HSDPA REVIEW AND PARAMETERS AFFECTING DATA THROUGHPUT

Presented by Alok Awasthi

HSDPA INTRODUCTION

- **HSDPA:** High Speed Down link Packet Access
- **Four New Channels** Introduced to support HSDPA (Released in Release 5 3GPP)
- Effective for High speed data downloads and Bursty Applications
- HSDPA increases data rate from **384 kbps to 14 Mbps**.
- HSDPA works using adaptive modulation

PERFORMANCE OF HSDPA COMPARED TO R99 DCH

- HSDPA offers multiple advantages over R99 DCH
  - Improved Air interface efficiency
  - Faster Download speeds for users
  - Improved Latency

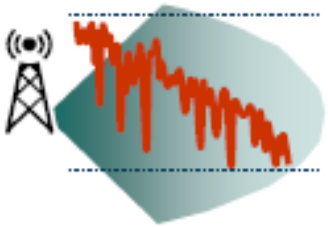
- HSDPA is a **shared resource**, and user data rates vary greatly according to the number of users in a cell

TECHNIQUES FOR HSDPA

Modulations: QPSK & 16 QAM to support high bit rates

Soft handover: only for Control channels

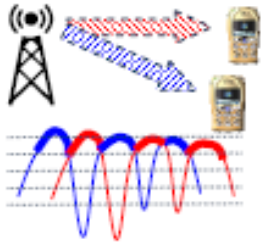
Shared Resources: Code & Power



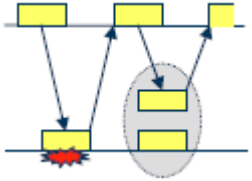
Link Adaption: Fast Link adaption Quality (CQI) based

Supports Multi code transmission

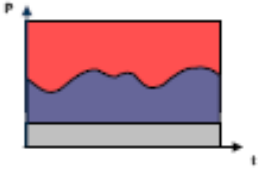
Short TTI (Transmit time Interval): 2ms



Scheduling: One to four users time sharing



HARQ: Fast Retransmission with soft combining



Dynamic Rate and Power Control: Dynamic switching

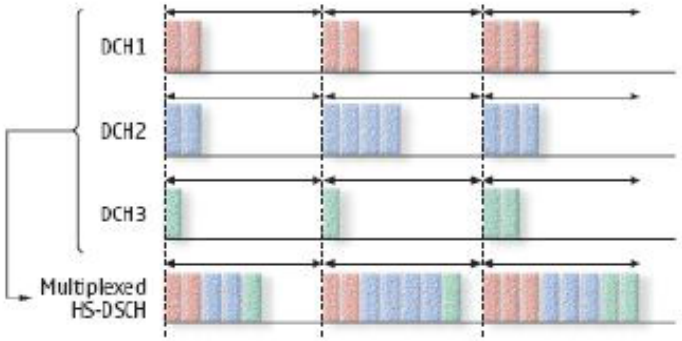
HSDPA DYNAMIC CODE ALLOCATION

- HSDPA Dynamic Code Allocation will maximize the number of HS-PDSCH codes that may be used by the HSDPA Scheduler
- The algorithm will periodically check whether there are available codes free in the code tree and if so, add it to the HS-DSCH allocation.
- If RBS base band hardware configuration limits the number of available HS-PDSCH codes, then more codes will be allocated to a sector with a higher number of active HS-DSCH users.
- The maximum number of codes that can be added is governed by the license level and parameter for maximum HSDPA user permissible
- The codes that are added by the dynamic code allocation algorithm will immediately be de-allocated from HS-DSCH if RNC request any of the codes for allocation of any other channel, e.g., DCH allocations.

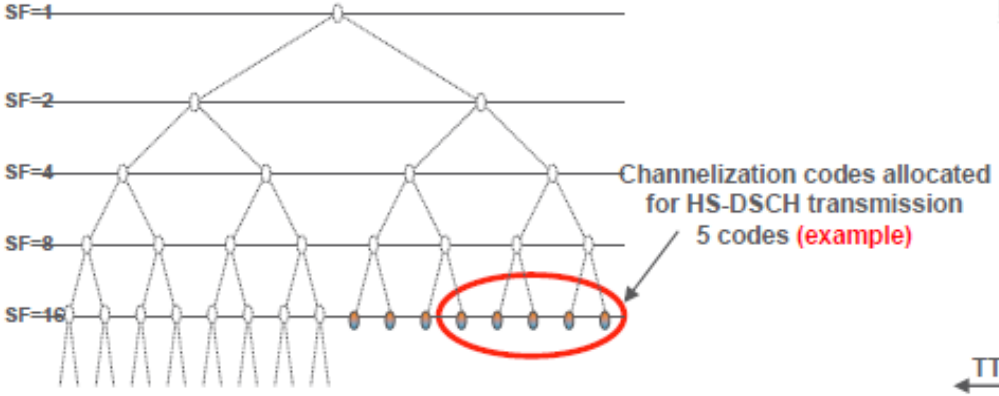
SHARED CHANNEL TRANSMISSION

- A set of radio resources dynamically shared among multiple users, primarily in the time domain hence better efficiency is achieved for code Utilization

- up to 15 codes (SF16) can be allocated and share on what the UE can support.



Shared channelization codes



UE CATEGORIES

- **12 Categories** of UE have been specified
- UE category is sent in the UE Capability message transmitted to RNC during call setup
- RNC & Node B restrict data, number of codes or air interface coding schemes depending on the UE Capability
- Due to processor limitations in some UE designs, processing of consecutive TTIs is not possible.

UE CATEGORIES

Category	Maximum number of supported HS-DSCH codes	Minimum inter-TTI interval	Number of soft values in terminal's hybrid ARQ buffer	L1 peak rate [Mbit/s]	Modulation schemes
Category 1	5	3	19,200	1.2	16QAM, QPSK
Category 2	5	3	28,800	1.2	16QAM, QPSK
Category 3	5	2	28,800	1.8	16QAM, QPSK
Category 4	5	2	38,400	1.8	16QAM, QPSK
Category 5	5	1	57,600	3.6	16QAM, QPSK
Category 6	5	1	67,200	3.6	16QAM, QPSK
Category 7	10	1	115,200	7.3	16QAM, QPSK
Category 8	10	1	134,400	7.3	16QAM, QPSK
Category 9	15	1	172,800	10.0	16QAM, QPSK
Category 10	15	1	172,800	14.0	16QAM, QPSK
Category 11	5	2	14,400	0.9	QPSK
Category 12	5	1	28,800	1.8	QPSK

