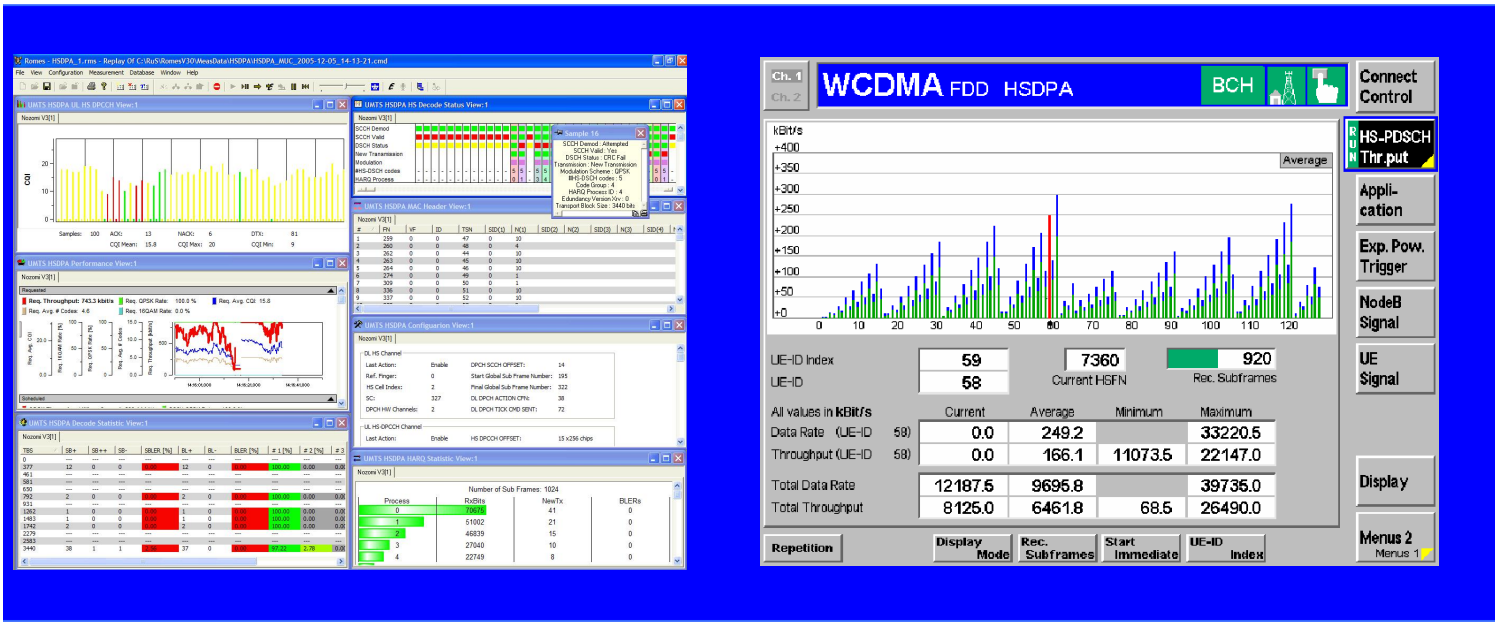


Products: R&S CMU300, R&S ROMES

Optimization of HSDPA networks

with the Radio Communication Tester R&S® CMU300 and Coverage Measurement System R&S® ROMES

Application Note

The Radio Communication Tester R&S CMU300 and Coverage Measurement System R&S ROMES provide a wide range of possibilities to check the HSDPA air interface and network quality. The measurement results that can be obtained with the aforementioned solutions ensure flawless operation of HSDPA services from the start and longstanding customer acceptance of the new technology.

ROHDE&SCHWARZ

Contents

1 Introduction

The introduction of HSDPA confronts the entire industry with enormous challenges. All network operators must ensure complete availability of services by skillfully planning their networks, and must decide which parts of the network they should upgrade first with HSDPA. Future HSDPA users must share resources with other UMTS users. It is therefore important to develop a strategy as to how much network capacity should be available to these HSDPA users. HSDPA contains an extensive protocol on the air interface and offers many possibilities for parameterization. To optimally support the desired services, every network operator must customize this parameterization.

Test and measurement solutions for user equipment (UE) and networks significantly help to ensure that the introduction of HSDPA runs smoothly. Besides the intensive testing of UE, intensive tests for the introduction of HSDPA are required in the network itself. Rohde & Schwarz offers a wide range of T&M equipment to ensure that HSDPA is rolled out on schedule.

HSDPA Network Optimization with the R&S CMU300 and R&S ROMES

The R&S CMU300 base station tester allows you to conduct HSDPA throughput measurements that make it possible to evaluate and optimize the algorithms for assigning resources. The tester can also be used to check HSDPA-specific settings on Node B and to perform measurements on the physical HSDPA channels.

R&S CMU300 base station tester

R&S Coverage Measurement System ROMES supports HSDPA network setup and radio network optimization. Extensive coverage measurements can be performed during a drive test. The network operator obtains information about the availability and parameterization of the HSDPA services at different locations within the network. The measurements provide information regarding the actual HSDPA configuration, the signaling and the data rates achieved on different levels. An end-to-end application is set up for this purpose and evaluated during the drive test. The network operator gains valuable information on how to further improve HSDPA coverage and the quality of service. These measurements can be configured in parallel to UMTS and GSM measurements to provide an overall picture of the network.

Coverage Measurement System R&S ROMES

2 Testing HSDPA Node Bs with the R&S CMU300

Realtime HS-SCCH Monitoring

The high-speed shared control channel (HS-SCCH) is important for communication in HSDPA mode. It transfers information about the nature of the following data channel (HS-PDSCH) as well as information indicating which UE the data packet is specified for. The information applies to the following:

Channelization code set

Modulation scheme

Transport block size

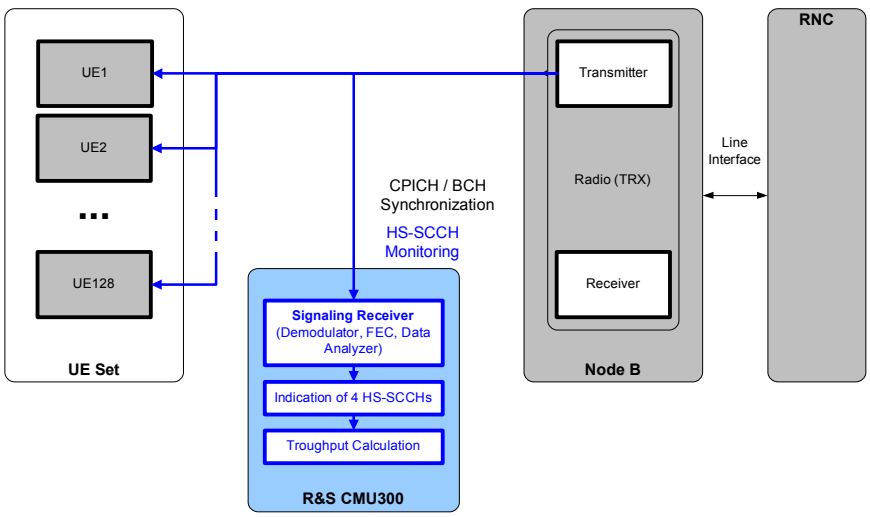
HARQ process

Redundancy and constellation

New data indicator

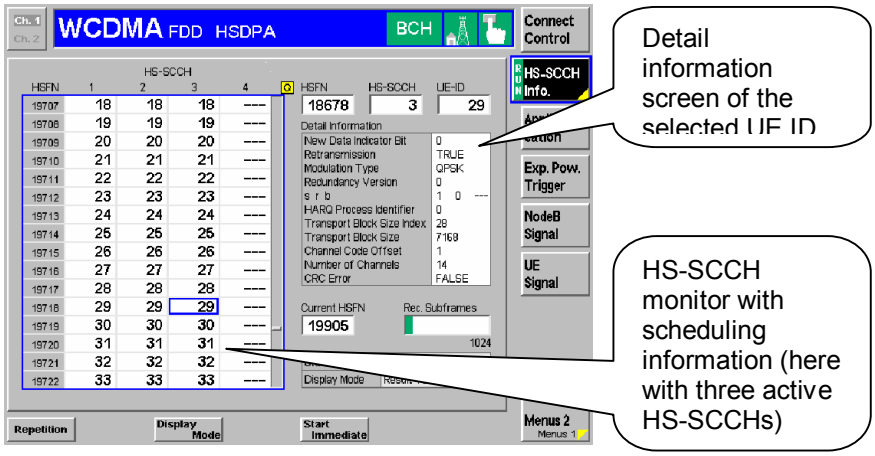
UE ID

Several HS-SCCHs may be transmitted simultaneously. The R&S CMU300 thus not only monitors the HS-SCCHs but also analyzes whether the communication in HSDPA mode is taking place correctly.



