Agenda item:	**AH24**
Source:	**Lucent Technologies**
Title:	HSDPA Technical Report status and text proposals
Document for:	Discussion and decision

1. INTRODUCTION

The study item HSDPA (endorsed at RAN#9) proposes to study enhancements that can be applied to UTRA in order to provide very high speed downlink packet access. The study item sheet [1], as agreed at RAN#9, defines the scope of the study as including, but not limited to the following:

?? Adaptive modulation and coding schemes

?? Hybrid ARQ protocols

?? Position of the scheduling function within UTRAN

?? Other advanced techniques

RAN#9 agreed that the TR should be presented to RAN#10 for information and RAN#11 for approval.

An outline first draft of the proposed TR HSDPA has been discussed in WG2, but not yet in WG1. At WG1#15, several contributions were received and it was agreed that a separate TR will be produced by WG1, as WG2 does not have time or expertise to work on physical layer aspects. It was agreed that work on the TR will start under WG1 beginning with agreement on simulation parameters, followed by agreement on suitable technologies for UTRA enhancement.

Hitherto, only limited simulation results have been presented in WG1.

Operation with AMC / higher order modulation schemes brings significant practical implementation problems (eg. increased complexity channel estimation, reduced Eb/No performance). Therefore, it is necessary to seek techniques which mitigate against these problems.

In WG1#15, multiple antenna based solutions for HSDPA were considered [2] and it was agreed that further results would be presented at WG1#16.

Practical issues are further discussed in [3]. Detailed simulation results are presented in [4], [5], showing promising performance gains.

2. MULTIPLE ANTENNA CODE RE-USE TECHNIQUE FOR HSDPA

Code re-use using multiple antennas has been introduced in [2] and is recapitulated here.

Figure 1 shows the downlink physical layer block diagram for implementing code re-use with HSDPA. The data source is demultiplexed into *M* data streams (*M* is the number of transmit antennas), and each stream is separately encoded, rate matched, interleaved, and mapped to a complex data symbol. Each stream is further demultiplexed for multi-code spreading, added, and scrambled with a pseudonoise (PN) code. The same set of multi-codes is used for each stream.

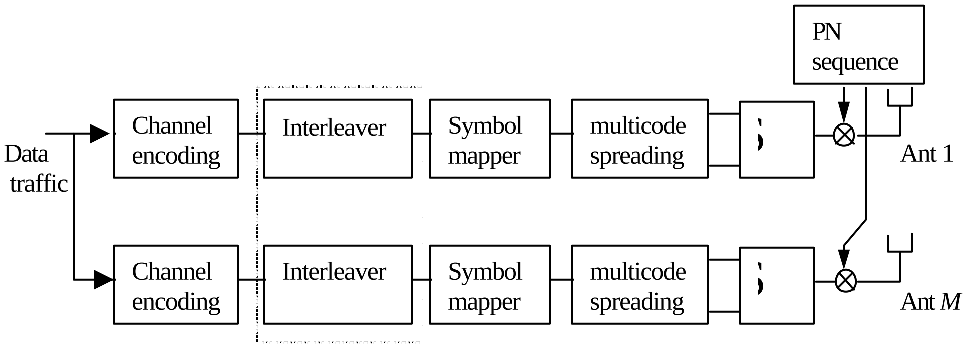

Figure 1. Multiple antenna transmitter for downlink shared channel.

3. TEXT PROPOSAL

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6 Overview of Technologies considered for HS-DSCH to support UTRA High Speed Downlink Packet Access

6.1 Adaptive Modulation and Coding

6.2 Hybrid ARQ (H-ARQ)

6.3 Fast Cell Selection (FCS)

6.4 Multiple Antenna Diversity

Diversity techniques based on the use of multiple downlink transmit antennas are well known; second order applications of these have been applied in the UTRA Release 3 specifications. Such techniques exploit spatial and/or polarisation decorrelations over multiple channels to achieve coherent antenna combining and fading diversity gains. Multiple link decorrelation can be exploited further still using multiple antennas and code re-use.

Multiple antennas provide at least three advantages over conventional HSDPA. First, using multiple receive antennas, the gain from coherent antenna combining reduces the required power for achieving a given rate. Alternatively, one can achieve higher rates using the same power, resulting in a higher overall cell throughput. Second, if multiple antennas are available at both the transmitter and receiver so that code re-use can be applied, additional schemes can be defined that have throughputs larger than the highest rate scheme currently defined for HSDPA without going to higher order constellations. In principle, the maximum achievable data rate with code re-use is *M* times the rate achievable with a single transmit antenna (where

M is the number of transmit antennas). Higher peak throughputs imply not only better average throughputs but also better throughput-delay characteristics. Third, with code re-use, some intermediate data rates can be achieved with a combination of code re-use and small data constellations. Compared to the single antenna transmission scheme with a larger constellation to achieve the same rate, the code re-use technique can have a smaller required Eb/No, resulting in overall improved system performance.

7 Adaptive Modulation and Coding Schemes (AMCS)

8 Hybrid ARQ

9 Associated signaling needed for HS-DSCH operation for High Speed Downlink Packet Access

10 Fast Cell Selection

11 Multiple Antenna Diversity

11.1 Technical Details

11.2 Evaluation of different configurations

11.3 Conclusions and Recommendations

12 Impacts on Interfaces

13 System Simulation Criteria

14 System Simulation Results

15 UE and RNS Impacts

16 Recommendations

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4. REFERENCES

[1] ftp://ftp.3gpp.org/TSG_RAN/TSG_RAN/Work_Item_sheets/

[2] Lucent Technologies. Enhancements for HSDPA using multiple antennas; R1-001057 & R1-001096, 22-26th August 2000, Berlin, Germany.

[3] Lucent Technologies. Practical aspects of multiple antenna architectures for HSDPA; R1-001219, 10-13th October 2000, Pusan, Korea.

[4] Lucent Technologies. Preliminary link level results for HSDPA using multiple antennas (PPT presentation); R1-001217, 10-13th October 2000, Pusan, Korea.

[5] Lucent Technologies. Preliminary link level results for HSDPA using multiple antennas (paper); R1-001218, 10-13th October 2000, Pusan, Korea.