ACHIEVABLE BIT RATE IN DIFFERENT UES

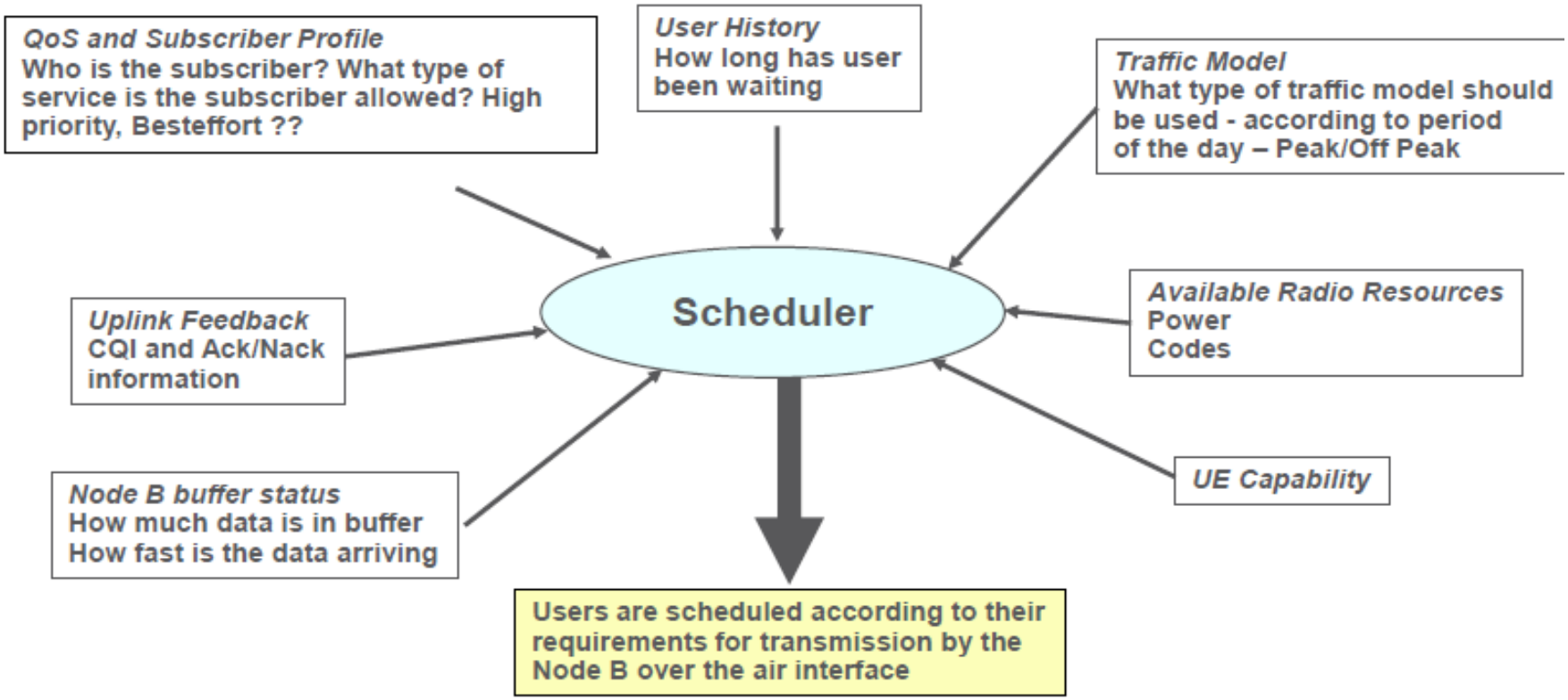
HS-DSCH category	Max bit rate with QPSK [Mbps]	Max bit rate with 16QAM [Mbps]
Category 1	0.64	1.12
Category 2	0.64	1.12
Category 3	0.96	1.68
Category 4	0.96	1.68
Category 5	1.92	3.36
Category 6	1.92	3.36
Category 7	3.84/3.84(1)	6.72/6.72(1)
Category 8	3.84/3.84(1)	6.72/6.72(1)
Category 9	6.56/6.72(1)	9.6/9.6(1)
Category 10	6.56/6.72(1)	11.2/13.44(1)
Category 11	0.8	-
Category 12	1.6	-

(1) Indicates the maximum data rate with 336/656 RLC PDU size

CQI – CHANNEL QUALITY INDICATOR

- UE sends CQI info in the UL to aid rate adaptation and scheduling
- CQI **(1-30)** provides the Node B with a measure of the UE's perceived channel quality and the UE receiver performance
- The CQI report estimates the number of bits that can be transmitted to the UE using a certain assumed power with a block error rate of 10%
- **The Node B uses reported CQI to calculate actually used CQI to decide the scheduling of data to a UE .The Used CQI is calculated according to CQi correction algorithm which takes into consideration the last series of ACKs or NACKs, UE capability, actual transmit power, amount of buffered data etc .**
- **An over estimation and under estimation of channel quality by UE can lead into inefficient scheduler functioning with low throughput or high block error rate**

SCHEDULERS

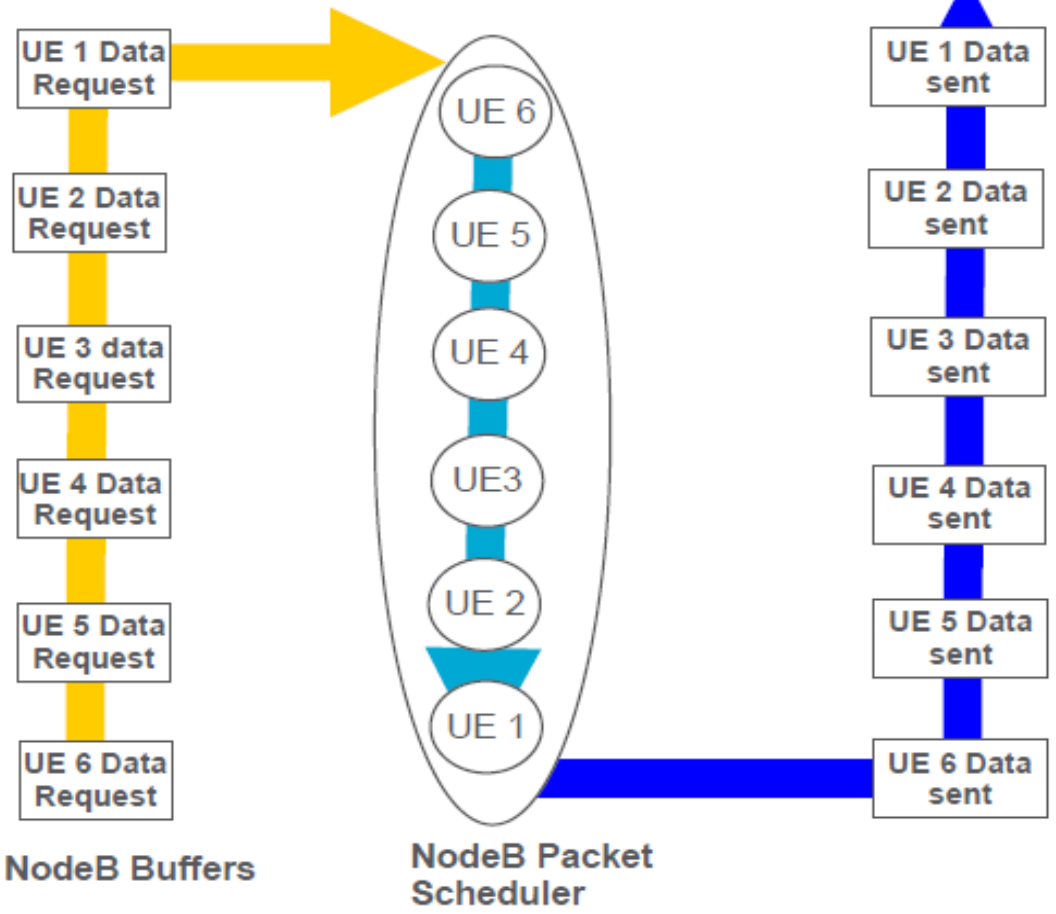

QoS and Subscriber Profile
Who is the subscriber? What type of service is the subscriber allowed? High priority, Besteffort ??
User History
How long has user been waiting
Traffic Model
What type of traffic model should be used - according to period of the day – Peak/Off Peak
Scheduler
Uplink Feedback
CQI and Ack/Nack information
Available Radio Resources
Power
Codes
Node B buffer status
How much data is in buffer
How fast is the data arriving
UE Capability
Users are scheduled according to their requirements for transmission by the Node B over the air interface

