3GPP TSG-RAN #13 **RP-010643**
Beijing, China. September 18-21, 2001.

Agenda item: 9.7

Source: RAN WG2

Title: Proposed Text for new TS [25.308]: UTRA High Speed Downlink Packet Access: Overall Description; Stage 2

Document for: Approval

It is proposed that a new specification [TS 25.308] be created and replace TR 25.855. The attached document is the proposed new TS, and is based on TR 25.855 with some modifications to conform to a TS format (list of changes is provided below for information).

It is proposed that RAN Plenary approve this document as version 5.0.0.

It is also proposed that once approved, this new [TS 25.308] without its annexes be submitted to ITU-R WP 8F as the 3GPP submission on HSDPA.

Description of differences with TR 25.855

The following modifications have been made with respect to the approved TR 25.855 and these modifications have been approved by RAN WG2 via email reflector for purposes of creating a specification more suitable for submission to the ITU-R WP 8F and for consistency with agreements reached late in the RAN WG1 meeting in Turin.

Non-editorial Modifications to TR 25.855 v 1.2.0:

- Removal of coding rate and rate matching parameters from 5.3 (Transport Channel Attributes) based on agreement in RAN WG1.
- Moved 64QAM as an optional modulation based on UE capability to the Annex since the issue is under consideration by RAN WG1.
- Modified description of what the HI (HS-DSCH Indicator) is in order to be consistent with the status in RAN WG1. New description leaves issue open for further consideration in RAN WG1.

Editorial Modifications to TR 25.855 v1.2.0:

- Moved Tables in the Signalling Requirements subclause to the informative Annex
- Moved Notes on modelling of the MAC-hs in the UE and UTRAN to the Annex
- Moved Evaluation criteria and Open Issues to Annex
- Moved other open issues under consideration to Annex D

3GPP TS [25.308] V0.1.0 (2001-09)

Technical Specification

3rd Generation Partnership Project; Technical Specification Group Radio Access Network; UTRA High Speed Downlink Packet Access; Overall Description; Stage 2 (Release 5)

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Contents

Foreword

This Technical Specification has been produced by the 3rd Generation Partnership Project (3GPP).

The contents of the present document are subject to continuing work within the TSG and may change following formal TSG approval. Should the TSG modify the contents of the present document, it will be re-released by the TSG with an identifying change of release date and an increase in version number as follows:

Version x.y.z

where:

x the first digit:

1 presented to TSG for information;

2 presented to TSG for approval;

3 or greater indicates TSG approved document under change control.

y the second digit is incremented for all changes of substance, i.e. technical enhancements, corrections, updates, etc.

z the third digit is incremented when editorial only changes have been incorporated in the document.

1 Scope

The present document is a technical specification of the overall support of High Speed Downlink Packet Access in UTRA.

2 References

The following documents contain provisions which, through reference in this text, constitute provisions of the present document.

- References are either specific (identified by date of publication, edition number, version number, etc.) or non-specific.
- For a specific reference, subsequent revisions do not apply.
- For a non-specific reference, the latest version applies. In the case of a reference to a 3GPP document (including a GSM document), a non-specific reference implicitly refers to the latest version of that document *in the same Release as the present document*.

[1] 3GPP TR 25.855: "UTRA High Speed Downlink Packet Access: Overall Description".

3 Definitions and abbreviations

3.1 Definitions

For the purposes of the present document, the following terms and definitions apply.

Data block: The data transmitted to one UE on HS-DSCH in one TTI.

Priority class: One flow of data within a HS-DSCH transport channel. One HS-DSCH can transport several priority classes (only one priority class per TTI)

HARQ Process: Peer state machines capable of achieving error correction by retransmission. One process can be used only for one data block at a time.

HARQ Entity: Consists of all the HARQ processes of a UE, controlling all the available soft buffer capacity.

3.2 Abbreviations

For the purposes of the present document, the following abbreviations apply:

HSDPA	High Speed Downlink Packet Access
MCS	Modulation and Coding scheme
NW	Network
TFRI	Transport Format and Resource Indicator
TSN	Transmission Sequence Number

4 Background and Introduction

High Speed Downlink Packet Access is based on techniques such as adaptive modulation and hybrid ARQ to achieve high throughput, reduce delay and achieve high peak rates.

It relies on a new transport channel, the HS-DSCH, which is terminated in the Node B in the UTRAN.

5 Basic structure of HS-DSCH

5.1 Protocol structure

The HSDPA functionality should be able to operate in an environment where certain cells are not updated with HSDPA functionality. The PDCP, RLC and MAC-d layers are unchanged from the Release '99 and Release 4 architecture.

RLC can operate in either AM or UM mode (but not in TM mode due to ciphering).

PDCP can be configured to either perform or not perform header compression.

MAC-d is retained in the S-RNC. Transport channel type switching is therefore feasible.

The new functionality of hybrid ARQ and HSDPA scheduling are included in the MAC layer. In the UTRAN these functions are included in a new entity called MAC-hs terminated in Node B. The transport channel that the HSDPA functionality will use is called HS-DSCH (High Speed Downlink Shared Channel) and is controlled by the MAC-hs.

Figure 1 shows the radio interface protocol architecture with termination points. MAC-hs in Node B is located below MAC-c/sh in CRNC. MAC-c/sh shall provide functions to HSDPA already included for DSCH in Release '99. The HS-DSCH FP (frame protocol) will handle the data transport from SRNC to CRNC (if the Iur interface is involved) and between CRNC and the Node B.

The architecture supports both FDD and TDD modes of operation, though in the case of TDD, some details of the associated signalling for HS-DSCH are different.

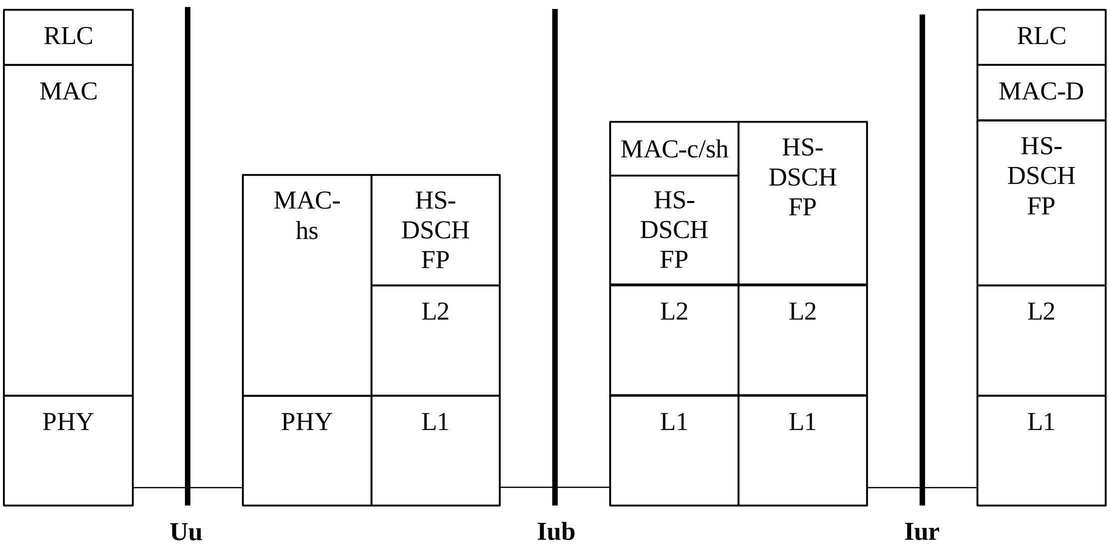


Figure 1: Radio Interface Protocol Architecture of HSDPA

5.2 Basic physical structure

5.2.1 HS-DSCH Characteristics

The HS-DSCH transport channel has the following characteristics:

- An HS-DSCH transport channel is processed and decoded from one CCTrCH;
- There is only one CCTrCH of HS-DSCH type per UE;
- The CCTrCH can be mapped to one or several physical channels;
- There may be multiple HS-DSCH per CCTrCH;

- If there are more than one HS-DSCH transport channels in a HS-DSCH CCTrCH, the transport format combinations are configured in such a way that for any transport format combination, there is a maximum of one transport channel having a transport format with one or more transport blocks;
- One HS-DSCH shall support one PDU size;
- Existence in downlink only;
- Possibility to use beam forming;
- Possibility of applying link adaptation techniques other than power control;
- Possibility to be broadcast in the entire cell;
- Always associated with a DPCH and one or more shared physical control channels.

As in Release '99 it shall be possible to map certain logical channels to DCH and HS-DSCH simultaneously.

5.2.2 DL HSDPA Physical layer model

5.2.2.1 FDD Downlink Physical layer Model

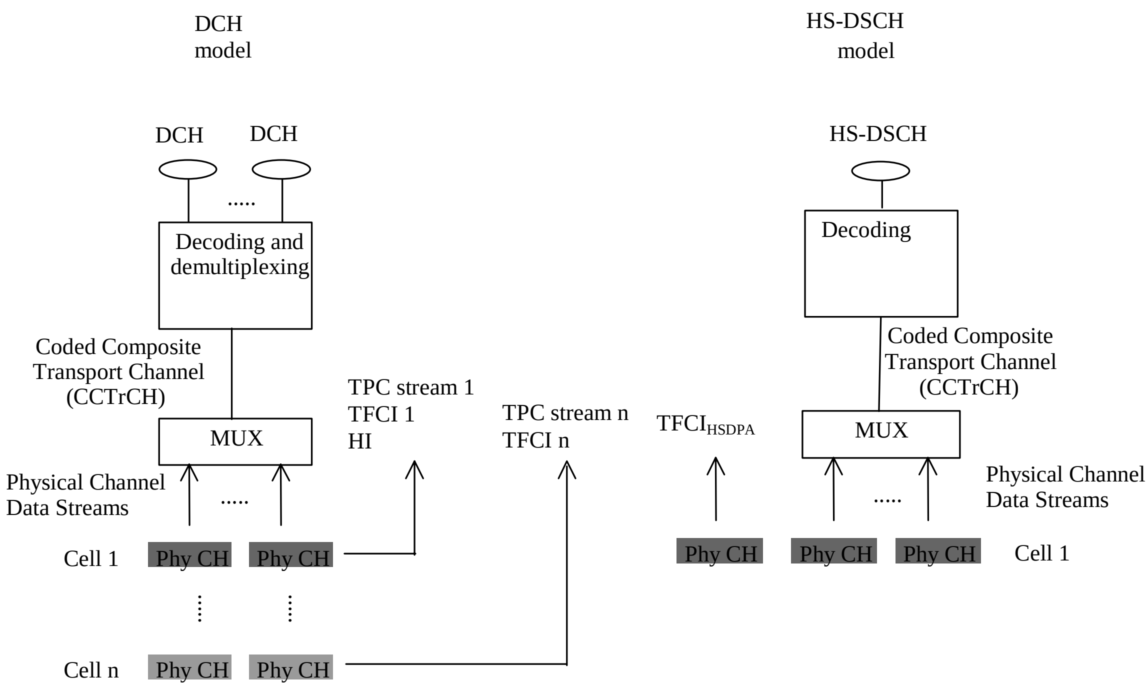


Figure 2: Model of the UE's Downlink physical layer - HS-PDSCH with associated DPCH. HS-PDSCH is transmitted from cell 1 in this figure.

The basic downlink channel configuration consists of an associated DPCH combined with a number of separate shared physical control channels in combination with the HS-PDSCH. The maximum number of shared control channels that a single UE needs to receive is four. The UTRAN may configure more than four shared control channels, but the UE needs to be provided at HS-DSCH configuration, which set of four shared control channels it needs to monitor.

A two-step signalling approach is used for indicating which UE has been scheduled and signalling the necessary information for the UE to decode the HS-PDSCH.

The associated DPCH carries a HI (HS-DSCH Indicator). The information provided by the HI is under consideration. In order to support the scenario wherein a UE may be in soft handover on the DPCH between a HSDPA supporting cell and a Release '99/Release 4 cell, the Release '99/Release 4 Node B does not need to support new slot formats other than that needed for Release '99/Release 4 DPCH operation only.

The upper layer signalling on the DCCH can be mapped to the associated DPCH or the HS-DSCH, as in the case of Release '99.

For each HS-DSCH TTI, each shared control channel carries HS-DSCH-related downlink signalling for one UE. The following information is carried on the shared control channel:

- Transport Format and Resource Indicator (TFRI)
  The TFRI includes information about the dynamic part of the HS-DSCH transport format, including transport block set size and modulation scheme. The TFRI also includes information about the set of physical channels (channelisation codes) onto which HS-DSCH is mapped in the corresponding HS-DSCH TTI.

- Hybrid-ARQ-related Information (HARQ information)
  This includes the HARQ protocol related information for the corresponding HS-DSCH TTI (subclause 7.1.2.1) and information about the redundancy version.

The shared control channel carries a UE identity that identifies the UE for which it is carrying the information necessary for decoding the HS-PDSCH.

The time offset between the start of the DL DPCH slot carrying the HI and the start of the shared control channel information can vary in the interval [0, T_{slot}] depending on the timing of the downlink DPCH, where T_{slot} equals approximately 0.67ms. There is a fixed time offset between the start of the shared control channel information and the start of the corresponding HS-DSCH TTI.