Setup for HSDPA monitoring and throughput measurements

The R&S CMU300 can simultaneously monitor up to four HS-SCCH channels. The code channels to be monitored can be selected by the user. Moreover, the R&S CMU300 can detect up to 128 different UE IDs. The UE IDs to be detected can be determined by means of a list or an automatic scan routine (UE ID Scan). The information of the detected HS-SCCHs is displayed directly on the R&S CMU300's user interface as follows:



HS-SCCH monitoring GUI

The HS-SCCH information measurement can be performed after successful CPICH/BCH synchronization in different modes:

Start mode

UE ID Scan:	Capturing starts when a predefined number of active UEs are detected.
Start Immediate:	Capturing starts right after the user starts the measurement.
Start at HSFN:	Capturing starts when the specified start HSFN is reached.
Start at UE ID:	Capturing starts when the specified start UE ID is detected the first time.

Repetition mode

Single Shot:	The measurement is stopped after 1024 HSFNs are captured (depending on display mode).
Continuous:	Continuous capturing of data until the measurement is explicitly stopped by the user.

Display mode

Result Table vs. HSFN: The monitored HSFNs are displayed continuously.

Result Table vs. UE ID: Only HSFNs containing data are displayed.

Realtime Cell Throughput Measurement

The Cell Throughput application measures the HS-PDSCH data rate and throughput by analyzing the HS-SCCH information. Up to four HS-SCCHs and 128 different UE IDs can be monitored and displayed in realtime. The UE IDs to be detected can be determined by means of a list or an automatic scan routine (UE ID Scan). For each monitored UE ID, the current throughput, the average throughput and the maximum/minimum values are analyzed. By evaluating the new data indicator flag, data rate and throughput are differentiated and displayed.

The throughput measurement can be performed after successful CPCIH/BCH synchronization in different modes:

Start mode

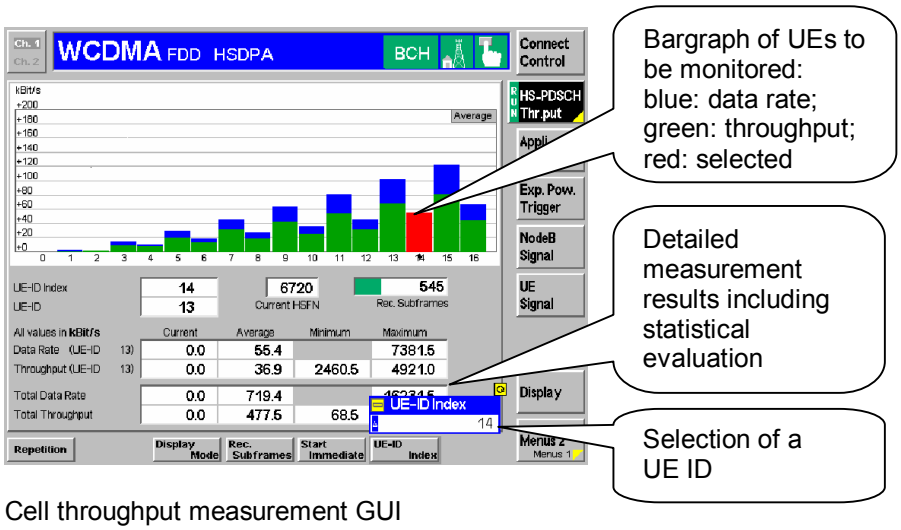
UE ID Scan:	Capturing starts when a predefined number of active UEs are detected.
Start Immediate:	The throughput measurement starts right after you press the Start button.
Start at HSFN:	The measurement starts when the specified Start HSFN is reached.
Start at UE ID:	The measurement starts when the specified Start UE ID is detected for the first time.

Repetition mode

Single Shot:	The measurement is stopped after a specific number of subframes (max. 20479).
Continuous:	Continuous capturing of data until the measurement is explicitly stopped by the user.

Display mode

Current:	Data rate and throughput of the current HSFN are displayed.
Average	Average results are calculated over a specified number of subframes.
Max / Min	Max/Min results are recorded over the whole measurement time.

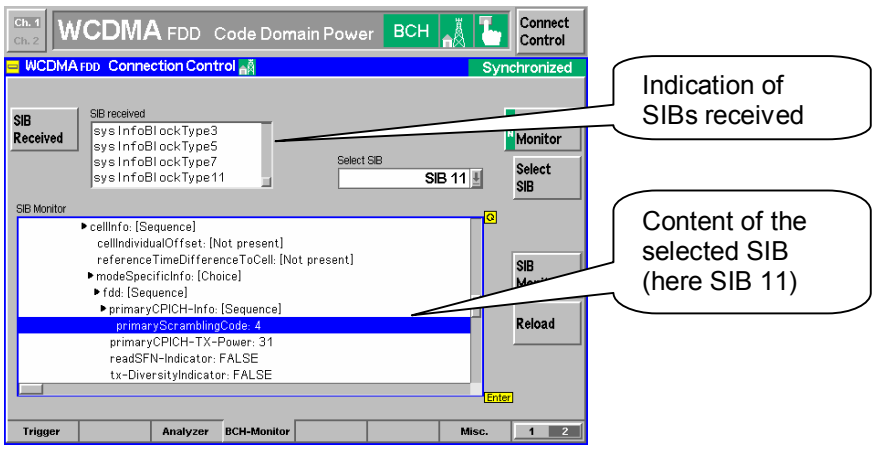


Cell throughput measurement GUI

The bar graph shows a rough overview of all UEs to be monitored. Depending on the display mode, the bar graph shows current, average, minimum or maximum values. The present display mode is shown in the upper right corner of the screen. The different colors of the bars show the data rate and throughput. To show detailed measurement values, a UE-ID index can be selected. The selected UE-ID index is marked red in the bar graph and the corresponding UE-ID is displayed. The display mode and the UE-ID for detailed measurement results can be selected during the measurement as well as after the measurement is stopped.

Realtime BCH Monitoring

The BCH monitoring function of the R&S CMU300 signaling mode provides a convenient means of performing online analysis of the system information blocks (SIBs).



BCH monitoring GUI

Checking Physical Transmission Parameters

The following measurements of static code channel combinations can be performed with the R&S CMU300:

Power measurement:

BTS output power

Modulation analysis:

Error vector magnitude (EVM) including magnitude error and phase error

IQ origin offset

IQ imbalance

Carrier frequency error

Waveform quality

Spectrum analysis:

Occupied bandwidth (OBW)

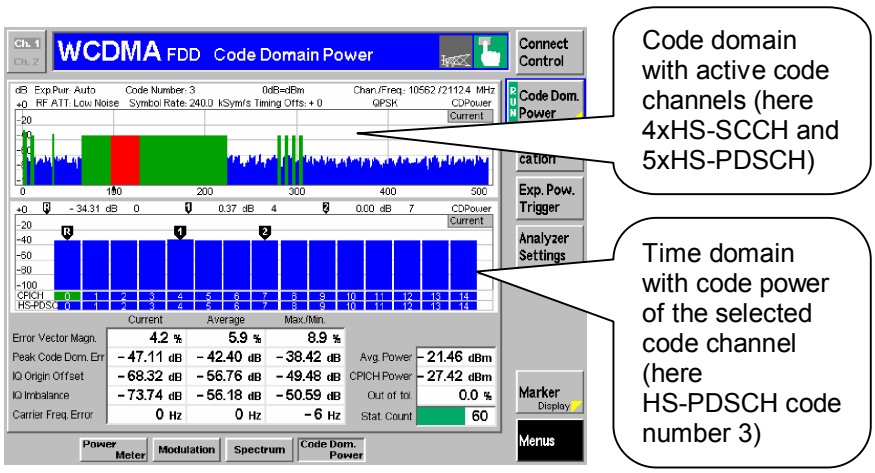
Spectrum emission mask (SEM)

Adjacent channel leakage ratio (ACLR)