HSDPA SCHEDULER PROCEDURE

Following procedure is followed by a scheduler before next TTI

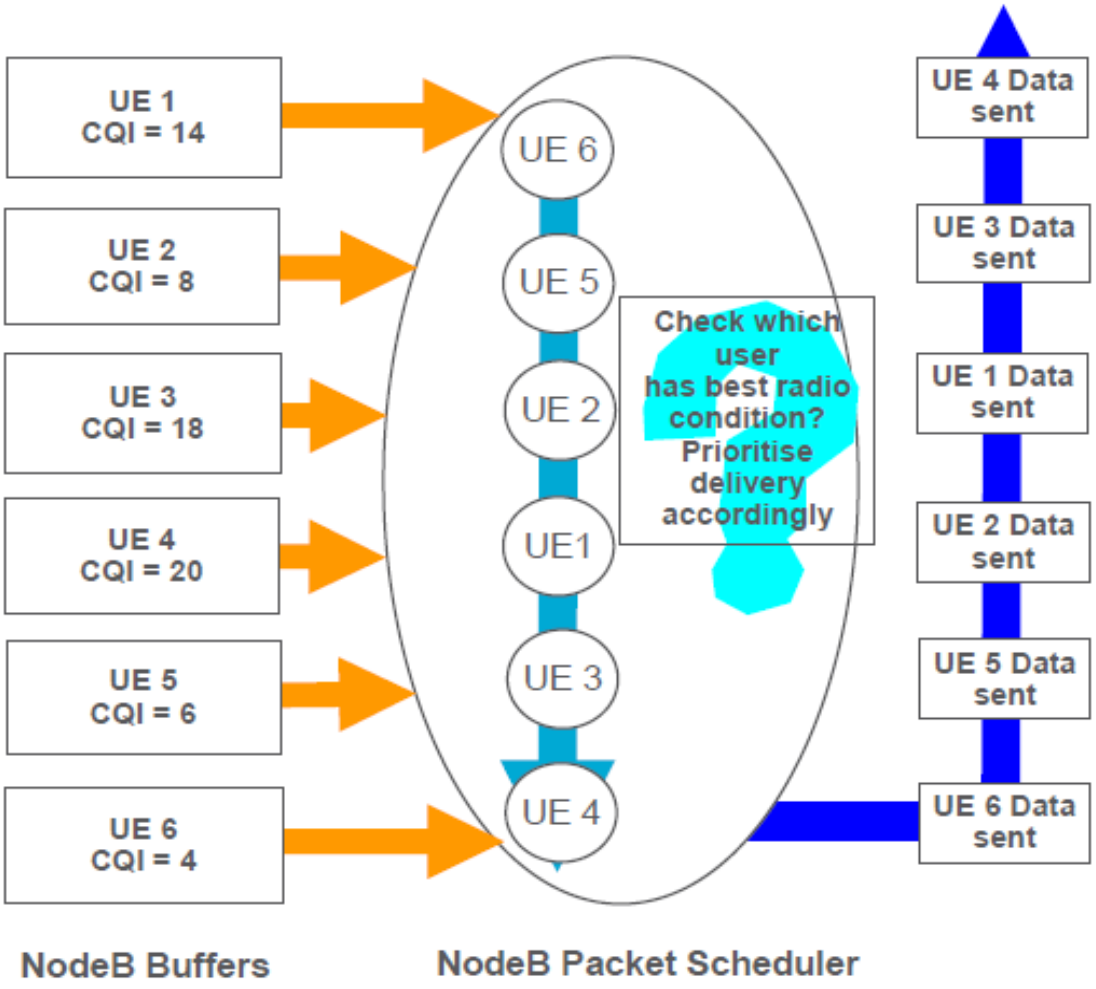
- **Resource Estimation:** Resource estimation measures the current power used by non-HS traffic and estimates the amount of power and codes available for HS-PDSCH.
- **Queue Validation:** Evaluates which users it is possible to transmit data to in the upcoming TTI, by regarding e.g. the radio quality and the UE capability
- **Resource Sharing:** Resource sharing decides how to allocate the available resource between different UEs
- **Queue Selection:** Queue selection finally selects the priority queues(requests) that will be allocated the HS-DSCH resource in the upcoming TTI, based on the result of the resource estimation, queue validation and other inputs, such as average rate and downlink radio quality.
- **Resource Check:** Remaining resource like Code Multiplexing checks are done again to check if additional users can be selected.

ROUND ROBIN SCHEDULER



- Simplest form of scheduler
- First in First out principle
- **Advantages:**
- Easy to implement
- Minimises waiting time Fair
- **Disadvantage:**
- System Throughput not Optimal

MAX CQI (BEST EFFORT)

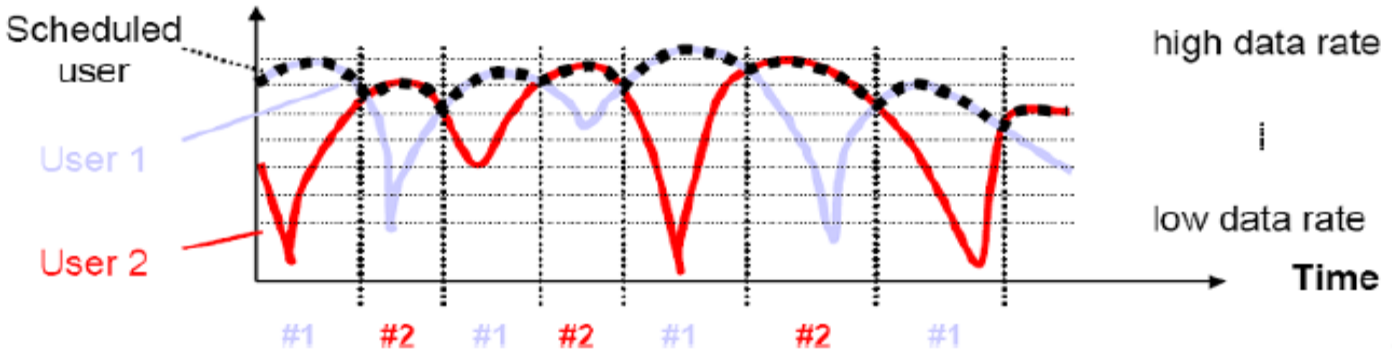


- Highest CQI (greatest throughput) user schedule first.
- Users with best radio conditions are given preference
- **Advantages:**
  - Easy to implement
  - Highest system throughput
- **Disadvantage:**
  - Due to bad CQI users may be starved of data

PROPORTIONAL FAIR SCHEDULER

Schedules users based on

- CQI
- Average throughput
- Retransmission (time between NACK reception and retransmission)
- Delay (time since last scheduled)



