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<b>Agenda item:</b>	<b>15</b>
<b>Source:</b>	<b>Ad Hoc #6</b>
<b>Title:</b>	<b>Ad Hoc #6 report to RAN WG1 meeting #7</b>
<b>Document for:</b>	<b>Approval</b>

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**Summary:**

Main decisions made by Ad Hoc #6 physical meeting were as follows:

FDD/release-99:

- Two closed loop modes are defined:
  - ★ Mode 1:
    - ◆ Based on original Nokia's proposal (also proposed by TI in [16])
    - ◆  $\pi/2$  constellation rotation in UE and two slot filtering at Node B
  - ★ Mode 2:
    - ◆ Based on Motorola's new proposal presented in [7]
    - ◆ 3 bit phase and 1 bit amplitude feedback with progressive refinement
- All the Tx diversity closed loop modes will use only 1 bit feedback. Two bit feedback is reserved for simultaneous use of closed loop modes and SSDF power control
- Orthogonal pilot pattern on dedicated channel transmitted from diversity antenna is always used in closed loop mode 1
- In closed loop mode 2 no orthogonal pilot pattern is used
- STTD encoding can be applied on PICH

TDD/release-99:

- Use of TSTD on SCH accepted as a working assumption

Liaison statements to TSG-R WG2, TSG-R WG4 and TSG-T WG1 were agreed to be made in order to inform them about the decisions. Liaison statement to TSG-R WG2 will also address the mode control issues brought up in reflector discussions

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## 1. INTRODUCTION

In the previous meeting several open issues were identified [1]. This time 15 contributions, part of which addressed the open items, were dealt with [2-16].

## 2. OPEN ISSUES OF FORWARD LINK TRANSMIT DIVERSITY

### 2.1 Details of the closed loop modes

The details of the closed loop modes have been under discussions for long time. Four contributions were made by the three main proponents, Nokia, Motorola and TI [7, 8, 14, 16]. As a result of offline discussions the three companies made the following proposal for release-99:

- Two closed loop modes are defined:
  - ★ Mode 1:
    - ◆ Based on original Nokia's proposal (also proposed by TI in [16])
    - ◆  $\pi/2$  constellation rotation in UE and two slot filtering at Node B
  - ★ Mode 2:
    - ◆ Based on Motorola's new proposal presented in [7]
    - ◆ 3 bit phase and 1 bit amplitude feedback with progressive refinement
- All the Tx diversity closed loop modes will use only 1 bit feedback. Two bit feedback is reserved for simultaneous use of closed loop modes and SSDF power control

**The proposal was accepted by Ad Hoc #6. A new text proposal will be prepared during the WG1 meeting #7.**

Panasonic contribution (R1-99c20) raised the issue of a need to have a message, which would indicate if the direction is wrong when beamforming is applied. **This issue was identified as a FFS item for later releases of the specifications.**

### 2.2 CIPCH transmission method from each antenna in Tx diversity

As the issue was already handled in plenary no further discussion took place.

### 2.3 Use of verification and orthogonal pilots

In order to further simplify the current closed loop solution **it was agreed that in release-99:**

- Orthogonal pilot pattern on dedicated channel transmitted from diversity antenna is always used in closed loop mode 1
- In closed loop mode 2 no orthogonal pilot pattern is used

## 2.4 Effect of reduced number of dedicated pilot bits on Tx diversity modes

Nokia presented an informative contribution on Tx diversity performance as a function of number of dedicated pilot symbols and feedback BER [13]. Based on the results having 4 pilot bits yields about 0.5 dB loss (when compared to the current 8 pilot bits) in case only dedicated pilot is used for channel estimation. The loss was about 2 dB if only 2 pilot bits is used. This supports the proposal of defining 4 pilot bits for SF 256 DL channel.

If CPICH only is used for channel estimation the performance is good if feedback BER is low. At 10 % feedback BER a loss about 2-3 dB was experienced (no verification was used). Thus if no dedicated pilot bits are available performance is sensitive to feedback BER (verification is not possible). This also supports the requirement that in minimum 4 dedicated pilot bits are needed for Tx diversity closed loop modes.