5.2.2.2 TDD Downlink Physical layer model

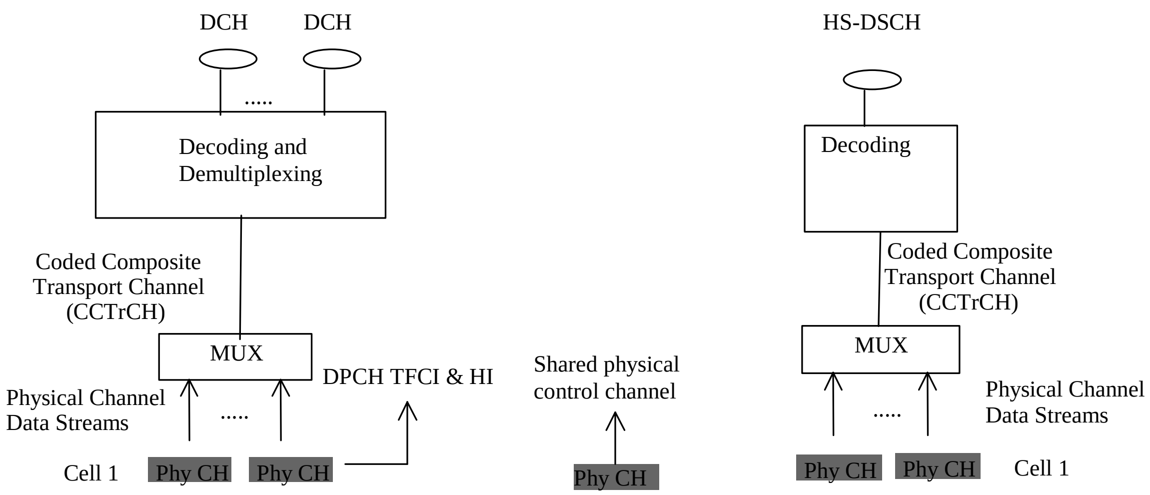


Figure 3: Model of the UE's physical layer (TDD)

The TDD overall downlink signalling structure is a two-step approach based on associated dedicated physical channels and shared physical control channels. The downlink signalling information for support of HS-DSCH is carried by a shared control channel. The HS-DSCH indicator (HI) on the associated dedicated physical channel provides information to the UE about the need to read the shared control channel. There may be multiple shared control channels in which case the HI also indicates which of the shared control channels (of a maximum of four that it monitors) the UE is to read.

As in Release '99, the associated dedicated physical channel can also be a fractionated channel for efficient resource usage with a corresponding repetition period in terms of TTIs. The associated dedicated physical channel carries HI (HS-DSCH Indicator). This HI indicates, that the UE has to read the shared control channels of the same TTI. If the repetition period is larger than one, the UE has to read in addition the shared control channels of the following TTIs for the whole repetition period to provide full scheduling flexibility. For continuous dedicated physical channels, the repetition period is consequently set to one TTI. The HI has to be sent in parallel or prior to the shared control channels.

5.2.3 UL HSDPA Physical layer model

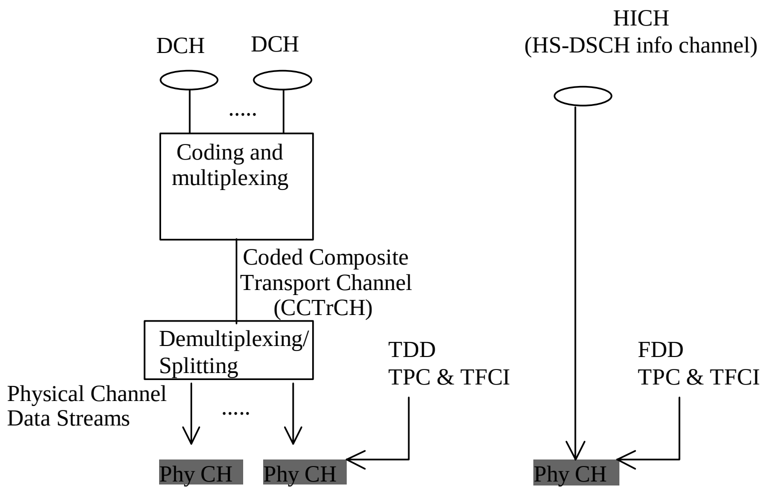


Figure 4: Model of the UE's Uplink physical layer

In FDD, the uplink signalling uses an additional DPCCH with SF=256 that is code multiplexed with the existing dedicated uplink physical channels.

In TDD, the UE shall use a shared uplink resource for transmitting ACK/NACK information. The relation between the shared control channel in DL and shared UL resource can be pre-defined and is not signalled dynamically on the shared control channel.

5.2.4 HSDPA physical-layer structure in the code domain

5.2.4.1 FDD

HS-DSCH relies on channelisation codes at a fixed spreading factor, SF=16. A UE may be assigned multiple channelisation codes in the same TTI, depending on its UE capability. Furthermore, multiplexing of multiple UEs in the code domain within a HS-DSCH TTI is allowed.

5.2.4.2 TDD

HS-DSCH relies on one or more channelisation codes with SF 16. Transmission on one or more timeslots is also allowed. Furthermore, a combination of code multiplexing and time multiplexing by timeslot within a HS-DSCH TTI is allowed.

5.3 Transport channel Attributes

The following is a list of HS-DSCH transport channel attributes:

1. Transport block size - semi-static.
2. Transport block set size - dynamic for 1st transmission. An identical transport block set size shall be applied for retransmission. There shall be no support for blind transport format detection.
3. Transmission Time Interval (TTI). For FDD the HS-DSCH TTI is fixed and equal to 2ms. The HS-DSCH TTI for 3.84 Mcps TDD is under consideration. For 1.28 Mcps TDD a fixed 5ms TTI shall apply.
4. Coding parameters:
   - Type of error protection: turbo code rate 1/3.

5. Modulation - dynamic for first transmission and retransmission. There shall be mandatory support for QPSK and 16QAM.

6. Redundancy version - dynamic.

7. CRC size - fixed size of 24 bits. There is one CRC per TTI, i.e. one CRC per TB set.

6 MAC Architecture

6.1 HSDPA MAC architecture– UE side

This subclause describes the architecture of the MAC and functional split required to support HSDPA on the UE side.

6.1.1 Overall architecture

Figure 5 shows the overall MAC architecture. In case of HSDPA the data received on HS-DSCH is mapped to the MAC-c/sh. The MAC-hs is configured via the MAC Control SAP by RRC similar to the MAC-c/sh and MAC-d, to set the parameters in the MAC-hs such as allowed transport format combinations for the HS-DSCH.

The associated Downlink Signalling carries information for support of HS-DSCH while the associated Uplink Signalling carries feedback information.

