Vector Signal Generator R&S®SMU 200 A

Convenient generation of 3GPP FDD HSDPA signals

With its new option R&S®SMU-K43, the Vector Signal Generator R&S®SMU 200 A is suitable for testing base stations (Node Bs) and user equipment (UE) that support release 5 of the 3GPP standard (HSDPA). The R&S®SMU 200 A handles all necessary signaling tasks ranging from simple component tests to sophisticated performance tests with channel-coded realtime data and radio channel simulation.

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Why HSDPA and what's new about it?

Up to release 4, the entire 3GPP FDD standard was connection-oriented, i.e. radio resources were provided exclusively to a specific user for the duration of the data transmission. Now, HSDPA is also adding packet services to 3GPP. These services have two major differences with respect to their earlier requirements:

- Higher peak data rates (e.g. for downloading an Internet page) are required. Yet, the intervals between the requests (e.g. the time needed for reading the page) are longer.
- The realtime requirements are lower and defective blocks may be repeated (this increases the net data throughput since the code error protection can be lower).

HSDPA meets these two requirements by using three new channels. On the downlink, HS-SCCH (control channel) and up to 15 HS-PDSCHs (data channels) are time-multiplexed among the UE, i.e. the packets are transmitted by interleaving.

On the uplink, the UE (e.g. a mobile phone) can acknowledge the correct reception of a packet (ACK/NAK) via the HS-DPCCH and can also indicate a preferred modulation mode (CQI).

TX measurements at a keystroke

Although 3GPP FDD with HSDPA is a very complex standard, some tests (especially on amplifiers and similar components) require only relatively simple measurement signals. The Vector Signal Generator R&S®SMU 200 A meets this requirement by offering factory-ready test models. You can activate them quickly from the upper control level. FIG 1 provides an example of EVM measurements on a base station.

Receiver tests on base stations

While correct modulation parameters (e.g. symbol rate, filter, signal amplitude distribution) are sufficient for the component test, the receiver test calls for signals with correct frame structure and data contents. You can primarily use channel-coded PRBS sequences, but precalculated data lists or even realtime dynamic data can also be fed in via USB.

The signal is generated by a DSP or FPGA, making setting times of significantly less than one second possible. FIG 2 shows the complete test setup. The Vector Signal Generator R&S®SMU 200 A, which is triggered by the base station, simulates a coded signal of a UE. The base station reverses modulation, spreading and channel coding and internally evaluates the bit or block error ratio.

Although the TS 25.141 test specification currently stipulates only very simple HS-DPCCH channels, option R&S®SMU-K43 supports this new channel with a variety of parameters to ensure that even complex UE responses can be simulated (FIG 3).

