HSDPA RF Measurements with the R&S®CMW500 in line with 3GPP TS 34.121

Application Note

Products:

- R&S®CMW500

Most of the tests specified in the TS 34.121 standard [1] for 3GPP Release-5 (Rel-5) can be performed with an R&S®CMW500. This document provides a step-by-step guide on how to use a standalone R&S®CMW500 to perform Rel-5 measurements on transmitter characteristics and receiver characteristics in line with TS 34.121 V9.5.0, clauses 5 and 6. Test cases that require additional instruments, such as a fading generator (R&S®SMU200A or R&S®AMU200A) are not discussed in this application note. A set of *.dfl files based on R&S®CMW500 firmware V3.0.10 for user equipment supporting Operating Band I with Power Class 4 is attached to this application note for easy recall of important settings while performing tests in line with the relevant specifications.

Application Note

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1 Introduction

Most of the tests specified in the TS 34.121 standard [1] for 3GPP Release 5 (Rel-5) can be performed with an R&S®CMW500. This document provides a step-by-step guide on how to use a standalone R&S®CMW500 to perform Rel-5 measurements on transmitter characteristics and receiver characteristics in line with TS 34.121 V9.5.0, clauses 5 and 6. A short demo of the testing is presented for each test case using user equipment (UE) supporting Operating Band I and Power Class 4. While carrying out the testing in strict adherence to the 3GPP specification, the testing needs to be performed on several test frequencies depending on the operating bands that the UE supports. Users may refer to the specifications to determine the applicable test points at which the testing needs to be carried out. The demo presented in this application note, on the other hand, concentrates on the test procedure. Consequently, the testing is carried out on one test point only. Also, test cases that require additional instruments, such as a fading generator (R&S®SMU200A or R&S®AMU200A) will not be covered in this application note to simplify the scope of this document. A set of save files based on version V3.0.10 of the R&S®CMW500 firmware for UE that supports Operating Band I and Power Class 4 with a 12.2 kbps reference measurement channel (RMC) plus an HSPA 34.108 test-mode connection is attached to this application note. These save files can be easily called up on any R&S®CMW500 with the same software version to start the testing process quickly.

Within this application note, information on these *.dfl files is marked with this symbol:

1.1 Testing Covered in Line with TS 34.121-1

Table 1 shows the 3GPP transmitter characteristics, receiver characteristics and performance tests that can be performed with the R&S®CMW500.

3GPP Rel-5 transmitter characteristics and receiver characteristics supported by the R&S®CMW500		
Test	**Clause**	**Test parameter**
Transmitter characteristics	5.2A	Maximum output power with HS-DPCCH (Release 5 only)
	5.2AA	Maximum output power with HS-DPCCH (Release 6 and later)
	5.2C	UE relative code-domain power accuracy
	5.7A	HS-DPCCH power control
	5.9A	Spectrum emission mask with HS-DPCCH
	5.10A	Adjacent channel leakage power ratio (ACLR) with HS-DPCCH
	5.13.1A	Error vector magnitude (EVM) with HS-DPCCH
	5.13.1AA	Error vector magnitude (EVM) and phase discontinuity with HS-DPCCH
	5.13.2A	Relative code-domain error with HS-DPCCH
Receiver characteristics [Rel-5]	6.3A	Maximum input level for HS-PDSCH reception (16QAM)
	6.3B	Maximum input level for HS-PDSCH reception (64QAM)
Receiver characteristics [Rel-8]	6.2A	Reference sensitivity level for DC-HSDPA
	6.3C	Maximum input level for DC-HSDPA reception (16QAM)
	6.3D	Maximum input level for DC-HSDPA reception (64QAM)

Table 1: 3GPP measurement supported by the R&S®CMW500.

2 Rel-5 Transmitter Characteristics

2.1 Generic Call Setup for Transmitter Characteristics

All parameters for the transmitter characteristics are defined using the 12.2 kbps uplink (UL) reference measurement channel (RMC) as specified in TS 34.121, Annex C.10.1.1 to C.10.1.4, unless stated otherwise.