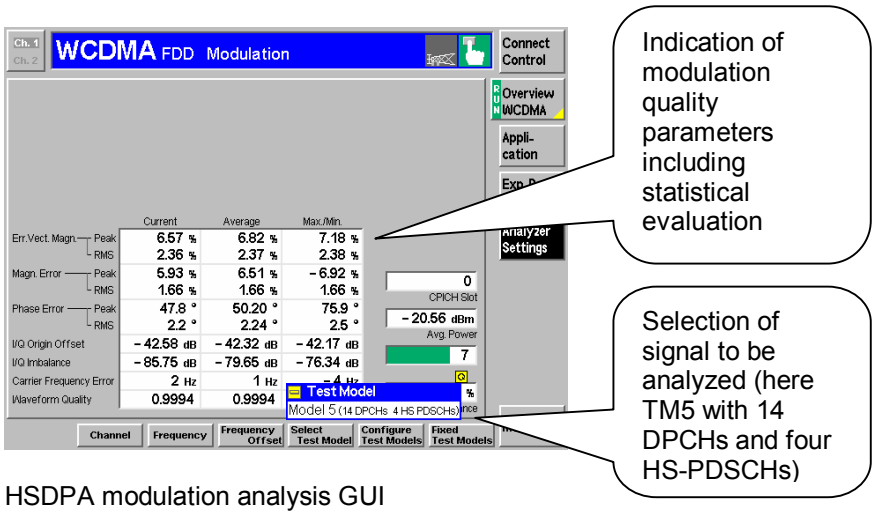
Code domain measurements:

Code domain power (CDP)

Peak code domain error power (PCDEP)



HSDPA code domain power measurement GUI



HSDPA modulation analysis GUI

The R&S CMU300 is able to analyze and measure the following static WCDMA TX signals (applies primarily to modulation analysis and code domain measurements):

- Conformance measurements in accordance with the 3GPP TS25.141 FDD R5 specification on the basis of predefined channel combinations (test models 1 to 5).
- Customer-specific preconfigured downlink channel combinations (table form) for frequently repeating test scenarios.
- The auto-channel detection mode makes it easy to test unknown static WCDMA signals. This mode automatically analyzes and measures the existing WCDMA channel combination.

For the R&S CMU300, it is irrelevant which Node B controller was used to activate the TX signal to be measured. All standard-compliant static WCDMA/HSDPA signals generated by an RNC or special Node B controller can be analyzed.

Measurement	Supported by the R&S CMU300
Maximum output power	√
CPICH power accuracy	√
Frequency error	√
Power control dynamic range	√
Total power dynamic range	√
Occupied bandwidth	√
Spectrum emission mask	√
Adjacent channel leakage ratio	√
Error vector magnitude	√
Peak code domain error power	√

TX measurements of UMTS specification 3GPP TS 25.141 FDD Release 5 supported by R&S CMU300

Tips for Practical Use

Connection to the base station

The R&S CMU300's flexible RF interface allows the instrument to be adapted to a variety of test environments:

RF1 input:	Direct connection of BTS antenna output with powers of up to 47 dBm CW possible (53 dBm PEP)
RF4 IN input:	Sensitive test input for peak powers of up to 0 dBm (PEP)

R&S CMU300 front panel, RF interface

The sensitive RF4 IN input allows you to test base stations that are in active operation as follows:

- Direct measurement of transmission parameters via heavily attenuated TX monitor outputs
- OFF AIR HSDPA measurements with line of sight to the BTS.

The RF input of the R&S CMU300 and the drive level must be selected to match the previously known maximum transmitting power. It is advisable to drive the instrument manually (via the Connection Control / Analyzer / Expected Power Mode / Manual menu); the R&S CMU300 input level to be expected should be set 5 dB above the maximum PEP to be expected (Expected Power: PEP + 5 dB).

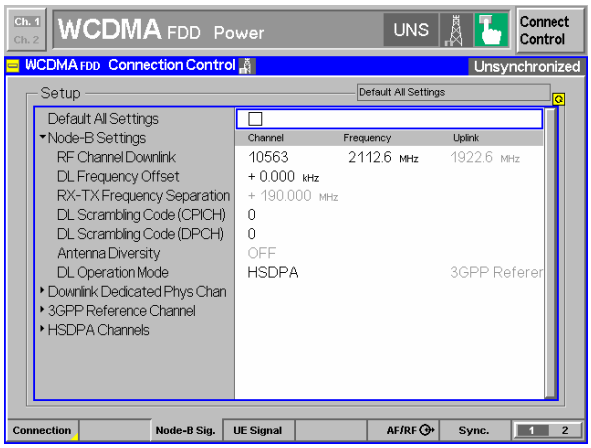
The R&S CMU300 can be connected to the reference frequency of the base station via a BNC input on the instrument's rear panel. This will eliminate test results corrupted by reference frequency offset. In addition, the instrument can be equipped with an OCXO (R&S CMU-B12 option).

Additional information regarding transmitter measurements

Physical transmitter measurements are performed mainly in the R&S CMU300 non-signaling mode; the common pilot channel (CPICH) in the channel combination to be tested must be activated. The scrambling code and the channel of the transmitter to be measured must be known in advance and entered in the Connection Control / BS Signal menu.

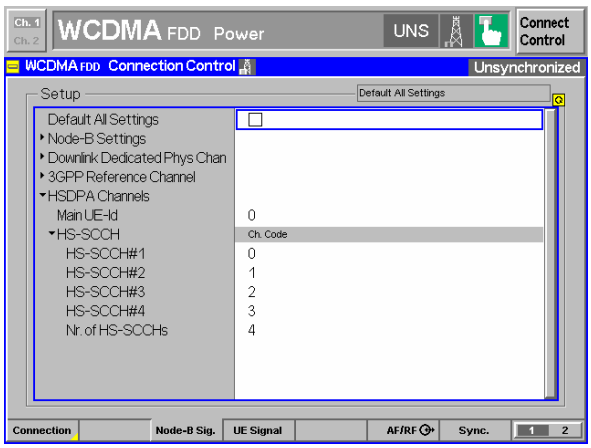
Additional information regarding HSDPA monitoring and throughput

All realtime measurement functions are performed in the R&S CMU300 signaling mode. This mode is based on a downlink receiver (FEC), where the instrument synchronizes like a UE to the cell (CPICH and BCH), (Connection Control / Connection / Softkey Start Sync. menu).



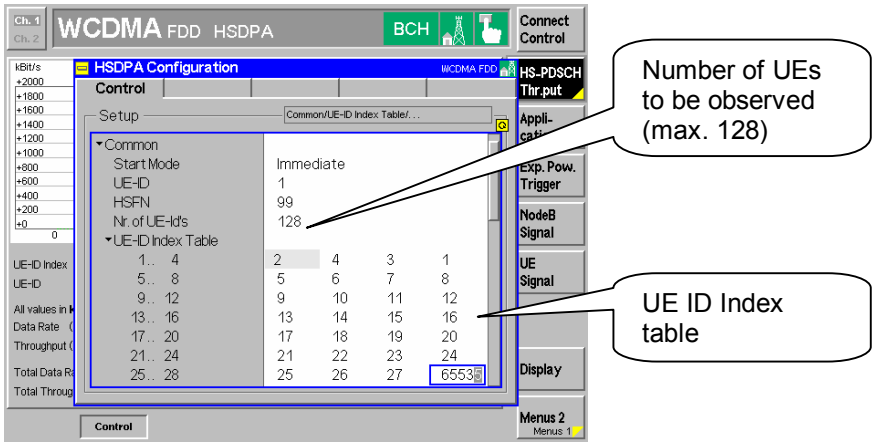
Connection Control / Node-B Sig. / Node-B Settings menu

The scrambling code and the channel of the cell to be measured must be known in advance and entered in the Connection Control / Node-B Sig. menu.



Connection Control / Node-B Sig. / HSDPA Channels menu

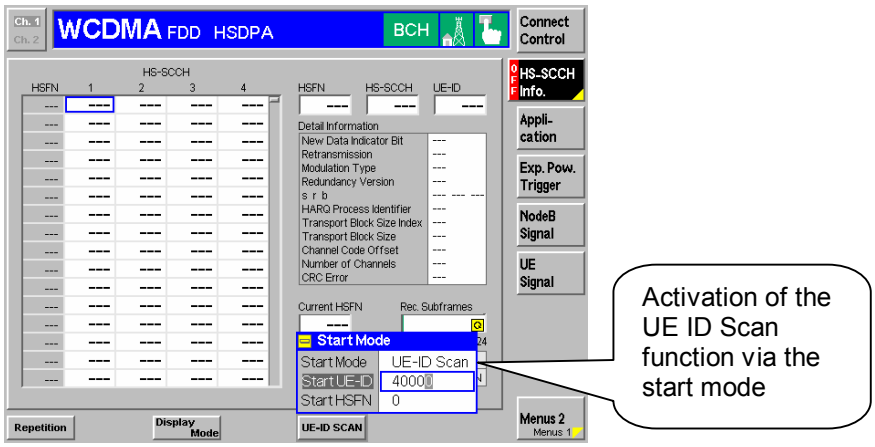
The number of HS-SCCHs used in the cell and their channel codes can be entered further down in the same menu. The Code Domain Power measurement menu makes it easier in most cases to determine the HS-SCCH parameters.



