R&S®SMU200A
Generating a DL Dual Cell HSDPA Test Signal
Application Sheet

Test & Measurement

Application Sheet

ROHDE&SCHWARZ

The following abbreviations are used throughout this document: R&S®SMU200A is abbreviated as R&S SMU. The options R&S®SMU-Kxx are abreviated as R&S SMU-Kxx

1 Downlink Dual Cell HSDPA Test Signal Generation

This application sheet describes how to configure the R&S SMU to generate a downlink signal for HSDPA performance tests for user equipment (UE) supporting Dual Cell HSDPA (DC-HSDPA) operation. A typical example is the "Demodulation of HS-DSCH" test described in clause 9.2. of the 3GPP TS 34.121 [1].

> The technical specification 3GPP TS 34.121 [1] is used as guideline for this description and some of the values/methods proposed in this document may differ from the values/methods defined in the standard.
>
> Please note that at the time of the release of this document a discussion is ongoing in the 3GPP body about whether or not there should be OCNS configured in the secondary serving cell in case of DC-HSDPA tests. In this document it is presumed that OCNS should be used in the secondary serving cell.

1.1 Options and Equipment Required

The following equipment is required:

- Two-path Vector Signal Generator R&S SMU equipped with:
    - Firmware version 2.10.111.53 or later. Latest firmware version recommended.
    - one of the baseband options per path, e.g. R&S SMU-B10
    - one of the frequency options, e.g. R&S SMU-B103
- 2 x Option R&S SMU-K42, "Digital Standard 3GPP FDD"
- 2 x Option R&S SMU-K43, "3GPP FDD enhanced MS/BS tests incl. HSDPA"
- 2 x Option R&S SMU-B14/B15, "Fading Simulator/Fading Simulator Extensions"
- 1 x Option R&S SMU-K62, "Additive White Gaussian Noise (AWGN)"

1.2 Test Setup

Fig. 1-1: Test Setup

Path A of the R&S SMU generates the DL signal of the serving cell, and path B the signal of the secondary serving cell.

1.3 Assumptions

The DC-HSDPA performance requirements for HS-DSCH demodulation tests are defined as minimum performance requirements for the UEs supporting one of the HS-DSCH categories 21-24. The 3GPP TS 34.121 [1] defines tests with several H-Sets per UE category, as well as different propagation conditions and power levels.

The example in this document does not cover all possible cases but focuses on one particular example. An overview of the used settings is provided in table 1-1.

Table 1-1: DC-HSDPA test parameters for testing Single Link Performance - Enhanced Performance Requirements Type 2 - QPSK FRC H-Set 6A (example)

Parameter	Value	Remark
Performance Requirements	Enhanced Performance Requirements Type 2	according to Table 9.2.3C, [1]
HS-DSCH UE Category	Category 21	according to Table 5.1a, [2]
Fixed Reference Channel	H-Set 6A	according to Table 9.2.3C, [1]
$\hat{i}_{or}/I_{oc}$	10.6 dB	according to Table 9.2.1FA.8, [1]
Modulation	QPSK	determines that test parameters for testing QPSK FRC H-Set 6A are used
I_{oc}	-60 dBm/3.84 MHz	according to Table 9.2.1FA.1, [1]
Redundancy and Constellation Version Coding Sequence	{0,2,5,6}	according to Table 9.2.1FA.1, [1]
Maximum Number of HARQ Transmissions	4	according to Table 9.2.1FA.1, [1]
Propagation Conditions	PA3	according to Table 9.2.1FA.8, [1]
HS-PDSCH E_c/I_{or}	-2.9 dB	according to Table 9.2.1FA.8, [1]
Level Set for HSDPA Measurements	Level Set 3	according to Table E.5.9, [1]
P-CPICH Ec/Ior	-9.9 dB	according to Table E.5.8, [1]
P-CCPCH Ec/Ior	-11.9 dB	according to Table E.5.8, [1]
SCH Ec/Ior	-11.9 dB	according to Table E.5.8, [1]
PICH Ec/Ior	-14.9 dB	according to Table E.5.8, [1]
HS-PDSCH Ec/Ior	-2.9 dB	according to Table E.5.8, [1]
HS-SCCH1 Ec/Ior	-8.4 dB	according to Table E.5.8, [1]
DPCH Ec/Ior	-8.4 dB	according to Table E.5.8, [1]
OCNS for the serving cell	off	according to Table E.5.8, [1]

Parameter	Value	Remark
OCNS for the secondary serving cell	on	
OCNS Channelization Codes	122 to 127 (SF 128)	according to Table E.6.2.1, [1]
DPCH Channelization Code	96 (SF 128)	according to Table E.6.2.1, [1]
HS-SCCH Channelization Code	2 (SF 128)	according to Table E.6.2.1, [1]
Mid Range Frequency	2140 MHz (serving cell) 2145 MHz (secondary serving cell)	according to the table for DC-HSDPA mode in chapter 5.1.1.1, [3]

1.4 Generating a DL DC-HSDPA Test Signal

Adjust the settings of the R&S SMU to generate a test signal suitable for the verification of the ability of the UE to receive a predefined test signal in multi-path fading conditions as follows:

General Workflow

1. Connect the test equipment, see figure 1-1.

2. Preset the R&S SMU to ensure a defined instrument state.

3. Set the noise level and adjust the propagation conditions, see "Configuring the AWGN Noise Source and the Fading Simulator" on page 6.