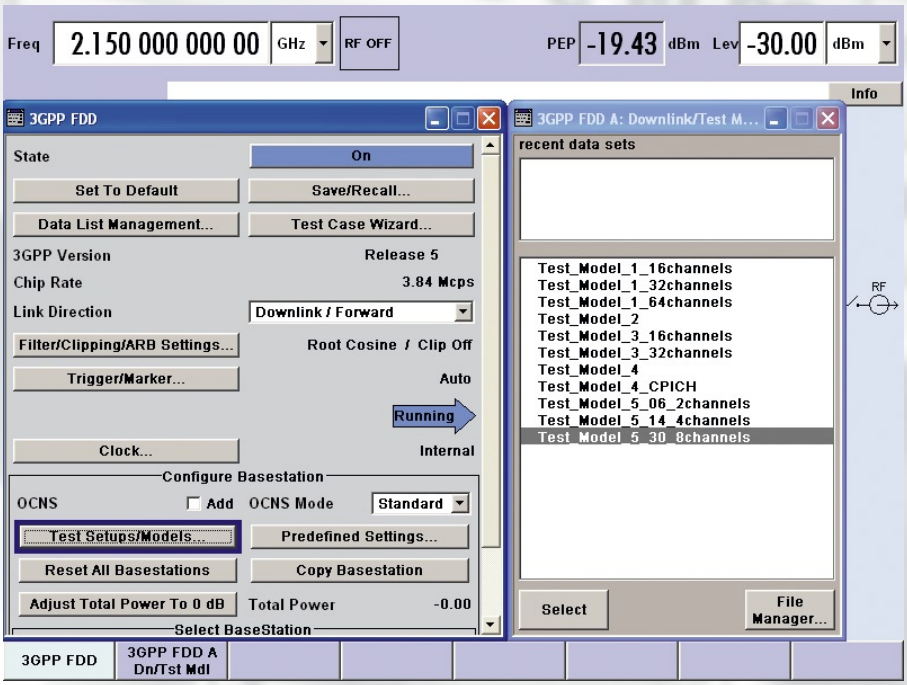

FIG 1 Easy selection of a test signal for EVM measurements on HSDPA base stations.

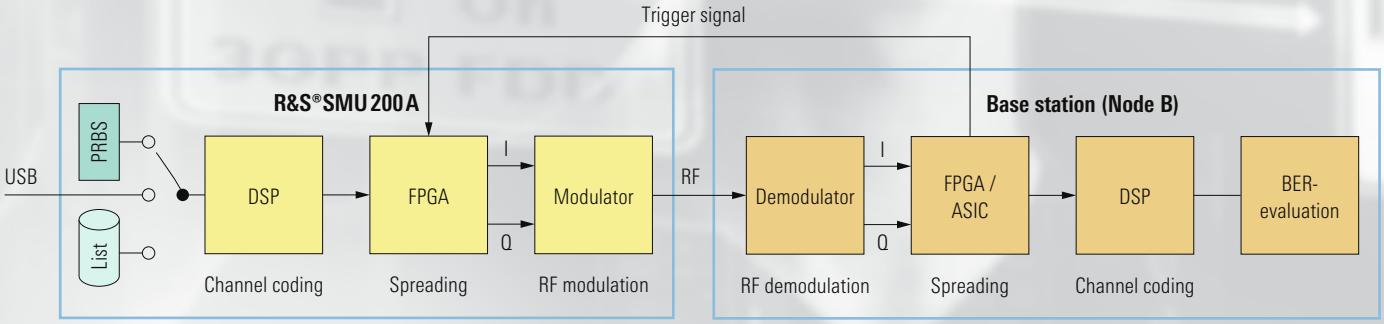

FIG 2 Basic schematic of the receiver test on base stations.

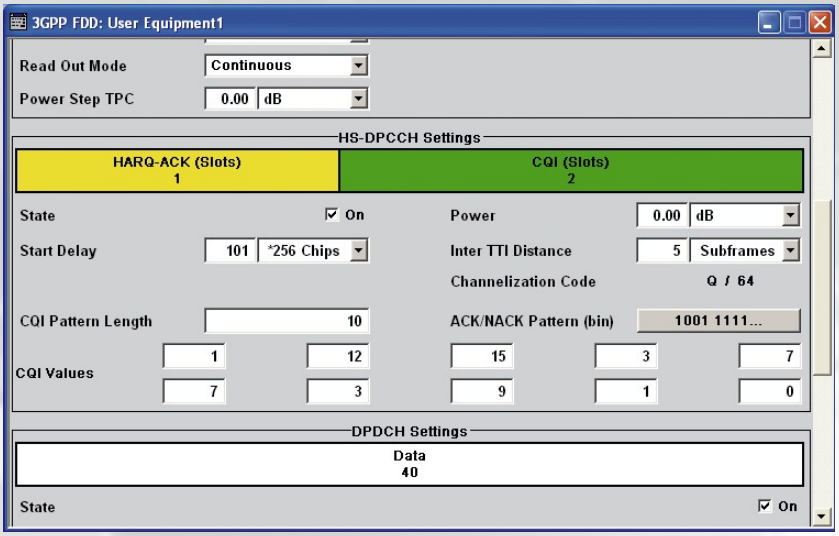

FIG 3 HS-DPCCH settings.