Cell Throughput / UE Configuration GUI

The number of UEs to be observed and their UE-IDs are taken into account as follows:

- If these parameters are known, they can be entered in the UE ID Index table.
- The UE ID Scan function scans in active operation specifically for HSDPA radio bearers; i.e. prior to the actual HS-SCCH analysis, active UE IDs are automatically detected and copied to the UE ID Index table.



HS-SCCH monitor GUI

In addition to the aforementioned HSDPA analysis functions, the instrument can simulate an HSDPA UE in the uplink. For this purpose, configurable ACK / NACK / CQI sequences are provided (R&S CMU-K73 option).

3 Measurements in HSDPA Networks with R&S ROMES

R&S ROMES Hardware Configuration for HSDPA

In comparison to the R&S CMU300 base station tester, the R&S ROMES coverage measurement system is designed for performing mobile phone measurements during drive tests.

Typically an R&S ROMES coverage measurement system consists of a laptop or PC running Windows XP Professional and the R&S ROMES software.

The R&S ROMES coverage measurement software is used for the following purposes:

- To define test devices
- To set up measurement tasks
- To acquire and store measurement data
- To display measurement results in realtime during the drive test

In addition, a replay function is included for replaying the drive test using similar or different display options in realtime or with adapted speed. Measurement data can also be exported in ASCII or other formats.

As test devices, one or more test mobile phones or data cards and one or more scanners are connected to the R&S ROMES laptop or PC.

Depending on the customer-specific requirements, the system may be used in different installations and environments, such as the following:

- In a rugged case, incl. laptop, scanner and mobile phones
- In a specially designed backpack incl. battery power management
- In a fixed 19" rack installation (e.g. inside a measurement vehicle)

Examples of coverage measurement system installation

For performing tests in HSDPA networks, the following minimum requirements are necessary:

- R&S ROMES 3.52 or later

  R&S ROMES 3.52 requires a PC with at least either Pentium M or Pentium IV 3GHz processor, min. 1 GB RAM and Windows XP Professional.

- R&S ROMES drivers R&S ROMES-UM1 (WCDMA) and R&S ROMES-UM4 (HSDPA)
- HSDPA-capable test mobile phone(s) or data card(s), compatible with R&S ROMES

The only chipset currently supported for HSDPA measurements is the Qualcomm MSM6275. To connect a device with this chipset to R&S ROMES, direct access to the Qualcomm interface is required.

Currently supported devices are Qualcomm's TM6275 test mobile phone and Option's GlobeTrotter Fusion+ (HSDPA-ready) data card.

Currently supported HSDPA devices

In future, several mobile phones and data cards are expected to be based on this chipset. Rohde & Schwarz will phase in the development of the necessary drivers in order for R&S ROMES to support these devices.

Further (non-HSDPA-specific) important information about WCDMA networks may be gained by using the R&S TSMU radio network analyzer in parallel to the HSDPA devices.

Although no HSDPA-specific logical channels are measured by the R&S TSMU, the recorded information is crucial for the optimization of the HSDPA networks. For example, the CQI uplink response of the HSDPA UE in the HS-DPCCH is directly related to the CPICH, which is measured by the R&S TSMU. Radio environment conditions have a direct impact on the data rates achieved.

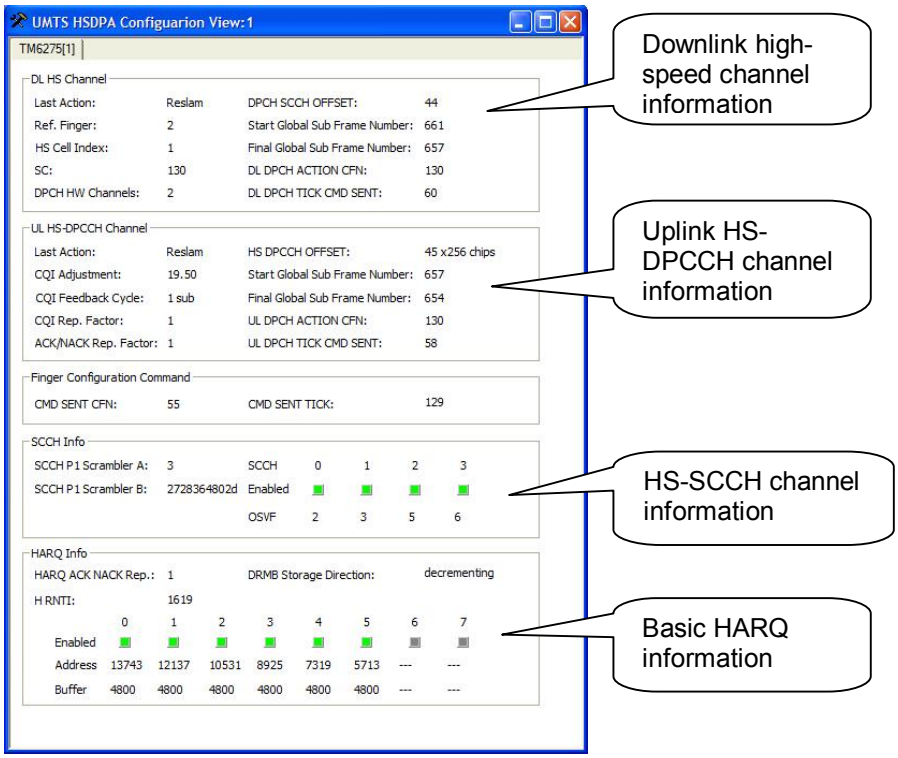
R&S TSMU radio network analyzer

For further details regarding the R&S TSMU, please see references [4] and [5].

HSDPA-Specific Information in R&S ROMES

To receive specific information about HSDPA-related parameters, Rohde & Schwarz has introduced the following HSDPA dedicated views into the R&S ROMES software:

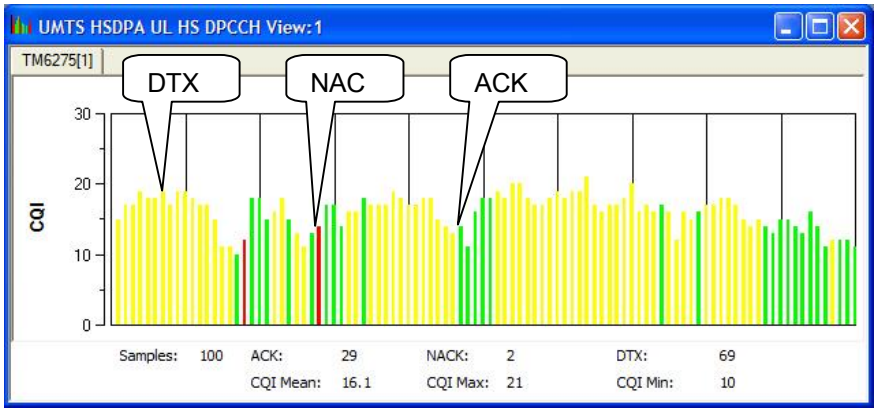
The **HSDPA Configuration View** provides a general overview of the HSDPA configuration:



UMTS HSDPA Configuration View

Most of the displayed information is mobile phone-specific and primarily intended for monitoring the status of the test mobile phone.

The high data rates in the downlink require steady feedback about the radio link situation from the mobile phone to the Node B. All uplink information is summarized conveniently in one window, the **HSDPA Uplink HS DPCCH View**.

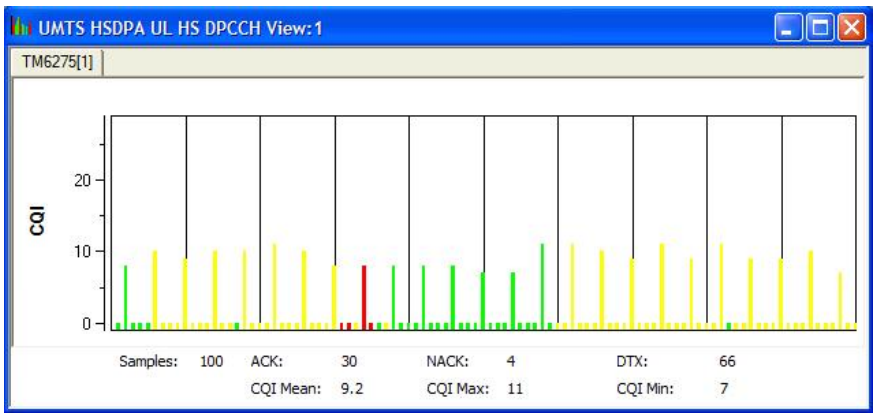


UMTS HSDPA Uplink HS-DPCCH View for CQI feedback cycle 1

If the CQI feedback cycle is set to 1, each bar represents a 2 ms HS-DPCCH subframe; 100 subframes are shown at a time.