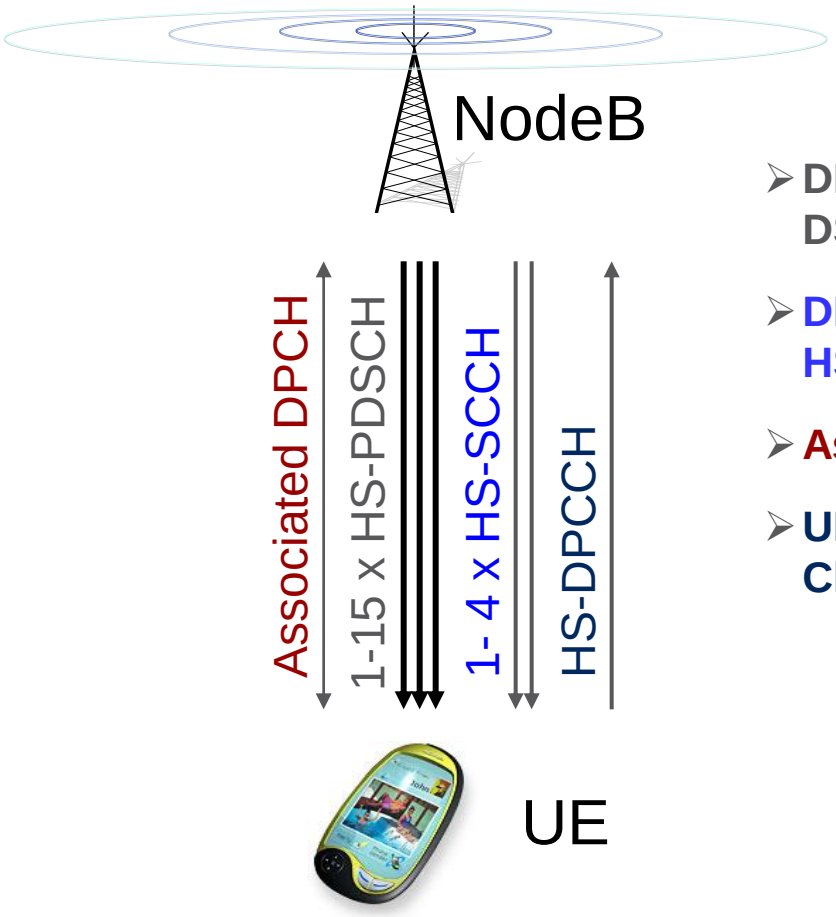
PROPORTIONAL FAIR SCHEDULER

- Provides improved system throughput over round robin by scheduling users when they are experiencing good radio conditions.
- Provides improved fairness over maximum CQI by considering average throughput and delay in the scheduling decision.
- The “fairness” of the algorithm can be adjusted using parameters.

HSDPA MOBILITY

- HS-DSCH and HS-SCCH (license based) do **not support soft/softer handover**
- **ADCH support soft/softer** handover (SRB and uplink DCH)
- HS connections perform a HS cell change through Physical Channel Reconfiguration Message.
- HS cell change performed only with cells in the Active Set and HSDPA enabled

CHANNELS IN HSDPA



- **DL: High-Speed Downlink Shared Channel – HS-DSCH**
- **DL: High-Speed Shared Control Channel(s) – HS-SCCH (SCHEDULING)**
- **Associated Dedicated Channel – A-DCH**
- **UL :HS Dedicated Physical Common Control Channel - HS-DPCCH (CQI, HARQ ACK/NACK)**

MORE ABOUT HSDPA CHANNELS

HS-DSCH: High-Speed Downlink Shared Channel is mapped to HS-PDSCH – High Speed Physical Downlink Shared Channel

- Carries user data in the Down Link
- 1 – 15 codes per channel
- Upto maximum of Four users can be multiplexed on a 2ms TTI
- Uses Spreading Factor 16
- Modulation used is QPSK or 16QAM
- No power control

HS-SCCH – High Speed Shared Control Channel is mapped to HS-PSCCH-High Speed Physical Control Channel

- Informs the UE of how and when to receive the HS-PDSCH in the Down link
- Uses Spreading Factor 128
- Can Have Dynamic Power control as per Measurement reports from the UE

MORE ABOUT HSDPA CHANNELS CONTD

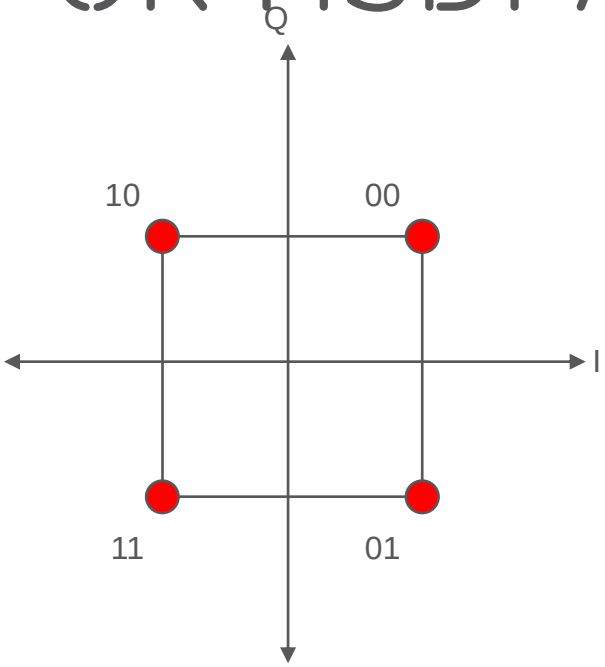
HS-DPCCH – High Speed Dedicated Physical Control Channel

- Active in Uplink
- Carries data Retransmission
- Used to report measured downlink channel Quality (CQI)
- Information on ACK/ACK and retransmission requests
- Power control relative to HS-SCCH
- Uses Spreading factor 256

A-DCH – Associated Dedicated Channel

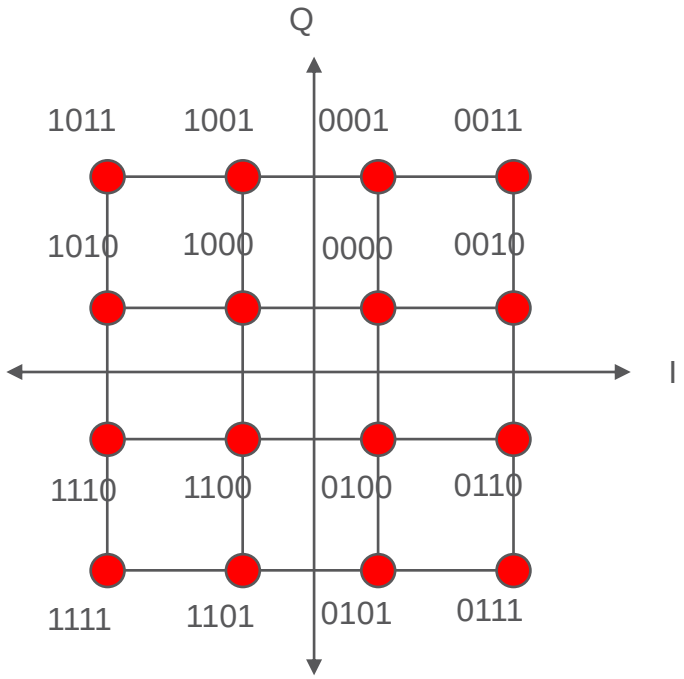
- One A-DCH is required per HSDPA user
- Carries signaling and uplink data

MODULATION TECHNIQUE FOR HSDPA



QPSK

2 bits / symbol
480 kbit/s/ HS-PDSCH
max. 7.2 Mbit/s



16QAM

4 bits / symbol
960 kbit/s/ HS-PDSCH
max. 14.4 Mbit/s

SUMMARY OF HSDPA

The maximum achievable bit rate on radio bearers transmitted on the HS-DSCH transport channel depends on the following factors:

- Available HS-PDSCH power
- Radio conditions (radio channel type, interference, UE speed, and so on)
- UE HS-DSCH category
- Available number of HS-PDSCH codes
- 16QAM availability

The actual experienced bit rates or Application data rate will be lower than the Maximum RLC Level throughput, due to retransmissions, RLC control signaling and over heads and RLC protocol limitations, Ue Category , RF conditions also the HARQ protocol works with a target block error rate of 10%, which corresponds to a 10% decrease of the achievable bit rate.