Receiver tests on UE

Receiver tests on UE place very high demands on test equipment since the maximum data rate on the downlink (so far only 384 kbit/s) has increased significantly. The new option supports information data rates of up to 2.3 Mbit/s (H-Sets 1 to 5). This corresponds to a physical data rate of 3.6 Mbit/s.

Owing to its user-friendly operating concept, the Vector Signal Generator R&S®SMU 200 A is impressive even when used for such sophisticated tests: When you select the H-Sets, the R&S®SMU 200 A sets all required parameters to standard-conforming values (FIG 4). During the test, you only have to set the number of the H-Set (e.g. 3) and the modulation mode (e.g. 16QAM). The measurement channel (consisting of one HS-SCCH and four HS-PDSCHs) will then be simulated.

All 3GPP FDD test cases for base stations and UE can be covered by a single generator. In addition to the second RF path (for transmit diversity tests), you also need the AWGN and fading simulator options. As the available fading profiles have already been expanded for HSDPA tests, the Vector Signal Generator R&S®SMU 200 A with option R&S®SMU-K43 is perfectly equipped for testing components and devices in accordance with release 5 of the 3GPP standard.

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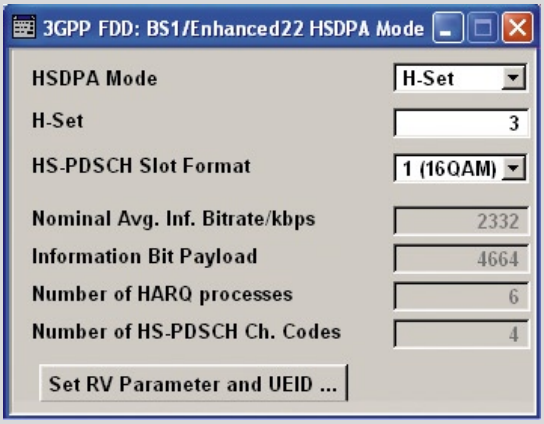
FIG 4 Selection of an HDSPA measurement channel (left); (right) excerpt from the TS 25.101 test specification Table A.27: Fixed Reference Channel H-Set 3.



Parameter	Unit	Value	
Nominal avg. inf. bit rate	kbit/s	1601	2332
Inter TTI distance	TTIs	1	1
Number of HRQ processes	processes	6	6
Information bit payload (N_{INF})	bits	3202	4664
Number code blocks	blocks	1	1
Binary channel bits per TTI	bits	4800	7680
Total available SMLs in UE	SMLs	57600	57600
Number of SMLs per HRQ process	SMLs	9600	9600
Coding rate		0.67	0.61
Number of physical channel codes	codes	5	4
Modulation		QPSK	16QAM

Glossary

3GPP FDD	**Third Generation Partnership Project** Name of a standardization committee (www.3gpp.org) and official name of the mobile radio standard. The FDD version (frequency division duplex) is the most important one and is already used in Japan and Europe.
UMTS	**Universal mobile telephone standard** Mainly used in Europe; synonymous with 3GPP (FDD).
WCDMA	**Wideband code division multiple access** Multiple access method; often synonymous with UMTS/3GPP (FDD).
HSDPA	**High speed downlink packet access** Technology that clearly increases the information data rate on the downlink.
Node B	physical layer, including the air interface.
UE	**User equipment** Term for the 3GPP terminals; can be a mobile phone, a PDA or a PCMCIA card.
HS-PDSCH	**High speed physical downlink shared channel** Data channel for HSDPA on the downlink; fixed spreading factor of 16.
HS-SCCH	**High speed shared control channel** Control channel for HSDPA on the downlink; fixed spreading factor.
HS-DPCCH	**High speed dedicated physical control channel** Control channel for HSDPA on the uplink.
H-Set	Downlink measurement channel for HSDPA receiver tests on user equipment.