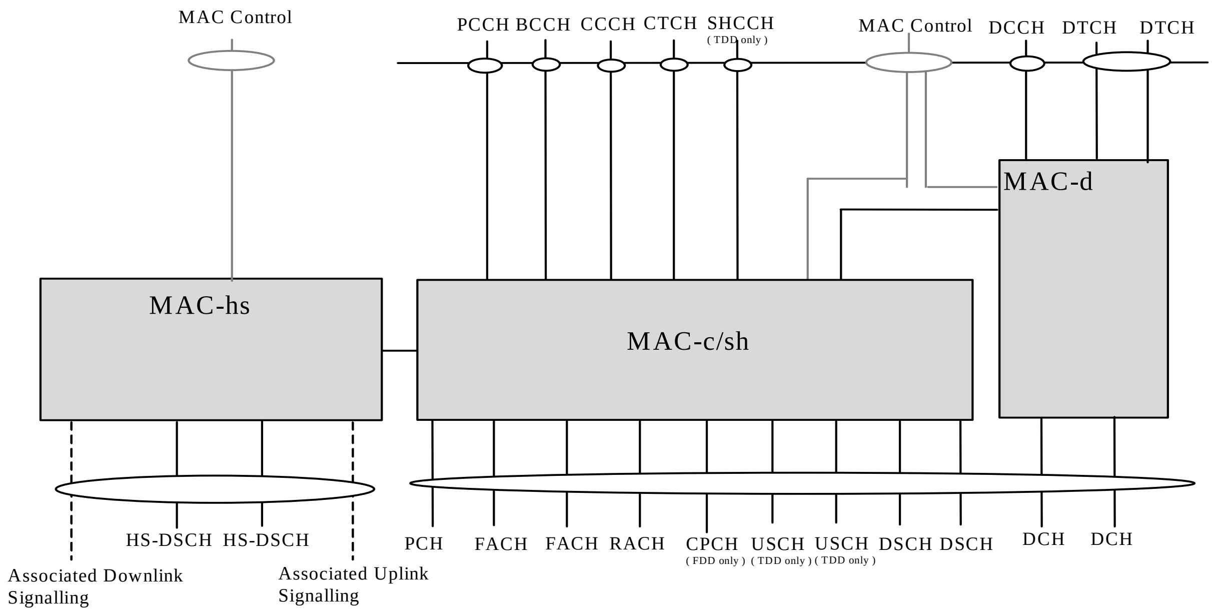
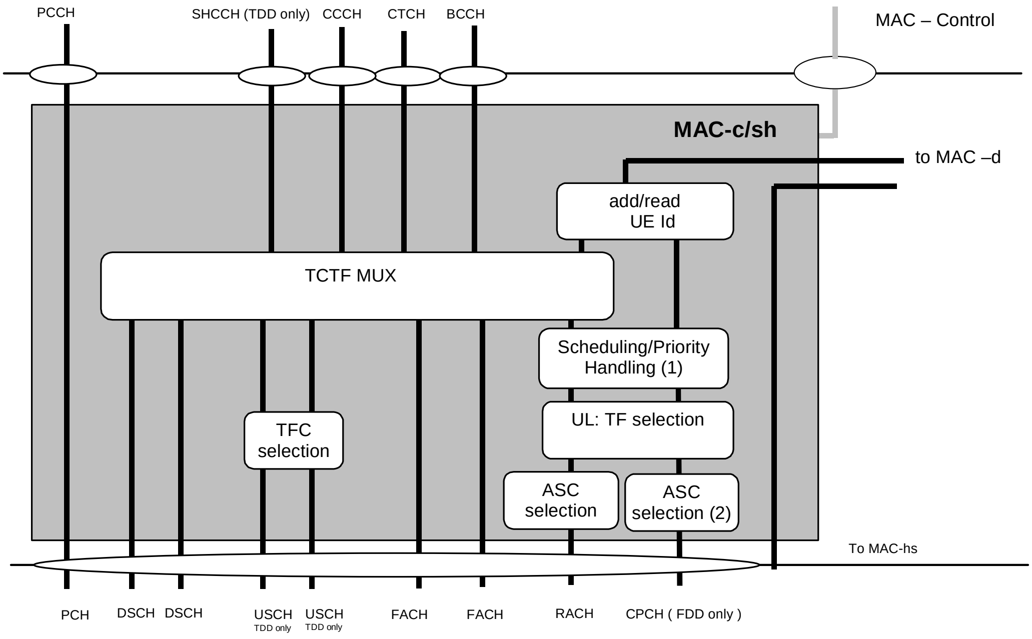


Figure 5: UE side MAC architecture with HSDPA

6.1.2 Details of MAC-c/sh

The MAC-c/sh on the UE side retains its functionality as defined in Release '99 with minor additions for HSDPA.



(1) Scheduling /Priority handling is applicable for CPCH
(2) In case of CPCH, ASC selection may be applicable for AP preamble.

Figure 6: UE side MAC architecture / MAC-c/sh details

6.1.3 Details of MAC-hs

The MAC-hs handles the HSDPA specific functions. In the model below the MAC-hs comprises the following entity:

- HARQ:
  The HARQ entity is responsible for handling the HARQ protocol. There shall be one HARQ process per HS-DSCH per TTI. The HARQ functional entity handles all the tasks that are required for hybrid ARQ. It is for example responsible for generating ACKs or NACKs. The detailed configuration of the hybrid ARQ protocol is provided by RRC over the MAC-Control SAP.

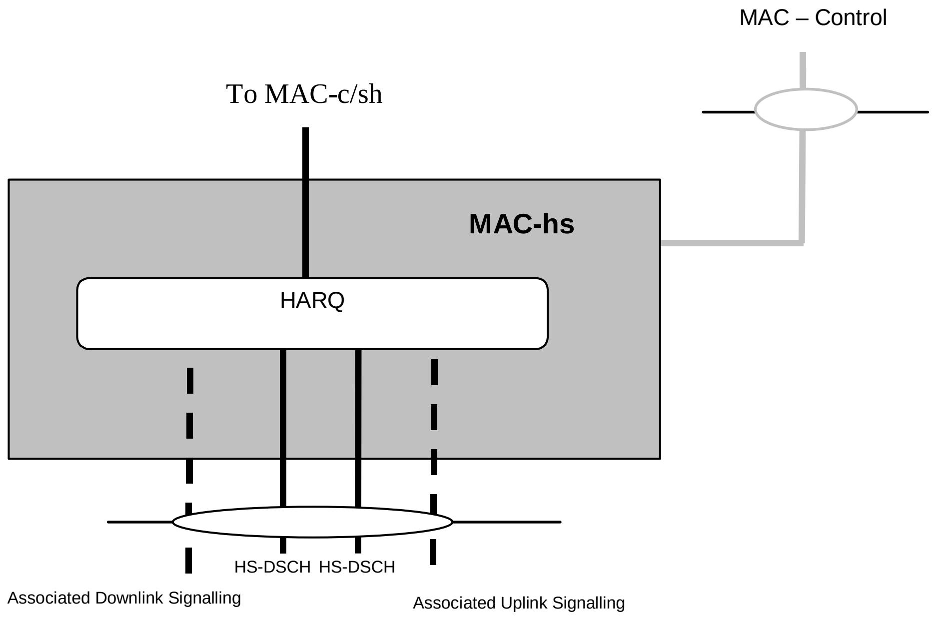


Figure 7: UE side MAC architecture / MAC-hs details

6.2 HSDPA MAC architecture – UTRAN side

This subclause describes the changes that are required to the MAC model to support the features for HSDPA on the UTRAN side.