The height of the bar indicates the CQI of this subframe. The color depends on the feedback answer received from the mobile phone: ACK (green), NACK (red) or no answer at all (DTX, yellow).

If the CQI feedback cycle is set to a value other than 1, the height of the bar would be 0. However, a short bar is shown to indicate the ACK, NACK or DTX message:



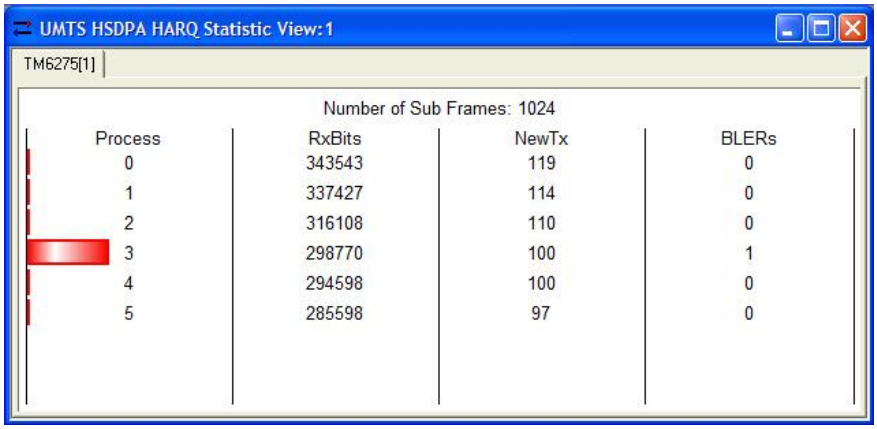
UMTS HSDPA Uplink HS-DPCCH View for CQI feedback cycle 4

The hybrid automatic repeat request (HARQ) is one of several new methods used in HSDPA to implement higher data rates. The idea is to keep the data received during the first transmission and to ask for additional information in case any errors have been detected. Basically there are two different types of HARQs:

Incremental redundancy: additional redundancy is added with each retransmission

Chase combining: retransmission of the same coded block in each retransmission

The current status for each of the (up to eight) HARQ processes is shown in the **HSDPA HARQ Statistic View**. A BLER >0 is clearly indicated by a red bar from the left. (The HARQ process will be terminated then). Alternatively green bars may be shown for the volume of new transmissions.

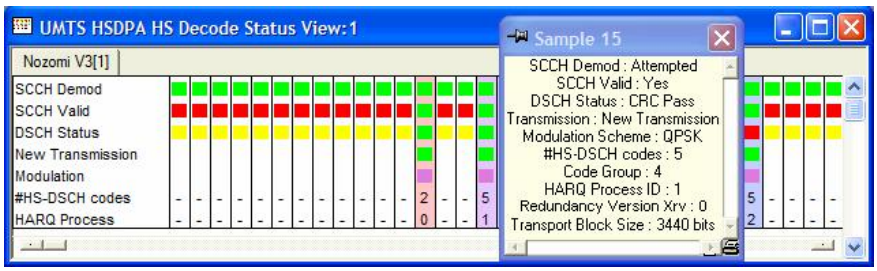


UMTS HSDPA HARQ Statistic View

For each TTI subframe received, the complete demodulation and decoding chain is shown in the **HSDPA HS Decode Status View**.

See also the R&S CMU300 "Realtime HS-SCCH Monitoring" section.

Each column represents one TTI subframe of 2 ms. A detailed view for each subframe may be opened and pinpointed (see the "Sample 11" box, which belongs to the subframe directly to the left of the pinpointed window).



UMTS HSDPA HS Decode Status View

Each line shows the successful (green square) or unsuccessful (red square) pass of each of the steps in the decoding chain:

Line 1: SCCH demodulation attempt

Line 2: SCCH decoding attempt

Line 3: CRC check of the data packet (yellow square denotes DTX)

The fourth line indicates whether the subframe contained a new transmission or a retransmission. In the fifth line, the modulation scheme used (16QAM or QPSK) is shown.

The next two lines provide information about the number of HS-PDSCH codes used (in this subframe). One UE supports 5, 10 or 15 channels in parallel (depending on the UE category).

Finally the last line shows the initiated HARQ process for this subframe. This number also defines the background color of the column.

Additionally, the pinpointed detail sample view shows the following three values:

- Code Group: code group indicator
- Redundancy Version: X_{rv} includes the redundancy version parameters r and s and the constellation version parameter b.
- Transport Block Size: value of the transport block size (not explicitly signaled, but decoded in accordance with the index value k_t)

TBS	SB+	SB++	SB-	SBLER [%]	BL+	BL-	BLER [%]	# 1 [%]	# 2 [%]	# 3 [%]	# 4 [%]	# 5 [%]	#>5 [%]
0	---	---	---	---	---	---	---	---	---	---	---	---	---
377	11	0	0	0.00	11	0	0.00	100.00	0.00	0.00	0.00	0.00	0.00
461	---	---	---	---	---	---	---	---	---	---	---	---	---
650	---	---	---	---	---	---	---	---	---	---	---	---	---
792	2	0	0	0.00	2	0	0.00	100.00	0.00	0.00	0.00	0.00	0.00
931	---	---	---	---	---	---	---	---	---	---	---	---	---
1262	1	0	0	0.00	1	0	0.00	100.00	0.00	0.00	0.00	0.00	0.00
1483	---	---	---	---	---	---	---	---	---	---	---	---	---
1742	2	0	0	0.00	2	0	0.00	100.00	0.00	0.00	0.00	0.00	0.00
2279	5	0	0	0.00	5	0	0.00	100.00	0.00	0.00	0.00	0.00	0.00
2583	8	0	1	11.11	8	0	0.00	87.50	12.50	0.00	0.00	0.00	0.00
3440	51	1	14	21.54	50	0	0.00	68.75	29.17	2.08	0.00	0.00	0.00

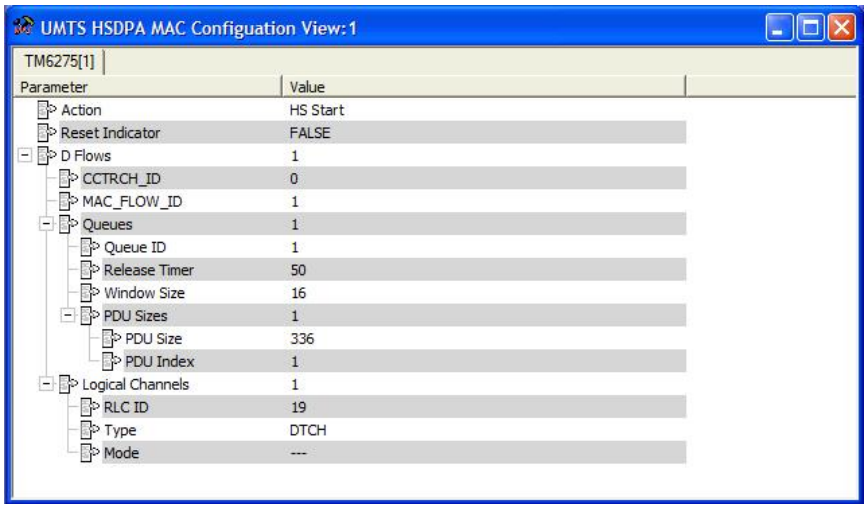
UMTS HSDPA Decode Statistic View

In the **HSDPA Decode Statistic View**, statistics are calculated once a second to provide a quick overview of the transferred user data.