The sections below help you configure the test set in line with the recommended parameters as specified in the test specification. Certain test cases that require deviation from the set parameters described below are identified in the respective test cases.

The R&S®CMW500 offers the flexibility to switch the packet-switched (PS) domain ON/OFF and provides an HSPA function. As the testing is conducted in line with Rel-5, the PS domain is switched ON along with the definition of the HSPA test mode to be used. With the selection of the RMC test mode on circuit-switched (CS) + HSPA 34.108, a PS call is established along with a 12.2 kbps RMC CS connection as defined in 3GPP TS 34.108 [2]. Such a connection is required for all test cases mentioned in this application note.

Configuration of RMC in the R&S®CMW500:
WCDMA-UE Signaling → PS Domain → On [check mark]
WCDMA-UE Signaling → UE Term. Connect → RMC
WCDMA-UE Signaling → RMC Data Rate → DL RMC 12.2 UL 12.2
WCDMA-UE Signaling → HSPA Test Mode → On [check mark]
WCDMA-UE Signaling → Procedure → RMC on CS Domain + HSPA 34.108
WCDMA-UE Signaling → Direction → HSDPA

Fig.1 illustrates the test-mode configuration that must be set up for all of the test cases described in the rest of this document.

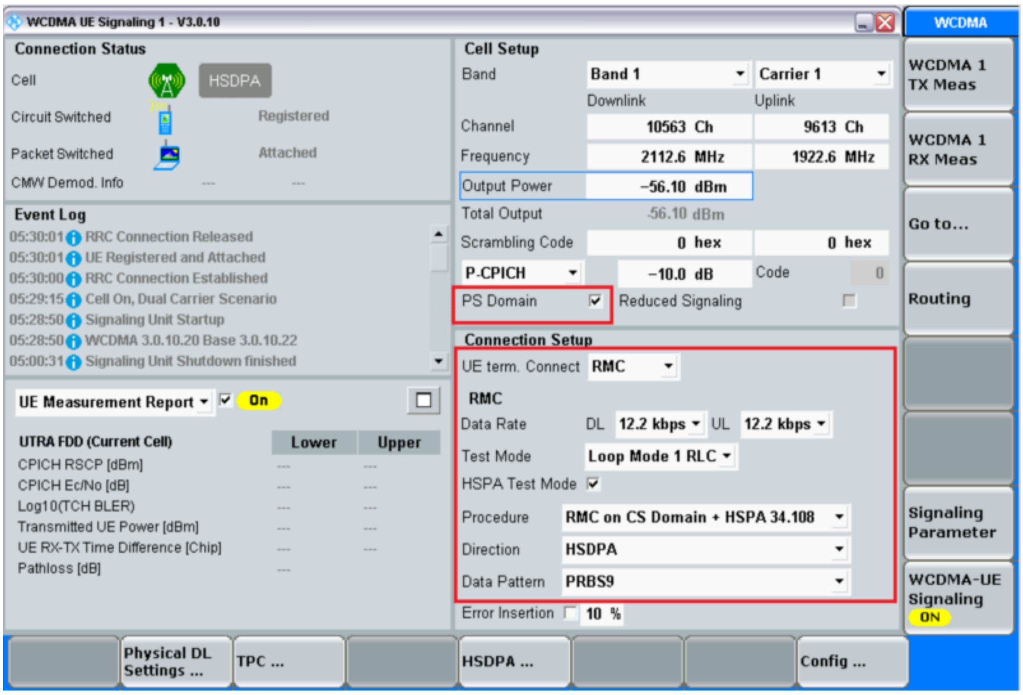

Fig. 1: 12.2 kbps + HSDPA 34.108 RMC configuration.

The content of the transport channel reconfiguration message content in line with Annex I of TS34.121 needs to be used for test cases with high-speed download packet access (HSDPA) as specified in clauses 5.2A, 5.2AA, 5.2C, 5.7A, 5.9A, 5.10A, 5.13.1A, 5.13.1AA and 5.13.2A. When test-specific content requires a deviation from this, that fact is stated in the test description for the relevant test cases. In such cases, those instructions override the generic settings mentioned below.