HSDPA parameter Effecting Data throughput

List of HSPA Parameters affecting Data Speed in Node-B

Following are the main parameter for Node-B which effect the data throughput in HS

Node-B Parameters	Suggested Values
hsdpaCapability	HSDPA_CAPABLE (Set through script)
maxNumHsPdschCodes	15 (Licensed based)
queueSelectAlgorithm	1 (default 0)
hsPowerMargin	**2** (default 2)
cqiAdjustmentOn	On (default false)
maxHsRate	44 (For 3 E1's)
steeredHsAllocation	False (Licensed based)
supportOf16qam	true (Licensed based)
featureStateHsdpaFlexibleScheduler	On (Licensed based)

HSPA Parameters affecting Data Speed in Node-B

hsdpaCapability

This parameter is use to set the HSDPA capability of cell.

Possible values:

- HSDPA_CAPABLE -------- Support HSDPA
- HSDPA_NON_CAPABLE -------- HSDPA Not supported.

```
Struct eulOptimalNoiseFloorLock has 2 members:
 >>> 1.eulNoiseFloorLock = false
 >>> 2.eulOptimalNoiseFloorEstimate = -1040
eulSlidingWindowTime                1800
eulThermalLevelPrior                -1040
hsCodeResourceId                    0
hsdpaCapability                     1 (HSDPA_CAPABLE)
localCellId                         2
maxDlPowerCapability                430
maxEAgchPowerDl                     -183
maxNumHsPdschCodes                  5
maxNumHsdpaUsers                    16
```

maxNumHsPdschCodes

The maximum number of HS-PDSCH codes is dependent on license level and parameter maxNumHsPdschCodes; up to 15 codes may be allocated. With a high number of HS-PDSCH codes allocated, the risk for code blocking will however increase and allocating 15 HS-PDSCH codes from the RNC is not advised. The number of HS-PDSCH codes in use for HS-DSCH transmission may also be dynamically adapted by the HSDPA Dynamic Code Allocation feature .

maxNumHsPdschCodes	Max. Speed(Mbps)
5	3.6
10	7.2
15	14.4

```
localCellId                         1
maxDlPowerCapability                430
maxEAgchPowerDl                     -183
maxNumHsPdschCodes                  5
maxNumHsdpaUsers                    16
maxUserEHichERgchPowerDl            -183
minDlPowerCapability                190
minSpreadingFactor                  4
```

We can verify this parameter from the Node-B KGET.

HSPA Parameters affecting Data Speed in Node-B

hsPowerMargin

$$P_{HS} = P_{max} - P_{non\text{-}HS} - \text{hsPowerMargin [dB]},$$

- P_{HS}: the power available for the HS
- P_{max}: the maximum downlink transmission power for the cell signaled from the RNC.
- $P_{non\text{-}HS}$: total transmitted carrier power of all codes not used for HS
- hsPowerMargin: HS Power Margin

As shown in the equation above, **the HS power is the remaining power after removing the Non-HS power from the maximum power**. **Usually an HS power margin is used to control the HS power.**
We can set it to zero and leave all the remaining power to HS (but this is not recommended). The better action is to optimize this margin case by case to provide more power for HS and avoid any power shortage.
.

It is relative to the maximum available power of the cell.

Value Range = 0 to 200

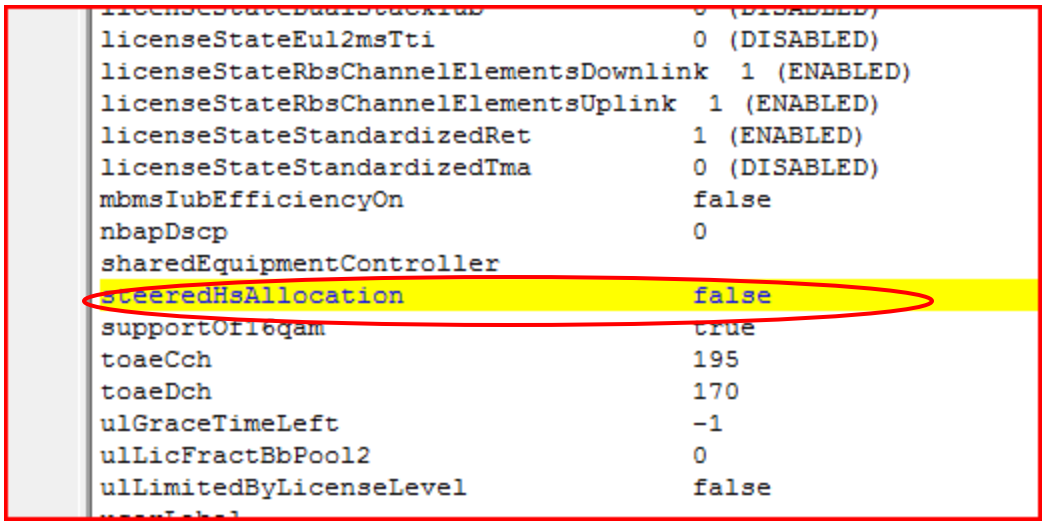
Suggested value =2

Ex. Value 2= 2*.1=.2dB

```
dbccDeviceRef[1]
 >>> dbccDeviceRef = ManagedElement=1,Equipment=1,S
dpclDeviceRef                          ManagedElement
frequencyPlane                         1
hsPowerMargin                          2
hsScchMaxCodePower                     -20
hsScchMinCodePower                     -150
operationalState                       1 (ENABLED)
```

steeredHsAllocation

Based on the estimated number of HS-PDSCH codes to be used per cell the TX boards in the RBS need to be configured. This is made by the numHsCodeResources parameter which defines how many processing resources (HS-DSCH) on the TX board that must be loaded with HSDPA SW. **The mapping between the cells and the processing resources (HS-DSCH) in RBS is made automatically and the HS-PDSCH codes are allocated dynamically**. For some situations, however, it is necessary to manually map cells to HS-DSCH resources to reach the desired configurations. The manual mapping is activated with parameter steeredHsAllocation and the mapping itself is based on that cells are tagged with the specific HS-DSCH resource number to which it shall be associated (hsCodeResourceId), **the recommended choice is to use the automatic mapping**



HSPA Parameters affecting Data Speed in Node-B

maxHsRate

maxHsRate is the maximum HSDPA bit rate possible over Iub i.e it determines the max possible HSDPA bit rate of HS flow over the Transport N/w.. iI is defined per Iub interface, range 1-1000.

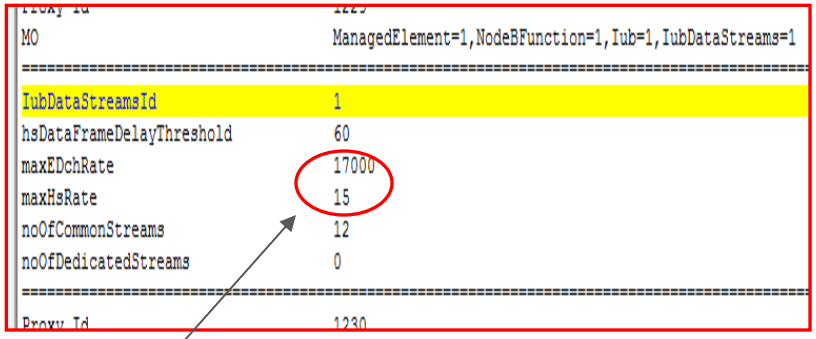
Default value is 15 that will support 1.5Mbps.

In a operator if channelization code is 5, i.e. we can get maximum speed of 3.6 Mbps.For achieving this speed we need to

tune the value of maxHsRate. We change it to 44 means it can support speed up to 4.4 Mbps.