For each transport block size (TBS) captured, the following values are shown (valid for all transport blocks of the same size):

- SB+: number of successfully decoded subblocks
- SB++: number of successfully decoded subblocks that have been sent more than once although the first transmission was already successful (usually the reason is a missing ACK from the mobile phone)
- SB-: number of subblocks that could not be decoded
- SBLER: subblock error rate in % (calculated from the above values SB+ and SB-)
- BL+: number of successfully decoded blocks
- BL-: number of blocks that could not be decoded
- BLER: block error rate in % (calculated out of the above values BL+ and BL-)
- #1: percentage of successfully decoded blocks at first transmission
- #2: percentage of successfully decoded blocks at second transmission, etc

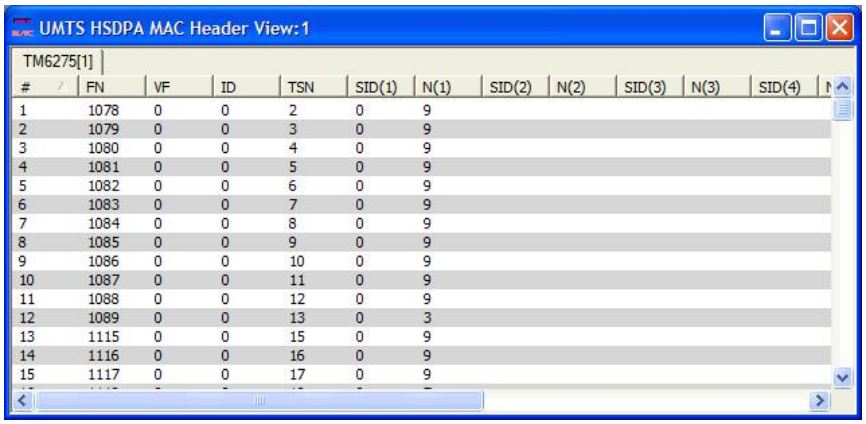
In the **HSDPA MAC Configuration View**, the MAC-hs configuration is shown; some of the parameters depend on the test mobile phone used:



UMTS HSDPA MAC Configuration View

In the **HSDPA MAC header view**, the complete MAC-hs header information is shown and decoded. The following parameters are listed:

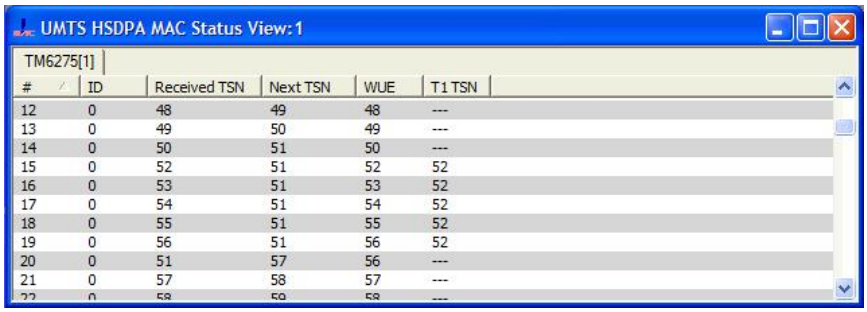
- Frame number (FN)
- Version flag (VF)
- Queue ID (ID) identifies the reordering queues in the receiver
- Transmission sequence number (TSN) for reordering purposes to support in-sequence delivery to higher layers
- Size index identifier (SIDx) showing the size of the set of consecutive MAC-d PDUs
- Number of consecutive MAC-d PDUs of equal size (Nx)



#	FN	VF	ID	TSN	SID(1)	N(1)	SID(2)	N(2)	SID(3)	N(3)	SID(4)	N
1	1078	0	0	2	0	9						
2	1079	0	0	3	0	9						
3	1080	0	0	4	0	9						
4	1081	0	0	5	0	9						
5	1082	0	0	6	0	9						
6	1083	0	0	7	0	9						
7	1084	0	0	8	0	9						
8	1085	0	0	9	0	9						
9	1086	0	0	10	0	9						
10	1087	0	0	11	0	9						
11	1088	0	0	12	0	9						
12	1089	0	0	13	0	3						
13	1115	0	0	15	0	9						
14	1116	0	0	16	0	9						
15	1117	0	0	17	0	9						

UMTS HSDPA MAC Header View

In the **HSDPA MAC status view**, the operator is able to check the reordering sequence in the receiver in detail: received TSN, next expected TSN and the window upper edge (WUE).



#	ID	Received TSN	Next TSN	WUE	T1 TSN
12	0	48	49	48	---
13	0	49	50	49	---
14	0	50	51	50	---
15	0	52	51	52	52
16	0	53	51	53	52
17	0	54	51	54	52
18	0	55	51	55	52
19	0	56	51	56	52
20	0	51	57	56	---
21	0	57	58	57	---

UMTS HSDPA MAC Status View

The main purpose for introducing HSDPA was to enable higher data rates in the downlink.

In terms of quality of service, of greatest interest to the operator is the resulting throughput on different layers – as a function of the existing radio conditions. The following information is available in the **HSDPA Performance View**, divided into five different 2D diagrams, all based on the same timeline:

Requested throughput (requested from the mobile phone, calculated on the basis of the CQI feedback)

- Requested throughput (kbit/s)
- Average CQI received from mobile phone
- Share of QPSK/16QAM modulation (%)
- Average number of HS-DSCH codes

The results are averaged over the number of subframes (100) shown in the HSDPA HS-DPCCH View.

Throughput scheduled by the SCCH (throughput that in fact has been assigned and reached)

- SCCH throughput (kbit/s)
- Share of QPSK/16QAM modulation (%)
- Requested average number of HS-DSCH codes

The results are averaged over the number of subframes (100) shown in the HSDPA HS-DPCCH View.

Delta throughput (scheduled throughput – requested throughput)

- Delta throughput (kbit/s)
- Delta share of QPSK/16QAM modulation (%)
- Delta average number of HS-DSCH codes

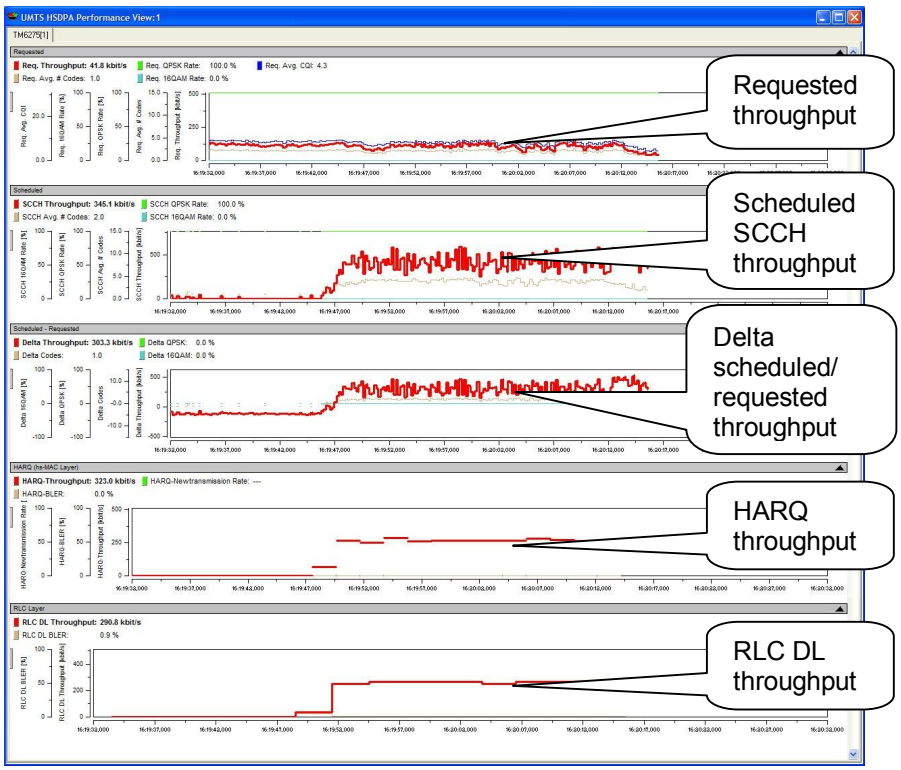
The results are averaged over the number of subframes (100) shown in the HSDPA HS-DPCCH View.

HARQ throughput (similar to the scheduled throughput, but includes re-transmissions)

- HARQ throughput (kbit/s)
- HARQ new transmission rate (%)
- HARQ BLER (%)

RLC downlink throughput (RLC blocks that the mobile phone receives from the network)

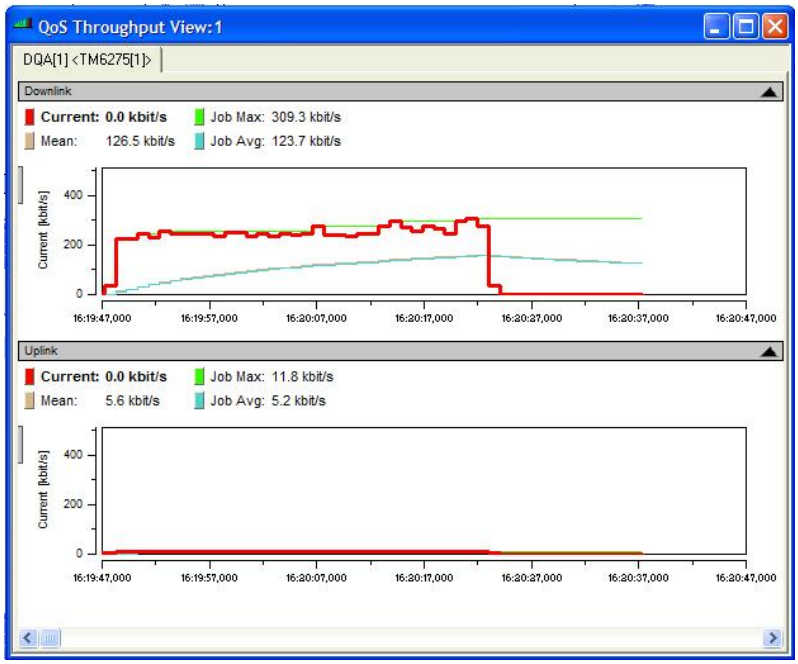
- RLC downlink throughput (kbit/s)
- RLC DL BLER (%)



UMTS HSDPA Performance View

The graphical display of all of the above diagrams can be widely adapted by the user.

