	25.211	093	1	Application of beamforming and combination of beamforming with TX-diversity on UTRA FDD downlink	F	3.5.0	4.0.0

CR-Form-v3

## CHANGE REQUEST

⌘ **25.211 CR 093** ⌘ 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  Radio Access Network  Core Network

<b>Title:</b>	⌘	Application of beamforming and combination of beamforming with TX-diversity on UTRA FDD downlink	
<b>Source:</b>	⌘	TSG RAN WG1	
<b>Work item code:</b>	⌘		<b>Date:</b> ⌘ 27.01.2001
<b>Category:</b>	⌘	<b>F</b>	<b>Release:</b> ⌘ Rel-4
		Use <u>one</u> of the following categories: <b>F</b> (essential correction) <b>A</b> (corresponds to a correction in an earlier release) <b>B</b> (Addition of feature), <b>C</b> (Functional modification of feature) <b>D</b> (Editorial modification) Detailed explanations of the above categories can be found in 3GPP TR 21.900.	Use <u>one</u> 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)

<b>Reason for change:</b>	⌘	The applicability of beamforming and combinations of beamforming and TX diversity is not currently covered in the TSG RAN WG1 specifications
<b>Summary of change:</b>	⌘	The table listing the downlink physical channels that may use beamforming (e.g. adaptive antennas) and the combinations of the beamforming and TX-diversity methods has been added based on the feedback received from TSG RAN WG4.
<b>Consequences if not approved:</b>	⌘	Potential misinterpretation may cause interoperability problems between UE and UTRAN when using beamforming or when using both TX-diversity and beamforming

<b>Clauses affected:</b>	⌘	5.3.1
<b>Other specs affected:</b>	⌘	<input type="checkbox"/> Other core specifications <input type="checkbox"/> Test specifications <input type="checkbox"/> O&M Specifications
<b>Other comments:</b>	⌘	

### 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](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 Downlink physical channels

### 5.3.1 Downlink transmit diversity [and beamforming](#)

Table 10 summarizes the possible application of open and closed loop transmit diversity modes on different downlink physical channel types. Simultaneous use of **STTD-open** and closed loop modes on the same physical channel is not allowed. In addition, if Tx diversity is applied on any of the downlink physical channels it shall also be applied on P-CCPCH and SCH. Regarding CPICH transmission in case of transmit diversity, see subclause 5.3.3.1. [For possible application of beamforming simultaneously with transmit diversity on different downlink channel types, see subclause 5.3.1.3 for both open and closed loop mode methods.](#)

Furthermore, the transmit diversity mode used for a PDSCH frame shall be the same as the transmit diversity mode used for the DPCH associated with this PDSCH frame. During the duration of the PDSCH frame, and within the slot prior to the PDSCH frame, the transmit diversity mode (open loop or closed loop) on the associated DPCH may not change. However, changing from closed loop mode 1 to mode 2 or vice versa, is allowed.

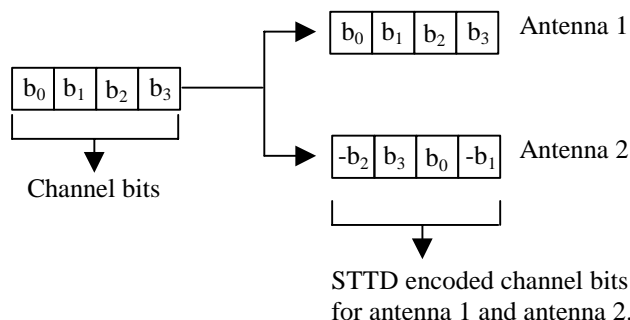
**Table 10: Application of Tx diversity modes on downlink physical channel types**  
"X" – can be applied, "-" – not applied

Physical channel type	Open loop mode		Closed loop Mode
	TSTD	STTD	
P-CCPCH	-	X	-
SCH	X	-	-
S-CCPCH	-	X	-
DPCH	-	X	X
PICH	-	X	-
PDSCH	-	X	X
AICH	-	X	-
CSICH	-	X	-

#### 5.3.1.1 Open loop transmit diversity

##### 5.3.1.1.1 Space time block coding based transmit antenna diversity (STTD)

The open loop downlink transmit diversity employs a space time block coding based transmit diversity (STTD). The STTD encoding is optional in UTRAN. STTD support is mandatory at the UE. STTD encoding is applied on blocks of 4 consecutive channel bits. A block diagram of a generic STTD encoder for channel bits  $b_0, b_1, b_2, b_3$  is shown in the figure 8 below. Channel coding, rate matching and interleaving is done as in the non-diversity mode. The bit  $b_1$  is real valued  $\{0\}$  for DTX bits and  $\{1, -1\}$  for all other channel bits.



**Figure 8: Generic block diagram of the STTD encoder**

### 5.3.1.1.2 Time Switched Transmit Diversity for SCH (TSTD)

Transmit diversity, in the form of Time Switched Transmit Diversity (TSTD), can be applied to the SCH. TSTD for the SCH is optional in UTRAN, while TSTD support is mandatory in the UE. TSTD for the SCH is described in subclause 5.3.3.4.1.

### 5.3.1.2 Closed loop transmit diversity

Closed loop transmit diversity is described in [5]. Both closed loop transmit diversity modes shall be supported at the UE and may be supported in the UTRAN.

### 5.3.1.3 Downlink Beamforming

Table 11 summarizes the possible application of beamforming with and without S-CPICH present in the same beam on different downlink physical channel types.

**Table 11: Application of beamforming concepts on downlink physical channel types**  
"X" – can be applied, "-" – not applied

Physical channel type	Beamforming with S-CPICH	Beamforming without S-CPICH
P-CCPCH	=	=
SCH	=	=
S-CCPCH carrying PCH	-	-
S-CCPCH carrying FACH only	X	-
DPCH	X	X
PICH	=	=
PDSCH*	X	X
AICH	=	=
CSICH	=	=

Note \* Associated DPCH shall be transmitted in the same beam

Table 12 summarizes the possible application of simultaneous use of beamforming and TX diversity with both open loop or closed loop TX diversity methods in [5] on a downlink physical channel. Note that only the channels that support the use of downlink beamforming as indicated in Table 11 have been included in Table 12. The restrictions in Table 12 are valid only for a channel using beamforming. There needs to be always S-CPICH (with diversity pilot) used in the same beam if it is desired to use both beamforming and TX diversity simultaneously on a downlink physical channel.

**Table 12: Application of Tx diversity modes on a downlink physical channel using beamforming,**  
"X" – can be applied, "-" – not applied

Physical channel type used	Open loop mode & beamforming with S-CPICH	Closed loop mode & beamforming with S-CPICH
S-CCPCH carrying FACH only	X	-
DPCH	X	X
PDSCH*	X	X

Note\* Associated DPCH shall be transmitted in the same beam