## 2.5 PICH

In the previous WG1 meeting a new physical channel, PICH, was accepted. In reflector discussions the question if STTD encoding could be applied on PICH was raised. It was noted that in minimum there is only 1 symbol to be decoded by UE. Yet, STTD encodes two symbols at time meaning that UE also needs to decode in minimum two symbols. This brought up the question if that has got some adverse effects to stand-by time performance of UE. Based on the discussions this was not seen as a problem. Therefore, **Ad Hoc #6 proposes that STTD encoding can be applied on PICH. A text proposal is presented in chapter 3.**

## 2.6 Effects of slotted mode to all Tx diversity modes

Possible impact of the slotted mode to the open and closed loop modes had been identified as one of the open items. For the closed loop modes it was agreed that this will be taken into account in the new text proposal. TI will check if a new text proposal needs to be made during the WG1 meeting #7 on STTD encoding in case of slotted mode.

## 2.7 TDD Tx diversity issues

TI contributions (R1-99b45 and R1-99b46) proposed that Delay Diversity (DD) should be used on BCH and DPCH. In a contribution by Motorola, block STTD is proposed to be used on BCH. **No decision were made yet.** Siemens, Motorola and TI will define simulation scenarios and conditions for further work. They will be posted to reflector.

**Panasonic proposal (R1-99c19)** of using midamplers transmitted in parallel to improve the open loop power control **was not yet accepted.** More studying is needed.

In R1-99c18 by Panasonic a proposal to use TSTD on SCH was made. **Use of TSTD on SCH was accepted as working assumption.**

In the Ad Hoc #6 meeting #6 in Espoo, some worries were presented regarding the effects of implementation imperfections (non-ideal PA/LNAs) to the performance of Tx AA. In Motorola contribution (R1-99c06) a study results of influence of transceiver chain phase imbalance on Tx AA performance were presented. Results indicate that Tx AA is very robust in this sense. No further studies on this issue is required by Ad Hoc #6.

In Bosch contribution (R1-99a82) performance results for single Tx antenna MMSE-JD, RAKE, Matched Filter (MF) and Joint Predistortion (JP) are shown, as well as dual Tx antenna STD, TxAA and JP performance in IndoorA and IndoorB environments. The JP performance seemed to be very promising. Yet, no decision was made. **Further discussions are needed before making decision to include JP for TDD.**

## 2.8 Text proposals

Due to new proposal for closed loop operation by Nokia, Motorola and TI, **the text proposals presented in R1-99c10 and R1-99c31 were not accepted.** Instead a new text proposal will be made.

Motorola **text proposals to TS 25.221 and TS 25.224 presented in R1-99c85 were accepted.**

TI **text proposal in R1-99b45 for DD to be used on BCH of TDD was not accepted** because the concept itself was not yet accepted.

**NEC text proposal (R1-99c17) on SSDT specification update to TS25.214 was tentatively accepted with a note that the table 3 of the text proposal will be deleted.** Yet, comments can still be made until the plenary discussion (agenda item 16). If no further comments or corrections will come up the proposal will be automatically accepted.

## 2.9 Liaison statements to other WGs

Two liaison statements were agreed to be made:

- To TSG-R WG2 in order to inform about the decisions made and to notify about the mode control issues raised during the reflector discussions
- To TSG-R WG4 and TSG-T WG1 in order to inform about the decisions made

### 3. TEXT PROPOSAL FOR PICH

The Table 8 in TS 25.211 v2.2.1 chapter 5.3.1 is proposed to be updated as follows:

-----Start text proposal-----

**Table 8: Application of Tx diversity modes on downlink physical channels.**

Channel	Open loop mode	Closed loop mode	Note
PCCPCH	X	N/A	STTD applied only to data symbols. The last odd data symbol in every frame (10 msec.) is not STTD encoded.
SCH	X	N/A	TSTD used.
SCCPCH	X	N/A	
DPCH	X	X	For the 7.5 kps channel, the last odd data symbol in every frame (10 msec.) is not STTD encoded.
<u>PICH</u>	<u>X</u>	<u>N/A</u>	<u>Only if closed loop Tx diversity is used in the cell and/or open loop mode is used on PCCPCH.</u>
PDSCH (associated with DPCH)	X	X	
AICH	X	N/A	Only if closed loop Tx diversity is used in the cell and/or open loop mode is used on PCCPCH.

N/A = Not applied

X = Can be applied

-----End text proposal-----

### 4. CONCLUSIONS

Main open issues were resolved for the FDD mode. For the TDD mode many issues remain still open.

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