We can verify this parameter from dump.

Default

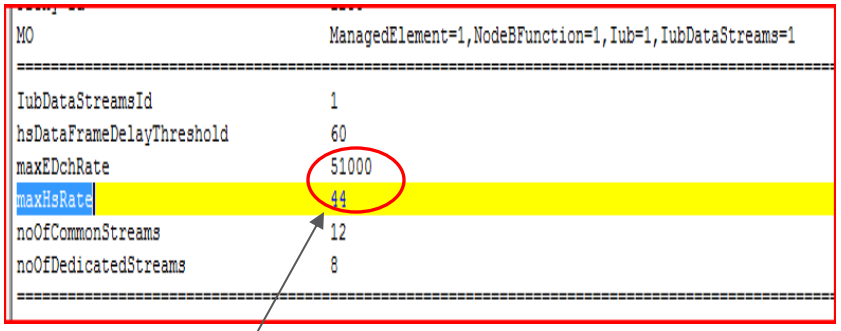


MO	ManagedElement=1,NodeBFunction=1,Iub=1,IubDataStreams=1
IubDataStreamsId	1
hsDataFrameDelayThreshold	60
maxEDchRate	17000
maxHsRate	15
noOfCommonStreams	12
noOfDedicatedStreams	0

maxHSRate=15

Max. speed~ 1.5 Mbps

New Value



MO	ManagedElement=1,NodeBFunction=1,Iub=1,IubDataStreams=1
IubDataStreamsId	1
hsDataFrameDelayThreshold	60
maxEDchRate	51000
maxHsRate	44
noOfCommonStreams	12
noOfDedicatedStreams	8

maxHSRate=44

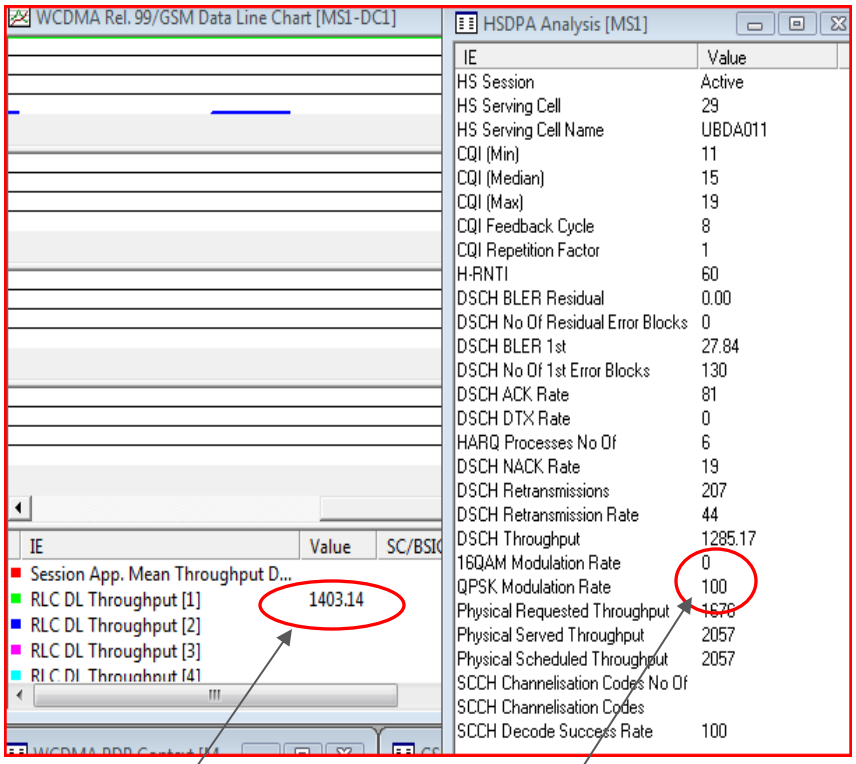
Max. speed~ 3.5 Mbps

HSPA Parameters affecting Data Speed in Node-B

supportOf16qam

Ericsson system supports both QPSK and 16QAM modulation. Symbol rate for QPSK and 16QAM are 2bits and 4bits respectively ie we can achieve higher rate with 16QAM with the same resource and good radio condition. However, support of 16QAM is an optional feature that can be configured on NodeB by setting supportOf16qam to TRUE. The available modulation type impacts the maximum achievable bit rate in the cell.

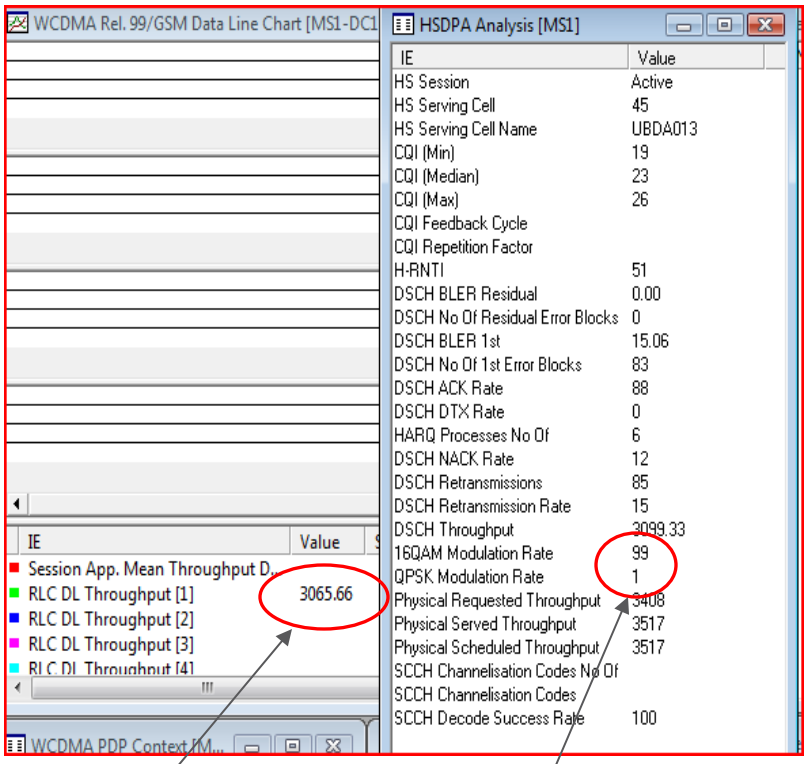
supportOf16qam=False



RLC Throughput

Modulation consist of 100% QPSK and 0% 16QAM

supportOf16qam=True



RLC Throughput

Modulation consist of both QPSK and 16QAM

HSPA Parameters affecting Data Speed in Node-B

cqiadjustmenton

CQI reported by different UE may be differ from each other due to different model and vendor.This may leads to over or under estimation of channel quality which results in low data rate.(reported CQI and used CQI)

In case of

a) overestimation ------- 1) HSDPA allocation will be too often, at the expense of other user.

b) Underestimation ------- 1) HSDPA allocation will be too often, at the expense of other user.

This can be resolved by activating CQI adjustment algorithm (setting cqiadjustmenton=true) in Node B.

queueSelectAlgorithm

It is use select the Priority Queues which will take decision of HS-DSCH resource in each TTI,it will consider only those Priority Queues that passed the queue validation step for the TTI.

queueSelectAlgorithm	Factors
Max. CQI	Depends upon CQI, Scheduling wt. and retransmission factor. Unfair scheduling may result in no any resource for some user.
Proportional fair – low fairness	Depends upon **CQI(scaling up**), Scheduling wt., retransmission factor and Average Rate.This is achive by scaling up the CQI factor.
Proportional fair – medium fairness	Depends upon **CQI(normal**), Scheduling wt., retransmission factor and Average Rate.
Proportional fair – high fairness	Depends upon **CQI(scaling down**), Scheduling wt., retransmission factor and Average Rate.This is achive by scaling down) the CQI factor.
Round Robin – Time based	Depends upon delay, Scheduling wt., retransmission factor .Higher waiting time with higher priority.
Equal rate	Depends upon Air rate, Scheduling wt., retransmission factor .

