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Title: SSDT
Document for: Discussion and decision

1. Introduction

In RAN WG1#22 meeting in Jeju, Korea, some discussion took place on SSDT. It was proposed by some companies to omit SSDT from R99 and Rel4 specifications or to make it optional in the UE [1]. In response, [2] showed that issues and concerns raised in [1] were not valid. However, the discussions in RAN WG1 #22 were inconclusive and have chosen to report the matter to RAN [3].

This document provides further information to RAN concerning the SSDT matters and proposes a way forward.

2. SSDT - background

SSDT is a sub-mode of soft handoff (SHO) and it is only activated once a UE enters SHO mode. SSDT significantly enhances the downlink capacity by UE selecting the best NodeB on a frame by frame basis for downlink DPDCH transmission. Other operations, for example: uplink handling, active cell list updates, handling of TPC commands in UE, follow the same process as in SHO mode.

3. Operation of SSDT with Closed Loop(CL) Transmit Diversity

[1] suggests that there is some uncertainty in calculating CL Tx Diversity feedback commands when it is operated with SSDT.

SSDT feedback calculations with and without transmit diversity are already clearly defined in R99 and Rel4 versions of TS25.214 and TS25.215. On the other hand UE behaviour in calculating CL Tx diversity feedback command when in SHO, regardless whether SSDT is active, is not clearly defined (ie: it is implementation dependent). So the uncertainty that [1] points out is not considered to be an SSDT specific problem. Therefore, omitting SSDT or making SSDT optional is a misleading solution of this problem.

With regards to the test requirement, as [1] quite rightly points out that there are no tests defined for CL Tx diversity in SHO, even though CL Tx feedback commands are dependent on UE implementation. In conclusion this is NOT a SSDT problem, but rather verification of UE performance behavior whilst in SHO for CL Tx Diversity (modes 1 and 2).

4. Combining of TPC commands received on the DL

[1] suggests that combining TPC commands received on the DL is a problem.

SSDT is a sub-mode of SHO and is only activated when UE is in soft-handoff mode. When activated, SSDT supresses the transmission of downlink DPDCH of the non-Primary Cells. Uplink continues to operate as in conventional SHO. Therefore it is implicit that the TPC commands received at UE on the downlink are processed in the same way as it would be in conventional SHO. The processing of these TPC commands is already decribed clearly in R99 and Rel4 versions of TS25.214 section 5.1.2.2.

The CR (R1-01-1250) already conditionally approved by RAN1, further adds clarification in the specifications.

5. Qth parameter in SSDT

[3] reports this as some sort of "conflict" in the specifications between Physical Layer and NBAP signalling.

Concerning this issue we would like to point out that, in 1999, experts in RAN3 have discussed the issue of signalling Qth parameter over the NBAP from S-RNC to Node-B and firmly decided that Qth is set in NodeB using OAM [4]. All relevant RAN3 specifications (ie: TS25.433 and TS25.423) are consistent with this decision.

A simple clarification in TS25.214 would clear-up any apparent confusion of the Qth parameter. Furthermore, this clarification is of no impact to UE implementation.

6. Overall system benefits of SSDT

In discussion of ESSDT, it was shown that there is significant benefit in the case of high bit rate transmission even in the current SSDT scheme [5]. Capacity gains of up to 50% are achievable for the downlink [6]. As SSDT gain is sensitive to the power offset value between DPCCH and DPDCH, it has been shown that SSDT retains acceptable gain by a careful choice of this power offset value[7].

Furthermore, it has been shown through simulations [8,9] that simultaneous use of SSDT and Tx Diversity (both open as well as closed loop modes) further enhances downlink capacity significantly.

7. Impacts of making SSDT optional in UE or removing SSDT from Rel99/Rel4.

If RAN1 decides to make SSDT optional for the UE, signalling would be required for UE capability so that network can distinguish UEs that support SSDT from those that do not support SSDT. This requires changes in UE signalling, which would not be acceptable.

The removal of SSDT feature will impact other layer 1 procedures: for example, PDSCH power control procedure. Therefore all impacts of the removal proposed in [1]needs to be clearly identified and carefully assessed before such a decision is made.

Furthermore, as R99 and Rel4 UEs will continue to operate in the system for many years to come, operators will not be able to reliably predict the downlink capacity when using SSDT in the later releases of 3G specs. Such an approach will undoubtedly dilute valuable and significant downlink capacity gain offered by SSDT.

8. Conclusion

The concerns raised in [1] are somewhat misplaced. The above shows that basic SSDT functionality is sufficiently well defined within the R99 and Rel4 specs. It offers significant capacity gains in the downlink. It is widely accepted that maximisation of downlink capacity is highly important in 3G systems. Omitting such a beneficial feature would only serve to sacrifice such capacity benefit without a clear justification. Alternatively, making the feature optional in UE will substantially reduce full realisation of valuable capacity gain offered by SSDT.

Therefore there is no clear reason to either omit SSDT from R99 and Rel4 specifications or to make it optional in the UE at this late stage. Moreover, the change which may be implied in the Layer 1 and Layer 3 procedures if SSDT is made optional in UE or removed would not be acceptable.

Therefore, we propose to retain the SSDT functionality in R99 and Rel4 as already specified.

References

[1] R1-01-1256, “SSDT”, Ericsson, QUALCOMM

[2] R1-01-1315, “Discussion on the contribution from Ericsson and Qualcomm regarding SSDT”, NEC, Fujitsu

[3] RP-01-0733, “RAN WG1 chairman’s report to TSG RAN#14”, Kyoto.

[4] R3-99-824, Approved Minutes of RAN3 meeting #5, 5-9 July 1999, Helsinki, Finland.

[5] R1-01-0275, “Enhancement of SSDT for Rel’5”, NEC

[6] TR25.922v4.1.0 “Radio Resource Management Strategies”

[7] R1-01-1303, “SSDT and downlink DPCCH Power Offset”, Fujitsu

[8] R1-99-790, “Ad-Hoc #6 Report to RAN WG1 meeting #6, 13-16 July 1999, Espoo, Finland.

[9] R1-99-A65, Approved Minutes of RAN WG1 meeting #6.