6.2.1 Overall architecture

A new MAC functional entity, the MAC-hs, is added to the MAC architecture of Release '99. The MAC-hs is located in the Node B. If one or more HS-DSCHs are in operation the MAC-hs SDUs to be transmitted are transferred from MAC-c/sh to the MAC-hs via the Iub interface.

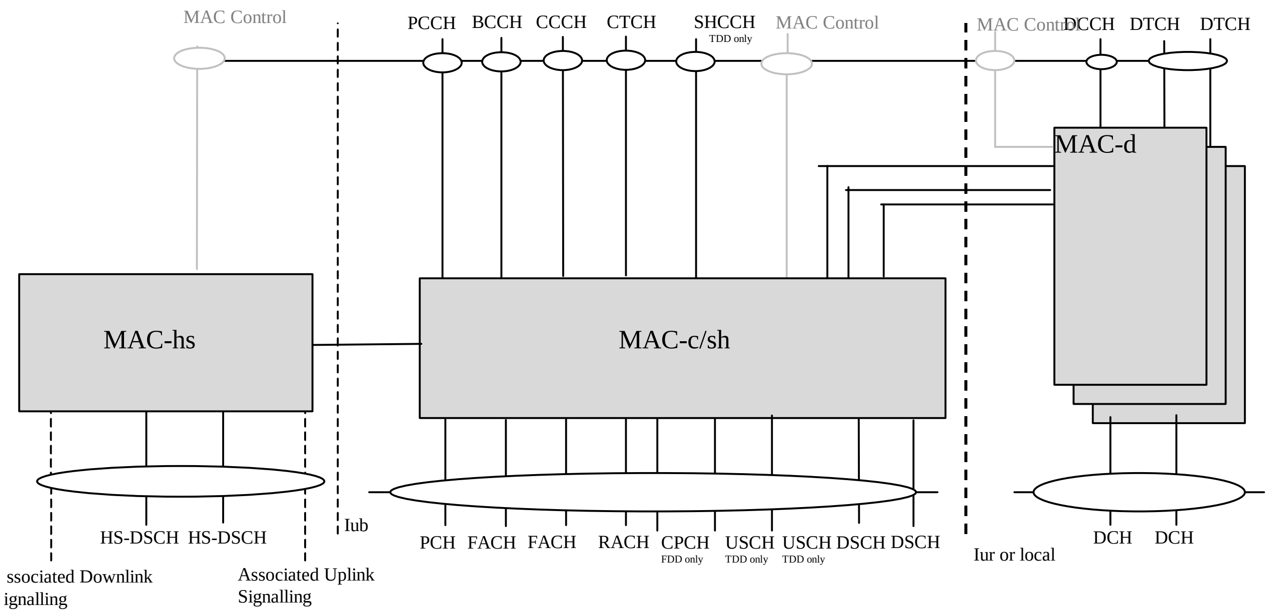


Figure 8: UTRAN side overall MAC architecture

6.2.2 Details of MAC-c/sh

The data for the HS-DSCH is subject to flow control between the serving and the drift RNC.

A new flow control function is included to support the data transfer between MAC-d and MAC-hs.

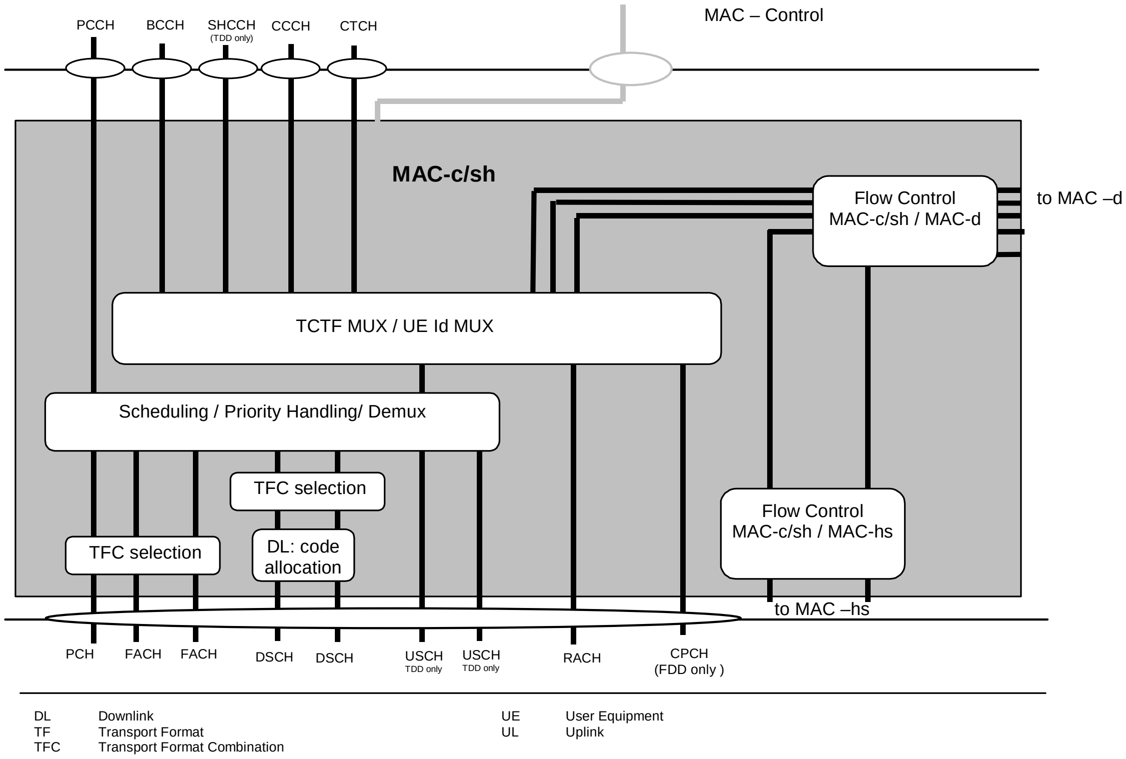


Figure 9: UTRAN side MAC architecture / MAC-c/sh details

6.2.3 Details of MAC-hs

The MAC-hs is responsible for handling the data transmitted on the HS-DSCH. Furthermore it is its responsibility to manage the physical resources allocated to HSDPA. MAC-hs receives configuration parameters from the RRC layer via the MAC-Control SAP. There shall be priority handling per MAC-d PDU in the MAC-hs. The MAC-hs is comprised of four different functional entities:

- Flow Control
  This is the companion flow control function to the flow control in the MAC-c/sh. Both entities together provide a controlled data flow between the MAC-c/sh and the MAC-hs taking the transmission capabilities of the air interface into account in a dynamic manner.

- HARQ
  One HARQ entity handles the hybrid ARQ functionality for one user. One HARQ entity is capable of supporting multiple instances (process) of stop and wait HARQ protocols. There shall be one HARQ process per HS-DSCH per TTI. Based on restrictions on the TFCS of the HS-DSCH CCTrCH, HARQ processes shall not operate in a simultaneous fashion in the transmitter. Details of the HARQ functionality require further study.