4. Adjust the frequency of RF output A to the center of the frequencies of both cells, e.g. 2142.5 MHz and activate the RF A output.

5. Select "Baseband A/B > Frequency Offset" and set the frequency offsets to -2.5 MHz and +2.5 MHz respectively.

6. Perform the steps required to establish a connection setup.

7. Adjust the 3GPP FDD settings of the serving and the secondary serving cell, see "Configuring the 3GPP FDD signal of the serving cell (Baseband A)" on page 6 and "Configuring the 3GPP FDD signal of the secondary serving cell (Baseband B)" on page 7.

8. Enable the generation of the 3GPP FDD downlink (DL) signal:
    a) In the path B, set the "3GPP FDD > State" to On
    b) In the path A, set the "3GPP FDD > State" to On.

    HSDPA data is transmitted on both the serving cells.

9. Measure the information bit **Throughput** per cell to verify the receiver's ability to meet the desired performance requirements.

Configuring the AWGN Noise Source and the Fading Simulator

1. Select "Fading A > Signal Routing > A->A|B->A" to enable the routing of the signal of path B to path A.

2. Open the "Fading Settings" dialog in path A (e.g. "Fading > Fading Settings") and perform the following settings:

   Table 1-2: Fading Settings (Path A and Path B)

R&S SMU Dialog	Parameter Name	Value
Fading Settings	Set to Default	
	Standard > 3GPP	3GPP PA3 (UE)
	State	On

   Perform the same fading settings in path B.

3. Open the "AWGN Settings" dialog in path A (e.g. "AWGN/IMP A > AWGN") and perform the following settings:

   Table 1-3: AWGN Settings

R&S SMU Dialog	Parameter Name	Value
AWGN Settings	Mode	Additive Noise
	System Bandwidth	3.84 MHz
	Minimum Noise/System Bandwidth Ratio	3.5
	Reference Mode	Noise
	Noise Level (System Bandwidth)	-60 dBm
	Carrier/Noise Ratio	13.61 dB
	State	On

Configuring the 3GPP FDD signal of the serving cell (Baseband A)

1. Open the "3GPP FDD" main dialog in path A (e.g. "Baseband Block > 3GPP FDD") and perform the following settings:

   Table 1-4: Configuration Settings for R&S SMU Path A

R&S SMU Dialog	Parameter Name	Value
3GPP FDD A Main Dialog	Link Direction	Downlink
Basestation BS1	Preset Channel Table	Reset
		HSDPA H-Set
Basestation BS1 > Channel Table > HS-SCCH Enhanced Channel Config > Enhanced HSDPA Mode	Predefined H-Set	6 (QPSK)
	HARQ Mode	Constant NACK
	Redundancy Version Sequence	0,2,5,6

R&S SMU Dialog	Parameter Name	Value
	Current ARB Seq. Length	Adjust
Basestation BS1	P-CPICH Power	-9.9 dB
	P-CCPCH Power	-11.9 dB
	P-SCH Power	-14.91 dB
	S-SCH Power	-14.91 dB
	PICH Power	-14.9 dB
	DPCH Power (Channel#11)	-8.4 dB
	HS-PDSCH Power	-12.9 dB
	HS-SCCH1 Power	-8.4 dB
	P-CPICH/P-CCPCH/P-SCH/S-SCH/PICH/ DPCH (Channel#11) State	On
	Domain Conflict	Resolve Domain Conflicts
	DPCH Channelization Code	96
	HS-SCCH Channelization Code	2
Basestation BS1 > Channel Table > DPCH Enhanced Channel Configuration	Channel Coding State	On
	Enhanced State	On
Trigger/Marker/Clock	Mode	Auto

2. Use the "Save/Recall" function to save the settings made for path A.

Configuring the 3GPP FDD signal of the secondary serving cell (Baseband B)

1. Use the "Save/Recall" function to load the settings made for path A into path B.

2. In the "Baseband B > 3GPP FDD B > Basestation BS1" dialog, disable the channels P-CCPCH, P-SCH, S-SCH, PICH and DPCH.

3. In the "Baseband B > 3GPP FDD B" dialog, select the "OCNS Mode" HSDPA and set the "OCNS State" to On.

4. In the "3GPP FDD B > Trigger/Marker" dialog, enable trigger mode "Armed Retrigger" and trigger source "Internal (Baseband A)".

1.5 Possible Extensions

The test configuration can be extended for testing DUTs with two antennas in several multi-path fading environments.

The following additional options are necessary:

- 1 x Option R&S SMU-K62, "Additive White Gaussian Noise (AWGN)"
- 1 x Option R&S SMU-K74, "MIMO Fading"
- one of the frequency options, e.g. R&S SMU-B203

1.6 Additional Information

For a comprehensive description of the R&S SMU capabilities and the features provided with the 3GPP FDD, AWGN and Fading Simulator options including the remote control refer to the signal generator help system or to the printable operating manuals:

- SMU_Operating.pdf
- RS_SigGen_3GPP-FDD_Operating.pdf
- RS_SigGen_Fading_Simulatior_Operating.pdf

This documents are available for download on the instrument's internet page.

1.7 References

- [1] 3GPP TS 34.121 "User Equipment (UE) conformance specification; Radio transmission and reception (FDD); Part 1: Conformance specification (Release 9)"
- [2] 3GPP TS 25.306 "UE Radio Access capabilities (Release 9)"
- [3] 3GPP TS 34.108 "Common test environments for User Equipment (UE); Conformance testing (Release 9)"