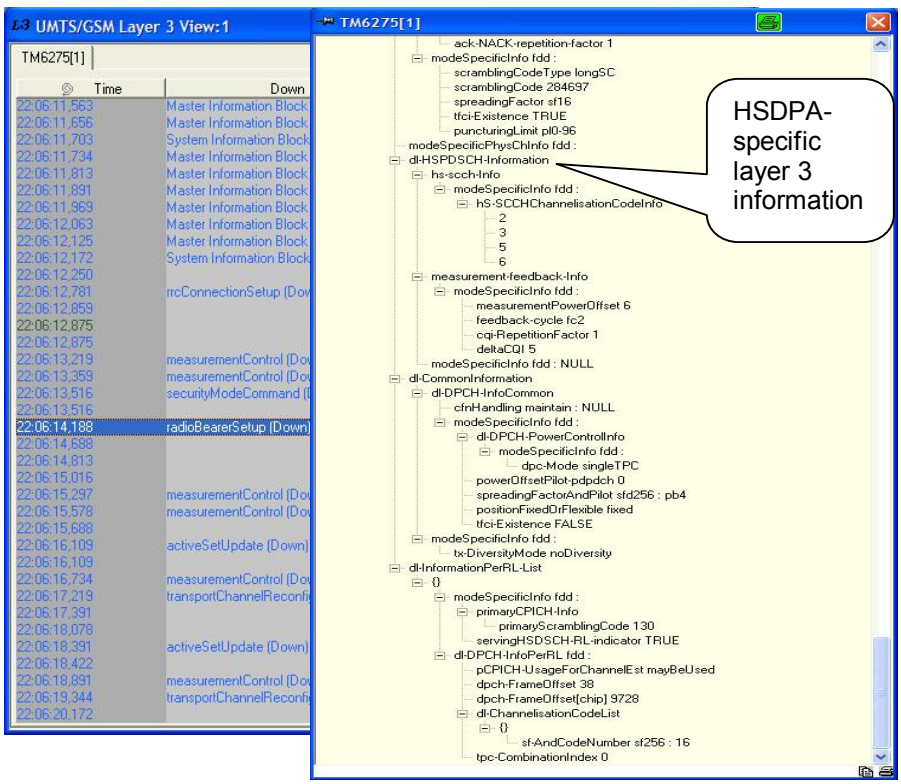
The actual throughput on application layer is shown specifically for the application (e.g. FTP download) in a separate window as part of the Data Quality Analyzer module in R&S ROMES (see also the "Quality of Service Measurements" section):



QoS Throughput View

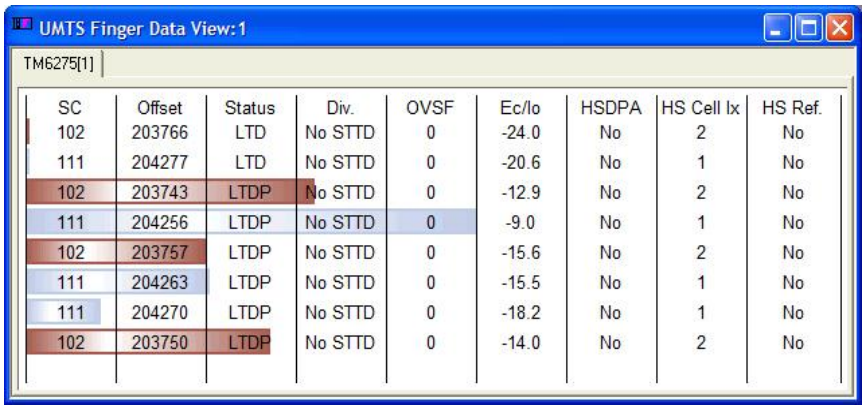
In addition to the completely new HSDPA-specific windows, other HSDPA-related information has been introduced in already existing windows.

For example, all HSDPA-specific layer 3 messages are shown and completely decoded in the UMTS Layer 3 Message View.



Layer 3 messages and detail view

Another example is the layer 1 rake finger data view, which provides the HSDPA status for each of the mobile phone's rake receiver fingers. The bar shows the E_c/I_o signal strength if it exceeds a selected minimum strength.



SC	Offset	Status	Div.	OVSF	Ec/Io	HSDPA	HS Cell Ix	HS Ref.
102	203766	LTD	No STTD	0	-24.0	No	2	No
111	204277	LTD	No STTD	0	-20.6	No	1	No
102	203743	LTDP	No STTD	0	-12.9	No	2	No
111	204256	LTDP	No STTD	0	-9.0	No	1	No
102	203757	LTDP	No STTD	0	-15.6	No	2	No
111	204263	LTDP	No STTD	0	-15.5	No	1	No
111	204270	LTDP	No STTD	0	-18.2	No	1	No
102	203750	LTDP	No STTD	0	-14.0	No	2	No

UMTS Finger Data View

Finally, the following **additional** HSDPA-specific signals are provided by R&S ROMES (i.e. the test device), which can be evaluated in user-defined 2D charts or alphanumeric views. It is also possible to export the following values:

HSDPA Decode Summary

- Decode Attempt Rate
- Decode Success Rate
- DSCH Passed Rate
- DSCH Failed Rate
- DSCH DTX Rate
- Retransmission Rate
- Max. Transport Block Size
- Min. Transport Block Size
- Average Transport Block Size
- SCCH Max. # Codes
- SCCH Min. # Codes
- SCCH Avg. # Codes
- SCCH Throughput When Served
- SCCH Throughput When Scheduled
- MAC Throughput

HSDPA CQI Statistics

- Time Span
- Req. Min. CQI
- Req. Max. CQI
- Req. Min. # of Codes

- Req. Max. # of Codes

HSDPA Modulator Control Table

- Start Global Sub. FN
- No. Subframes

HSDPA SCCH Statistics

- No. Subframes
- No. Subframes SCCH Decoding Attempted
- No. Subframes SCCH valid
- HS-SCCH Success Rate

HSDPA DSCH HARQ Statistics

- HARQ-Throughput
- HARQ-Retransmission Rate

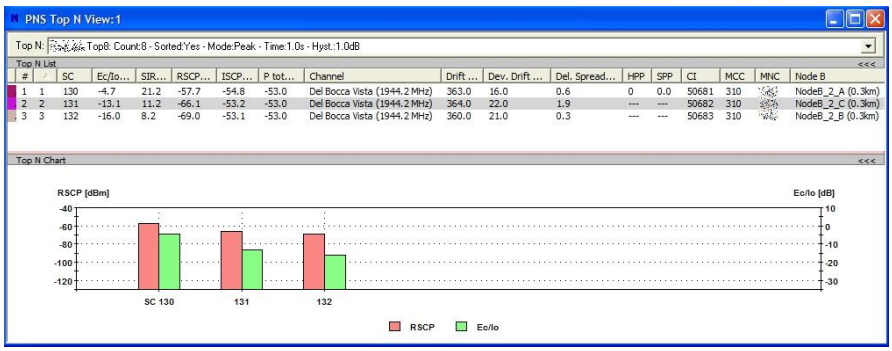
Coverage Measurements

The original purpose of a coverage measurement system (also referred to as a mapping system) is to survey and record the existing coverage and its characteristics during a drive test and to plot the relevant data onto a map.

Coverage measurements do not provide any HSDPA-specific data (especially in idle mode). However, the recorded radio conditions have a considerable influence on HSDPA performance. It is therefore wise to check both aspects in parallel, i.e. to monitor the radio link parameters during an HSDPA download and compare them with the achieved data rates.

Coverage measurements may be performed by test mobile phones performing calls (preferably HSDPA data calls) and by the R&S TSMU radio network analyzer, which scans in parallel the radio environment – not necessarily limited to the frequency in question, but the whole frequency spectrum, incl. uplink.