- Scheduling/Priority Handling
  Due to the restrictions in the physical layer combining process, it is not permitted to schedule new transmissions, including retransmissions originating in the RLC layer, within the same TTI, along with retransmissions originating from the HARQ layer.

- TFC selection
  Selection of an appropriate transport format combination for the data to be transmitted on HS-DSCH.

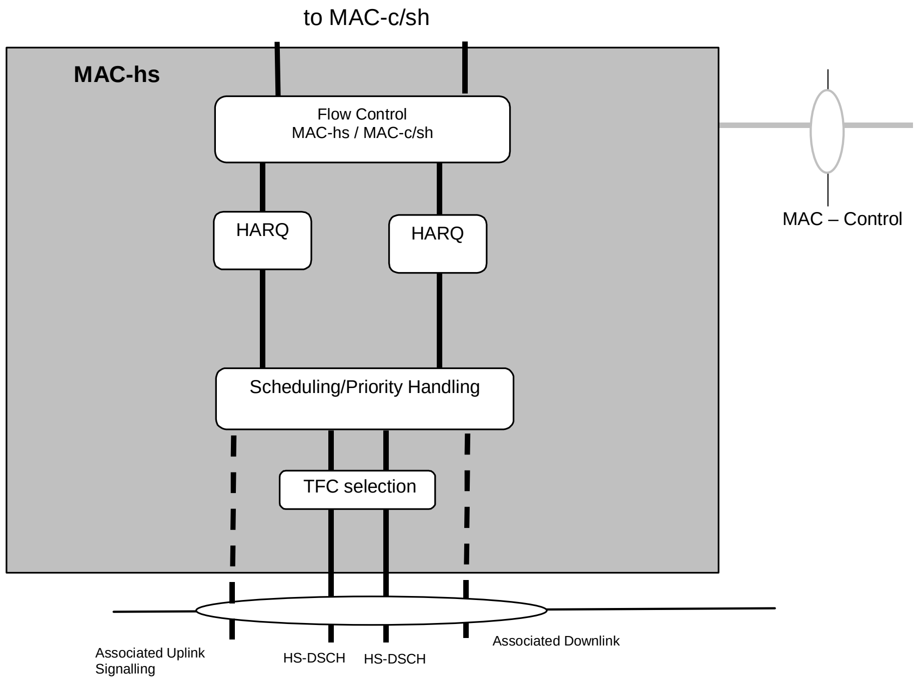


Figure 10: UTRAN side MAC architecture / MAC-hs details

7 HARQ Protocol

The HARQ protocol is based on an asynchronous downlink and synchronous uplink scheme. The ARQ combining scheme is based on Incremental redundancy. Chase Combining is considered to be a particular case of Incremental Redundancy. The UE soft memory capability shall be defined according to the needs for Chase combining. The UTRAN should take into account the UE soft memory capability when configuring the different transport formats (including possibly multiple redundancy versions for the same effective code rate) and when selecting transport formats for transmission and retransmission.

7.1 Signalling

7.1.1 Uplink

In the uplink, a report is used indicating either ACK (positive acknowledgement) or NACK (negative acknowledgement).

7.1.2 Downlink

7.1.2.1 Shared control channel

The following HARQ protocol parameters are carried on the shared control channel:

- HARQ process identifier
    - Every HARQ process is assigned an identifier, which is used to couple the processes in the transmitter and the receiver.
- New data indicator
    - It is used to distinguish between data blocks. It is specific to the HARQ process. It is incremented for each new data block.

7.1.2.2 In-band signalling on HS-DSCH

The following parameters are signalled in-band in the MAC-hs header to support in-sequence delivery and priority handling at the UE. These parameters are protected by the same CRC as the Data block.

- Priority class identifier
  - It is used to separate different priority classes in order to differentiate between logical channel priorities multiplexed in the same transport channel.
- Transmission sequence number
  - It is incremented for each new data block within a priority class. It is used for reordering to support in-sequence delivery.

7.2 Network operation

The following are the functions of the various functional entities at the network in support of the HARQ protocol.

7.2.1 Scheduler

The scheduler performs the following functions:

- Schedules all UEs within a cell;
- Services priority class queues:
  - The scheduler receives MAC-hs SDUs based on information from the Iub frame protocol;
- Determines the HARQ Entity and the queue to be serviced;
- Schedules new transmissions and retransmissions:
  - Based on the status reports from HARQ Processes the scheduler determines either new transmission or retransmission. A new transmission can be initiated also on a HARQ process at any time.

7.2.2 HARQ Entity (one per UE)

There is one HARQ entity per UE. It performs the following functions:

- Priority class identifier setting
  - It sets the priority class identifier based on priority class of the queue being serviced.
- Transmission sequence number setting
  - The TSN is incremented for each new data block within the same HS-DSCH and priority class. TSN is initiated at value 0.
- HARQ process identifier setting
  - The HARQ process to service the request is determined and the HARQ process identifier is set accordingly.

7.2.3 HARQ process

The following are the functions of the HARQ process:

- New Data Indicator setting
  - The New data indicator is incremented each time when there is new data for this HARQ process.
- Processes ACK / NACK from the receiver
  - The status report from the UE is passed to the scheduler.

7.3 UE Operation

The UE operation in support of the HARQ protocol is split among the following three functional units with their associated functions.

7.3.1 HARQ Entity

There is one HARQ entity at the UE performing the following function:

- Processes HARQ process identifiers
  - It allocates received data blocks to different HARQ processes based on the HARQ process identifiers.

7.3.2 HARQ process

The HARQ process at the UE performs the following functions:

- New Data Indicator processing
  - If the New Data Indicator has been incremented compared to the value in the previous transmission, if any, the data currently in the soft buffer can be replaced with the received data block.
  - If the New Data Indicator is identical to the value used in the previous transmission, the received data is combined with the data currently in the soft buffer.
- Error detection result processing
  - The physical layer decodes the data in the soft buffer and checks for errors.
  - If no error was detected, the decoded data is forwarded to the reordering entity and an ACK is generated.
  - If an error was detected a NACK is generated.
- Status report transmission
  - The status report is scheduled for transmission based on predetermined configuration.
- Priority class identifier processing.
  - Received data is arranged in queues based on priority class identifiers.

7.3.3 Reordering entity

There is one re-ordering entity for each priority class and transport channel configured at the UE. It performs the following functions:

- Reordering of received data based on transmission sequence numbers
  - A received data block is inserted to its appropriate position in the queue according to the TSN.
- Forwarding data to higher layer
  - If the received data block is the next to be delivered to higher layer, all data blocks with consecutive TSNs up to the first not received data block are delivered to higher layer.
  - A timer mechanism determines the delivery of non-consecutive data blocks to higher layer.