HSPA Parameters affecting Data Speed in Node-B

ROUND_ROBIN=0;
PROPORTIONAL_FAIR_MEDIUM=1;recommended
PROPORTIONAL_FAIR_HIGH=2;
PROPORTIONAL_FAIR_LOW=3; MAXIMUM_CQI=4;
EQUAL_RATE=5

featureStateHsdpaFlexibleScheduler

flexibleSchedulerOn is used to activate the HSDPA flexible scheduler feature, and the scheduling algorithm is chosen through the parameter **queueSelectAlgorithm.**

More HSDPA Parameters affecting Data Speed

Following are the main parameter for Node which effect the data throughput in HS

Parameter	Range	Suggested Value
bandwidthMargin	0 to 100	90%
bandwidthMarginUL	0 to 100	90%
codeThresholdPdu656	0-15	6
numHsPdschCodes	5 to 15	5
hsCellChangeAllowed	TRUE/FALSE	TRUE
HsdpaMobilityPhase1	TRUE/FALSE	TRUE
HsdpaMobilityPhase2	TRUE/FALSE	TRUE
ulDownswitchBandwidthMargin	0 to 100	50%
dlDownswitchBandwidthMargin	0 to 100	50%
hsdschInactivityTimer	1-255,7200	4
hsMeasurementPowerOffset	(-60 to 130)	80
hsOnlyBestCell	TRUE/FALSE	TRUE
sf16Adm		8
sf16AdmUl		8
sf16gAdm		8
sf8Adm		4
sf8AdmUl		4
sf8gAdmUl		4
sf4AdmUl		0
hsdpaUsersAdm		4
sf32Adm		32

HSPA Parameters affecting Data Speed in RNC

bandwidthMargin

Downlink throughput threshold required for triggering an **upswitch** of the **downlink**, **expressed as a percentage of the maximum channel capacity**. If set to 0, upswitch request will never be issued irrespective of user throughput.

When the DL throughput has been higher than this threshold for the length of time defined by upswitchTimer, an upswitch is issued.

```
==========================================================
Proxy Id                                  12248
MO                                        ManagedElement=1,
==========================================================
ChannelSwitchingId                        1
bandwidthMargin                           90
bandwidthMarginUl                         90
coverageTimer                             10
dlDownswitchBandwidthMargin               80
dlRlcBufUpswitch                          500
dlRlcBufUpswitchMrab                      1
dlThroughputAllowUpswitchThreshold        0
```

RNC KGET

bandwidthMargin Ul

Uplink throughput threshold required for triggering an **upswitch** of the **uplink**, expressed as a percentage of the maximum channel capacity. If set to 0, upswitch request will never be issued irrespective of user throughput.

When the UL throughput has been higher than this threshold for the length of time defined by upswitchTimerUl, an upswitch is issued.

Parameter	Range(%)	Suggested Value
bandwidthMargin	0 to 100	90%
bandwidthMarginUL	0 to 100	90%

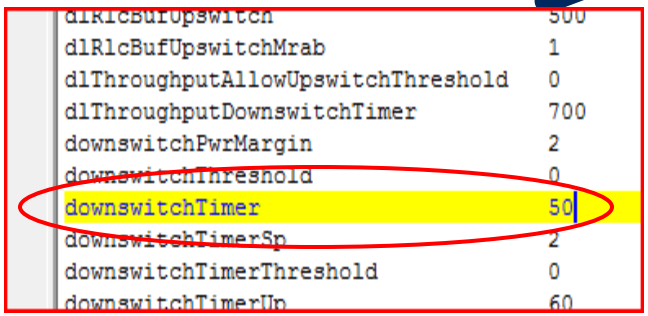
Up switch bandwidth margin(for ul and dl)

HSPA Parameters affecting Data Speed in RNC

ulDownswitchBandwidthMargin

Uplink throughput threshold, defining a low utilization of the radio bearer, is the percentage of the maximum allowed rate for the radio bearer below the allocated rate
When the UL throughput has been lower than this threshold for the length of time defined by ulThroughputDownswitchTimer, a **downswitch** is issued.

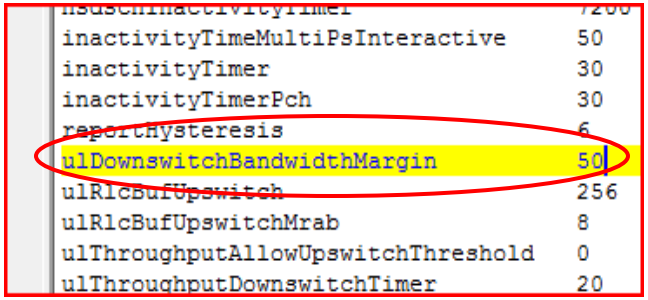
Special values:
0 means that the downwitch will never take place, since the throughput can never be below 0 kbps



dlDownswitchBandwidthMargin

Downlink throughput threshold defining a low utilization of the radio bearer, percentage of the maximum allowed rate for the radio bearer below the allocated rate.
When the DL throughput has been lower than this threshold for the length of time defined by dlThroughputDownswitchTimer, a **downswitch** is issued.

Special values:
0 means that the downwitch will never take place, since the throughput can never be below zero kbps.



RNC KGET

Parameter	Range(%)	Suggested Value
ulDownswitchBandwidthMargin	0 to 100	50%
dlDownswitchBandwidthMargin	0 to 100	50%

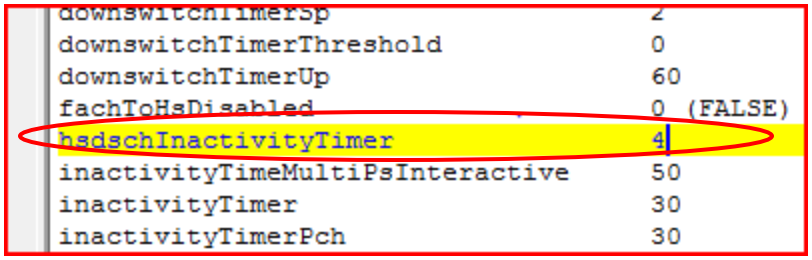
Downswitch bandwidth margin for ul and dl

HSPA Parameters affecting Data Speed

hsdschInactivityTimer

Time, not including data transmission, after which a connection configured on HS-DSCH is switched down to state CELL_FACH. If CELL_FACH state is not available, the connection is switched down to IDLE state. Unit s.

Parameter	Range	Suggested Value
hsdschInactivityTimer	1-255,7200	4

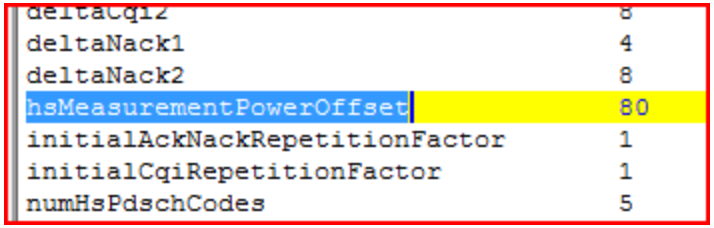


RNC KGET

hsMeasurementPowerOffset

Offset relative to the P-CPICH that the UE must use when calculating the assumed HS-PDSCH power in the CQI estimation.