Typically the Top N View provides a very good overview of the WCDMA radio conditions:



PNS Top N View

The following parameters are shown for each CPICH in the Top N pool:

SC: scrambling code

E_c/I_o: averaged energy per chip / total inband energy during one chip

SIR: signal to interference ratio

RSCP: received signal code power

ISCP: interference power

P_{total}: total average inband power

Frequency of the CPICH

Drift: mean time drift of P-CPICH signal

Dev. drift: 90% confidence interval width of mean time drift

Delay spread: RMS delay spread

HPP: hard pilot pollution

SPP: soft pilot pollution

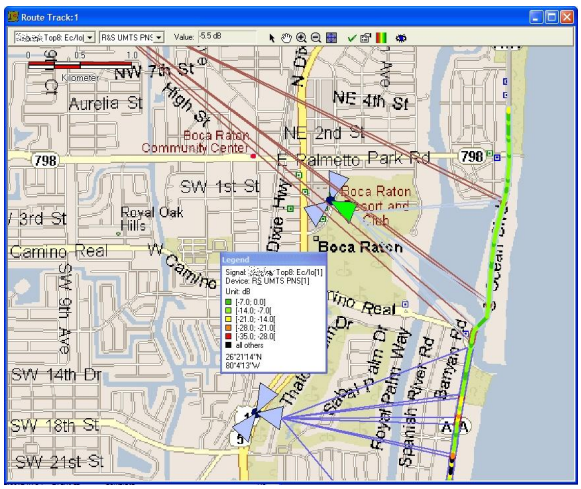
CI: cell identity (with R&S TSMU BCH demodulation option)

MCC: mobile country code (with R&S TSMU BCH demodulation option)

MNC: mobile network code (with R&S TSMU BCH demodulation option)

Name of closest Node B using this SC (of Node B database if available)

As a typical output, the E_c/I_o may be plotted onto a map; additionally the best serving cell is indicated by a colored line:



Route Track View

If certain limits of e.g. E_c/I_o or RSCP are of interest, it is possible to define an "event", i.e. to indicate during measurement or replay the achievement of a predefined threshold. Such indication may be visual or by an audio signal, or both, depending on user definition. You can also differentiate between a positive or negative slope.

Quality of Service Measurements

With the R&S ROMES DQA (Data Quality Analysis) module, which is fully integrated into the R&S ROMES coverage measurement software, Rohde & Schwarz offers a reliable tool for quality of service measurements for packet-switched data with respect to the 3GPP/ETSI specification process. For circuit-switched calls, the network quality analyzer (NQA) provides ETSI-specified call parameters such as dropped call rate, for example.

The DQA can handle up to five mobile phones simultaneously. This makes benchmarking of different networks under the same conditions very easy.

The DQA measurements are fully configurable since the DQA offers jobs which can be combined in any order of sequence:

Connect to Network

Disconnect from Network

Ping

HTTP Download

FTP Download

FTP Upload

FTP Upload and Download simultaneously

UDP Download

UDP Upload and Download simultaneously

Web Browsing

E-mail Upload

E-mail Download

Each job is configured independently. For example, if five parallel connections need to be tested, five connection jobs with up to five different dialup connections have to be configured.

The DQA offers a variety of pre-defined views to show the results of the different jobs and to present the automatically prepared statistics. Examples of these views are the Qos Report View, which shows a statistic of the connection jobs, or session-specific reports such as the FTP Download Report View, for example.

For HSDPA, the preferred job would be a FTP or HTTP download. The measurement results analyzed by the DQA are combined with the tracing information of the HSDPA test mobile phone, e.g. application throughput in comparison to requested or scheduled throughput (see also the UMTS HSDPA Performance View and QoS Throughput View screenshots).

For further details of the DQA, please see reference [6].

In parallel the related general radio conditions are checked using the R&S TSMU radio network analyzer, e.g. E_c/I_o, RSCP, SC, etc (see the "Coverage Measurements" section).

4 References

[1] 3GPP TS 25.141 Technical Specification, 3rd Generation Partnership Project; Technical Specification Group Radio Access Network; Base Station (BS) conformance testing (FDD) (Release 5)

[2] Universal Radio Communication Tester R&S CMU300 Product Brochure

[3] Universal Radio Communication Tester R&S CMU300 Specifications

[4] R&S ROMES-US1 (R&S ESPI / R&S FSP) and R&S ROMES-US2 (R&S TSMU) Technical Information

[5] Radio Network Analyzer R&S TSMU Data Sheet

[6] R&S ROMES-Z6 (R&S ROMES DQA) and R&S ROMES-Z7 (VSQ Analyzer) Technical Information

5 Abbreviations

3GPP	3rd Generation Partnership Project
ACLR	Adjacent Channel Leakage Ratio
BCH	Broadcast Channel
CDP	Code Domain Power
CPICH	Common Pilot Channel
DL	Downlink
E_c/I_o	Energy per chip / Interference level
EVM	Error Vector Magnitude
FEC	Forward Error Correction
FDD	Frequency Division Duplex
HARQ	Hybrid Automatic Repeat Request
HSFN	High-Speed System Frame Number
HS-DPCCH	High-Speed Dedicated Physical Control Channel
HS-PDSCH	High-Speed Physical Downlink Shared Channel
HS-SCCH	High-Speed Shared Control Channel
HW	Hardware
GUI	Generic User Interface
Node B	WCDMA Base Station
OBW	Occupied Bandwidth
PCDEP	Peak Code Domain Error Power
PEP	Peak Envelope Power
RMC	Reference Measurement Channel
RNC	Radio Network Controller

RSCP	Received Signal Code Power
SC	Scrambling Code
SEM	Spectrum Emission Mask
SFN	System Frame Number
SIB	System Information Block
SW	Software
TrCH	Transport Channel
TX	Transmitter
UE	User Equipment
UE-ID	User Equipment Identity
UL	Uplink

6 Ordering Information

TYPE	Stock No.	Designation
R&S® CMU300	1100.0008.03	UNIVERSAL RADIO COMMUNICATION TESTER FOR BTS TEST
R&S® CMU-B12	1100.5100.02	HW OPTION FOR R&S CMU300: REFERENCE OSCILLATOR OCXO, AGING $3.5x10^{-8}$/YEAR
R&S® CMU-B78	1159.1800.02	HW OPTION FOR R&S CMU300: LAYER 1 BOARD FOR WCDMA DL RX AND UL TX
R&S® CMU-K72	1200.7603.03	SW OPTION FOR R&S CMU300: HS-SCH MONITOR AND HS-DSCH THROUGHPUT MEASUREMENT, R&S CMU-K78 NECESSARY:
R&S® CMU-K75	1150.3200.02	SW OPTION FOR R&S CMU300: WCDMA TX TEST (3GPP/FDD/DL)
R&S® CMU-K78	1157.4802.02	SW OPTION FOR R&S CMU300: BCH SYNCHRONIZATION AND MONITORING (3GPP FDD)
R&S® CMU-K79	1150.4407.02	SW OPTION FOR R&S CMU300: HSDPA TX MEASUREMENTS (NON-SIGNALING, 3GPP/FDD/DL), R&S CMU-K75 NECESSARY

TYPE	Stock No.	Designation
R&S® ROMES	1143.7991.30	R&S ROMES DRIVE TEST SOFTWARE PLATFORM WITH USB HARDLOCK INCL. EXPORT
R&S® ROMES-Z6	1143.8123.04	R&S ROMES SOFTWARE MODULE DQA (DATA QUALITY ANALYZER)
R&S® ROMES-UM1	1156.3031.04	R&S ROMES SOFTWARE MODULE WCDMA - QUALCOMM MSM 62xx BASED
R&S® ROMES-UM4	1156.3031.06	R&S ROMES SOFTWARE EXTENSION HSDPA – QUALCOMM MSM 6275 BASED
R&S® TSMU	1153.6000.02	RADIO NETWORK ANALYZER R&S TSMU
R&S® TSMU-K11	1153.4550.02	OPTION FOR R&S TSMU: WCDMA PN-SCANNER
R&S® TSMU-K14	1153.4614.02	OPTION FOR R&S TSMU: BCH DEMODULATOR
R&S® TSMU-Z1	1166.3786.02	POWER SUPPLY 230V FOR R&S TSMU
R&S® TSMU-Z2	1153.6700.02	RACK ADAPTER 19" FOR R&S TSMU
R&S® TSMU-Z3	1153.6900.02	INDOOR BACKPACK SYSTEM, FRAME WITH ACCU PACK, CHARGER, 2ND BATTERY AND ACCESSORIES
R&S® TS51GA30	1090.7993.15	SYSTEM CASE PORTABLE MEASUREMENT SYSTEM FOR R&S TSMU AND UP TO 4 MOBILE PHONES

ROHDE & SCHWARZ GmbH & Co. KG · Mühldorfstraße 15 · D-81671 München · Postfach 80 14 69 · D-81614 München · Tel (089) 4129 -0 · Fax (089) 4129 - 13777 · Internet: http://www.rohde-schwarz.com