7.4 Error handling

The most frequent error cases to be handled are the following:

- NACK is detected as an ACK. The NW starts afresh with new data in the HARQ process. The data block is discarded in the NW and lost. Retransmission is left up to higher layers.

- ACK is detected as a NACK: If the network retransmits the data block, the UE will re-send an ACK to the network. If in this case the transmitter at the network sends an abort indicator by incrementing the New Packet Indicator, the receiver at the UE will continue to process the data block as in the normal case.
- [A threshold to detect lost status message is up to NW implementation. If detecting is possible, better performance is achieved by defaulting to a NACK.]
- If a CRC error on the shared control channel is detected, UE receives no data and sends no status report. If the absence of the status report is detected, NW can retransmit the block.

8 Signalling Parameters

8.1 Downlink Signalling Parameters

8.1.1 UE identification

This identifies the UE (or UEs) for which data is transmitted in the corresponding HS-DSCH TTI.

8.1.2 Transport Format

This defines what transport format is used in the corresponding HS-DSCH TTI.

8.1.3 Code channels in case of code multiplexing (FDD only)

This identifies to the UE (or UEs) the codes it (they) should receive and decode.

8.1.4 HS-DSCH physical channel configuration (TDD only)

This identifies to a UE (or UEs) the timeslots and codes it (they) should receive and decode. Additionally, which transport formats are applied on HS-DSCH is also signalled.

8.1.5 HARQ

Details of signalling parameters for the HARQ Protocol can be found in subclause 7.1.2.1. In addition, to support the Incremental Redundancy combining scheme, the Redundancy version is also signalled on the shared control channel.

8.1.6 Measurement feedback rate (FDD only)

This identifies the feedback rate for downlink quality measurement. This information may be sent at a much lower rate than the other parameters described in this subclause.

8.2 Uplink Signalling Parameters

8.2.1 ACK/NACK

This will be used by the HARQ protocol for indicating a successful/unsuccessful transmission on the HS-DSCH.

8.2.2 Measurement Report

This may be used in the choice of modulation and coding rate by the network. The transmission rate of the measurement report to the network can be configured by higher layer signalling. In TDD, measurement reports may be specifically requested in DL signalling, and downlink channel quality measurements may be reported for specifically requested timeslots.

9 Resource Management

For HSDPA, the resources shall be:

- Number of Codes;
- Power that can be allocated for the codes;
- Managed on a cell basis.

Annex A (informative): Evaluation Criteria

The following considerations should be taken into account in the evaluation of the different techniques proposed for HSDPA:

1. The focus shall be on the streaming, interactive and background services. It should be noted that it might not be possible to simultaneously optimise the performance of HSDPA for all of the above traffic classes.
2. System performance improvement shall be obtained with concomitant reduction in delay of service.
3. Priority shall be given to urban environments and then to indoor deployments. The techniques shall not be limited to these environments however.
4. The techniques accepted shall be optimised at speeds typical of urban environments but techniques should apply at other speeds also. Full mobility shall be supported, i.e., mobility should be supported for high-speed cases also, but optimisation should be for low-speed to medium-speed scenarios.
5. Features or group of features considered should demonstrate significant incremental gain.
6. Features accepted shall provide the benefit at reasonable cost to the operators. The value added per feature should be considered in the evaluation.
7. The techniques should be compatible with advanced antenna and receiver techniques.
8. The techniques should take into account the impact on Release '99 networks both from a protocol and hardware perspective.
9. The choice of techniques (such as HARQ) shall take into account UE processing time and memory requirements.
10. The UE complexity shall be minimised for a given level of system performance.
11. An evolutionary philosophy shall be adopted as opposed to a revolutionary one in adopting new techniques and architectures.

Annex B (informative): Signalling Parameters

B.1 Signalling Parameters under consideration

The following signalling parameters are under consideration.

B.1.1 Downlink Parameters

B.1.1.1 HS-DSCH power level

For FDD, this defines the relationship of HS-PDSCH and CPICH code power level while for TDD it defines the P-CCPCH to HS-DSCH power ratio.

B.1.1.2 Power offset for uplink control channel

The applicability of this parameter on the shared control channel is under consideration.

B.1.1.3 Request for Measurement Report (TDD only)

The need for the following signalling parameters is under consideration.

- HS UE-Id
  - Identifies UE that is informed about request for measurement report.
- Power offset for uplink shared control channel
- Request for DL channel quality measurement report on the uplink shared control channel
  - This parameter indicates which DL timeslots to measure.

B.1.1.4 Message Type (TDD only)

If several independent signalling messages exist in TDD, explicit identities are required.

Table B.1 is a template of the signalling parameters and the associated information to be considered in the evaluation of the downlink signalling parameters for HSDPA.

Table B.1: Parameters and range for consideration in signalling approach evaluation

Parameter		Before the HSDSCH data packet			Simultaneously with HSDSCH data packet		
		Min	Prop	Max	Min	Prop	Max
UE identification							
MCS							
HS-DSCH power level							
Code channels							
HARQ process identifier							
HARQ redundancy version							
New Data Indicator							
Power offset for uplink							
Measurement feedback rate							
UL Resource ID for HS-PUSCH (TDD)							
Resource Allocation Information for PUSCH (TDD)							
	HS UE-Id						
	UL Resource ID for PUSCH						
	Synchronisation shift (Low chip rate TDD)						
Resource Allocation Information for PUCCH (TDD)							
	HS UE-Id						
	UL Resource ID for PUCCH						
	UL Resource ID for PUCCH						
	Synchronisation shift (Low chip rate TDD)						
Total							

The current working assumption is a range of 10-20 bits for FDD for the various downlink signalling fields irrespective of the precise final list of parameters and their placement or splitting of the parameters across the various downlink signalling channels (i.e. dedicated control channel and shared control channel).

For TDD, Table B.2 and B.3 below captures the present status; details need to be verified by both RAN WG1 and RAN WG2 along with a comparison of the work on FDD.

Table B.2: Summary of downlink signalling for TDD Resource Allocation Information for HS-DSCH

TDD Resource Allocation Information for HS-DSCH:	Before the HSDSCH data packet			Simultaneously with HS-DSCH data packet		
	Min	Prop	Max	Min	Prop	Max
HI (on associated DPCH)	1	1	1			
UE identification	0	1.28 Mcps TDD: 6 3.84 Mcps TDD: 8	16			
Message Type	1	1.28 Mcps TDD: 1 3.84 Mcps TDD: 2	3			
MCS	2	3	3			
HS-DSCH physical channel configuration	0	1.28 Mcps TDD: 6+x 3.84 Mcps TDD: 20+x	1.28 Mcps TDD: 64 3.84 Mcps TDD: 96			
Power Offset for Uplink	0	1.28 Mcps TDD: 2 3.84 Mcps TDD: 3	1.28 Mcps TDD: 12 3.84 Mcps TDD: 12			
HARQ process number				0	2	2
HARQ redundancy version				0	2	2
HARQ packet number				0	6	12
Total (1.28 Mcps TDD)	4	19+x	99	0	10	16
Total (3.84 Mcps TDD)	3	37+x	131	0	10	16

NOTE: In the above table "x" denotes the number of additional bits that may be required in TDD that may be required for the HS-DSCH physical channel configuration information.