It can be used to enable the UE to use the entire CQI reporting range . If the value is too low, then the UE will assume a very low HS-PDSCH power and only use the lower end of the CQI reporting range with loss of dynamic range as a result. Similarly, a value too high will make the UE use only the higher end of the CQI reporting range. Sent to the UE and RBS via RRC and NBAP. **Used to offset the CQI in order to utilize the whole CQI range.**



RNC KGET

Parameter	Range	Suggested Value	Unit	Resolution
hsMeasurementPowerOffset	(-60 to 130)	80	0.1 dB	5

More HSPA Parameters affecting Data Speed

codeThresholdPdu656

```
administrativeState                1  (UNLOCKED)
availabilityStatus                 0  (NO_STATUS)
codeThresholdPdu656                6
cqiFeedbackCycle                   8
deltaAck1                          4
```

Range: 0 - 15
Threshold for determining when to use the RLC PDU size = 656 bits for UEs with HS-DSCH physical layer category 7 to 10, 13 or higher.
Special values:
0: always used
15: never used
any other value:
- 656 bits are used if codeThresholdPdu656 < numHsPdschCodes,
- 336 bits are used if codeThresholdPdu656 >= numHsPdschCodes

Due to limitations in the RLC protocol as specified by 3GPP, a 336 bit RLC PDU cannot support user bit rates above 6 Mbps. To enable higher rates, which are supported with Category 7-10 UEs only, a 656 bit RLC PDU size alternative is available and the selection between the 336 and 656 size is controlled by the codeThresholdPdu656 parameter which is compared with the number of HS-PDSCH codes that are configured from the RNC, determined by the numHsPdschCodes parameter. If parameter codeThresholdPdu656 is smaller than parameter numHsPdschCodes the 656 bit RLC PDU size will be used for category 7-10 UEs, otherwise the 336 bit RLC PDU size is used.
For UEs not belonging to Category 7-10, the 336 bit RLC PDU size is always used

Parameter	Range	Suggested Value
codeThresholdPdu656	0-15	6

numHsPdschCodes

Number of codes of SF=16 used for the HS-PDSCH.
Disturbances:
Changing this attribute may affect ongoing traffic.
When the number of codes is incremented, all traffic is released from the cell.
When the number is decreased, traffic is not released in the cell, but the Hs-dsch throughput may be affected.

```
initialAckNackRepetitionFactor     1
initialCqiRepetitionFactor         1
numHsPdschCodes                    5
numHsScchCodes                     1
operationalState                   1  (ENABLED)
```

HsdpaMobilityPhase1 & HsdpaMobilityPhase2

When the UE moves between cells that are HSDPA enabled (that is, when hsdpaCapability = HSDPA_CAPABLE), the HSDPA connection is maintained by means of the serving HS-DSCH cell change functionality, shortly, HS cell change.

HS-DSCH does not use soft handover as the dedicated channels (DCH) do. There is a trade-off between optimizing the radio quality of HS-DSCH (that is, frequent enough cell changes) and minimizing the impact on throughput at cell change (that is, as few cell changes as possible).

Both this parameters are license control.

If HsdpaMobilityPhase1 =True i.e. intra RNC HS-DSCH Cell Change is possible.

If HsdpaMobilityPhase2 =True i.e. inter RNC HS-DSCH Cell Change is possible if Iur connection is available between both RNC.

```
Proxy Id                                  14
MO                                        ManagedElement=1,SystemFunctions=
==========================================================================
RncFeatureId                              HsdpaMobilityPhase2
featureState                              1 (ACTIVATED)
isLicenseControlled                       1 (TRUE)
keyId                                     CXC4030002
licenseState                              1 (ENABLED)
serviceState                              1 (OPERABLE)
==========================================================================
Proxy Id                                  15
MO                                        ManagedElement=1,SystemFunctions=
==========================================================================
RncFeatureId                              HsdpaMobilityPhase1
featureState                              1 (ACTIVATED)
isLicenseControlled                       1 (TRUE)
keyId                                     CXC4030001
licenseState                              1 (ENABLED)
serviceState                              1 (OPERABLE)
==========================================================================
```

HSPA Parameters affecting Data Speed in RNC

hsCellChangeAllowed

If the parameter hsCellChangeAllowed is TRUE, a valid target cell evaluation is performed within the current active set.
if the parameter hsCellChangeAllowed is FALSE, or if no Suitable HS cell is found, or if the Cell Change execution fails and the connection does not drop, then RNC will attempt to reconfigure to DCH instead.

Parameter	Range	Suggested Value
hsCellChangeAllowed	TRUE/FALSE	TRUE

```
gpehDataLevel                          0 (HEADER_DAT
gpehFileSize                           15000
highPrioScanReserve                    0
hsCellChangeAllowed                    1 (TRUE)
hsOnlyBestCell                         1 (TRUE)
Struct hsToDchTrigger has 5 members:
 >>> 1.servHsChangeInterRnc = 0 (OFF)
 >>> 2.servHsChangeIntraRnc = 0 (OFF)
 >>> 3.changeOfBestCellIntraRnc = 0 (OFF)
 >>> 4.poorQualityDetected = 1 (ON)
```

hsOnlyBestCell

RNC wide switch for selecting only the best cell for HS.

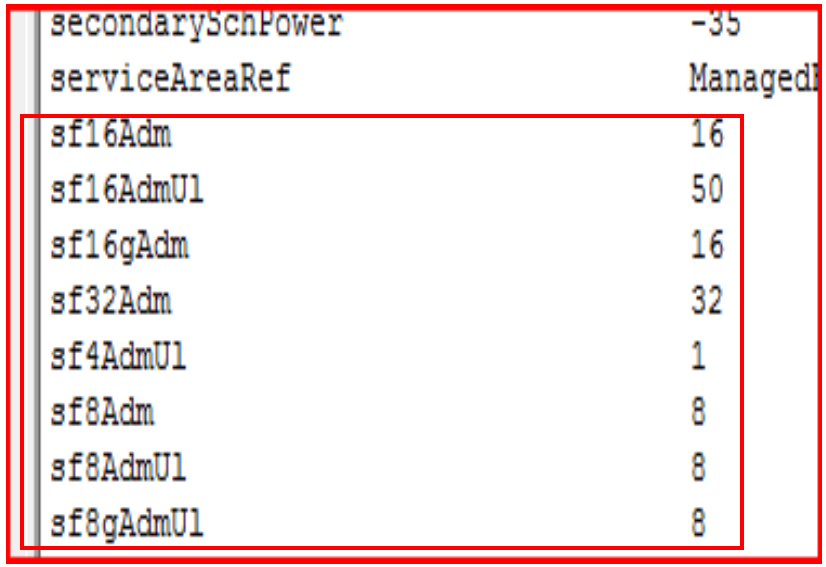
hsOnlyBestCell = FALSE, which means that selection of a cell other than the best cell is allowed.

Parameter	Range	Suggested Value
hsOnlyBestCell	TRUE/FALSE	TRUE

Admission control parameter

Below are the some admission control parameter and its suggested value.
It gives the maximum possible number of a particular SF on per cell basic.
It provide a trade off between R99 and HSDPA as well as speed and capacity.

Parameter	Suggested Value
sf16Adm	8
sf16AdmUl	8
sf16gAdm	8
sf8Adm	4
sf8AdmUl	4
sf8gAdmUl	4
sf4AdmUl	0
hsdpaUsersAdm	4
sf32Adm	32



ERICSSON