Table B.3: Summary of downlink signalling for TDD DL Channel Quality Measurement Request

TDD DL Channel Quality Measurement Request:						
	Min	Prop	Max			
HI (on associated DPCH)	1	1	1			
UE identification	0	1.28 Mcps TDD: 6 3.84 Mcps TDD: 8	16			
Message Type	1	1.28 Mcps TDD: 1 3.84 Mcps TDD: 2	3			
DL Channel Quality Measurement Request	0	1.28 Mcps TDD: 5 3.84 Mcps TDD: 12	1.28 Mcps TDD: 6 3.84 Mcps TDD: 14			
Power Offset for Uplink	0	1.28 Mcps TDD: 2 3.84 Mcps TDD: 3	1.28 Mcps TDD: 12 3.84 Mcps TDD: 12			
Total (1.28 Mcps TDD)	2	15	38			
Total (3.84 Mcps TDD)	2	26	46			

The need for the TDD DL Channel quality Measurement Request is under consideration.

Table B.4 contains the summary of the uplink signalling parameters for TDD.

Table B.4: Summary of parameters and suggested range for uplink signalling in TDD

UL Acknowledgement/Measurement Report			
Parameter			
	Min	Prop	Max
H-ARQ ack/nack	[1]	[1]	[y]
Downlink channel quality	[7]	[38]	[60]
Total Bits → (Note1)	[8]	[39]	[60 + y bits]

NOTE 1: UL signalling parameters are optional in individual UL acknowledgement/measurement reports.

NOTE 2: "y" in the above Table refers to the total bits that may be required due to additional information that may be transmitted on the uplink.

Annex C (informative): Open Issues

In order to aid the discussion regarding the introduction of HSDPA into UTRA a number of issues need to be carefully considered.

C.1 General Impacts

C.1.1 Mobility in HSDPA

C.1.1.1 Interaction between compressed mode and HSDPA

Compressed mode is used by UE in order to handover to an inter-frequency carrier. How is the scheduling handled between the compressed mode and the scheduler within the Node B for the HS-DSCH?

C.1.1.2 Speed and HSDPA

In order to assess the services that may be provided using HSDPA, an understanding is required for which user mobility speeds are best suited and applicable. Can HSDPA be used for user at 0 km/h, 3 km/h, 50km/h, 120km/h, 250km/h?

C.1.2 Interactions between RNC and Node B scheduler

C.1.2.1 Allocation of power to the HS-DSCH scheduler

What feedback is required in the RNC in order that the "outer loop" allocation of power for the "inner loop" HS-DSCH can be made in an efficient manner? How frequently can this be expected to change?

C.1.2.2 Impacts of high mobility and handovers in HSDPA

What feedback is required in the RNC and Node B in the case that not all packets that have been moved to a Node B can be delivered?

C.1.2.3 Admission/Load control between all RNC resources and channels

What interactions are envisaged in the case of load sharing between the RNC and standard DCH/DSCH users? How will the power budget be handled?

C.1.3 Uplink channel used for feedback

A clear definition is required of the uplink feedback information that is used in order to perform link adaptation.

C.1.4 Measurements

Which parameter measurements are made that can be used to perform the fast link adaptation? What type of accuracy can be expected for these channel condition measurements?

C.1.5 Others

The interaction of HSDPA with IPDL needs to be considered i.e. can both of them be operational simultaneously?

C.2 Network Infrastructure Impact

C.2.1 Impact of existing infrastructure hardware

C.2.1.1 Estimate the impact on the current interfaces due to the introduction of HSDPA.

In order to ensure interoperability between existing and future features, the issue of interoperability needs to be considered so that ubiquitous service may be provided. Further clarification is required of the handling of HS-DSCH traffic across the Iub FP.

C.2.1.2 Impact on the Node B hardware

What will be the overall impact on the Node B cell hardware? Is a new power amplifier required?

C.2.1.3 Impact on the RNC hardware

Does the introduction of HSDPA require substantial upgrades to existing Release '99 RNCs?

C.3 Impacts on User Equipment

C.3.1 Impact of existing User Equipment

C.3.1.1 Increase in UE memory/buffering

Given the potential high data rate transmissions, what is the impact in terms of UE memory/buffering.

C.3.1.2 Impact of receiving multiple codes

Is there a significant increase in the complexity of the UE hardware and processing required in order to be able to receive 20 simultaneous codes?

Annex D (normative): Issues under Consideration

D.1 Protocol Structure

The possibility to connect directly the HS-DSCH user plane of the SRNC and Node B using the transport network, i.e. by-pass the DRNC for the HS-DSCH user plane, is under consideration.

D.2 Modelling of MAC-hs at UE

It is under consideration whether a separate functional entity within MAC-hs needs to be added in order to model the handling of measurement results provided by physical layer, management of uplink resources (in case of TDD), etc., or whether these functions are described within HARQ functional entity.

D.3 Modelling of MAC-hs at UTRAN

It is under consideration whether a separate functional entity within MAC-hs needs to be added in order to model the handling of feedback information, modulation and coding rate selection, allocation of uplink resources (in case of TDD), provisioning of flow control information, etc., or whether these functions are described within the above-mentioned functional entities.

D.4 Modulation

It is under consideration whether there shall be optional support for 64QAM based on a UE capability.

D.5 UE Identity on HS-DSCH

The need for insertion of the UE Id within MAC-c/sh for the HS-DSCH is under consideration. The current working assumption is that there is sufficient reliability on the downlink signalling for the scheduling and thus the UE-Id is not required additionally on the HS-DSCH and its presence on the associated shared control channel is sufficient.

D.6 Transport Block Set size

Depending on the granularity of the TB set size a dummy MAC-hs PDU may need to be supported with a corresponding indication in the header.

D.7 Shared Control Channels

RAN WG2 needs to study the impacts on scheduling due to the limitation of maximum four shared control channels that a UE needs to monitor.

D.8 Measurements

It is under consideration what measurements need to be fed back to the UTRAN.

D.9 Resource Management

More precise management of power beyond that outlined in clause 9 is under consideration.

Annex E (informative): Change history

Document history		
Date	**Version**	**Comment**
September 10, 2001	0.1.0	Text based on v1.2.0 of TR 25.855
Rapporteur for 3GPP [TS 25.308] is: Ravi Kuchibhotla		
Email : Ravi.Kuchibhotla@motorola.com		
This document is written in Microsoft Word 2000.		

NOTE: The table above will be deleted when this TS is presented to the TSG-RAN plenary in version 2.0.0 and be replaced by the table below.

Change history							
Date	**TSG #**	**TSG Doc.**	**CR**	**Rev**	**Subject/Comment**	**Old**	**New**