Content of the transport channel reconfiguration message: HSDPA		
Information element	**Value/Remark**	**Version**
Uplink DPCH info – Uplink DPCH power control info – Ack-Nack repetition factor	 3	Rel-6 Rel-5
Downlink HS-PDSCH Information – Measurement feedback info – CQI feedback cycle, k – CQI repetition factor	 4 ms 2	 Rel-5 Rel-5

Table 2(a): Content of the transport channel reconfiguration message: HSDPA (Annex I of TS 34.121 [1])

Configuring the radio bearer setup message for HSDPA on the R&S®CMW500:
WCDMA-UE Signaling → Config. → HSDPA → CQI Feedback Cycle → 4 ms
WCDMA-UE Signaling → Config. → HSDPA → CQI Repetition Factor → 2
WCDMA-UE Signaling → Config. → HSDPA → ACK/NACK Repetition Factor → 3

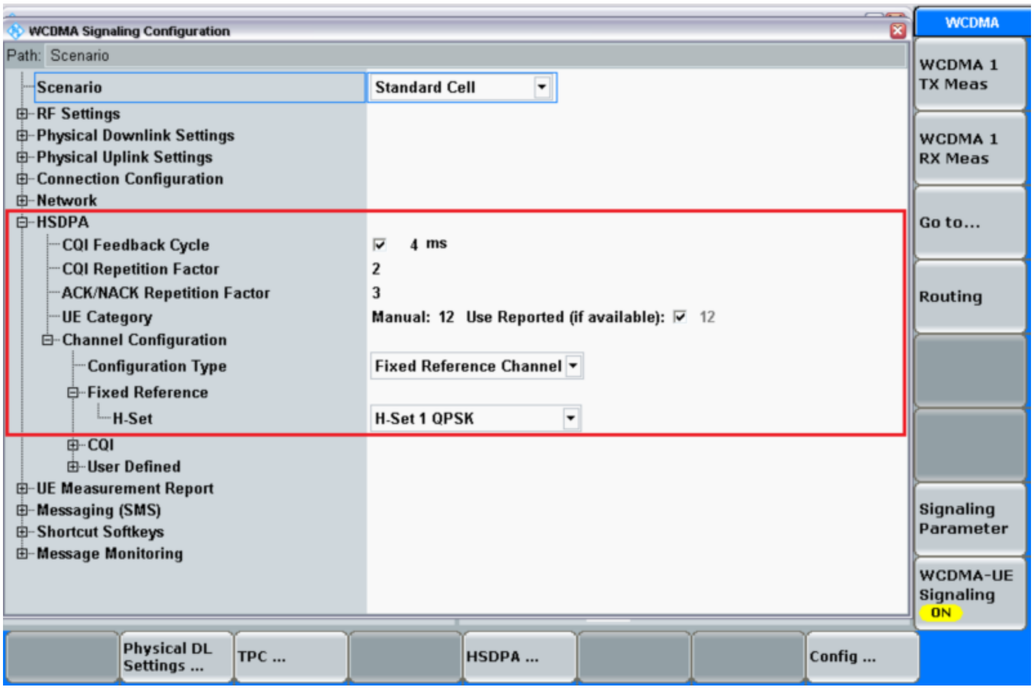

Fig. 2: HS-DSCH configuration – transport channel and fixed reference channel (H-Set).

The content of the RRC connection setup message is the "UM message" in 9.2 of TS 34.108 [2]; this is used to configure an HSDPA call with the following exceptions:

Content of the RRC connection setup message: UM	
Information Element	**Value/remark**
– Default DPCH Offset Value	Arbitrarily set to a value of 1536…306176 by a step of 2560 (this corresponds to a 0.5 slot timing offset between the DPCCH and the HS-DPCCH)

Table 2(b): Content of the RRC connection setup message: UM (section 7.3.6.4.3 of TS 34.121 [1]).

Configuring the DL DPCH Timing Offset on the R&S®CMW500:

*WCDMA-UE Signaling → Config. → Physical Downlink Settings → DPCH Enhanced → Timing Offset → 6 * 256 chip*

Since there can be a timing offset between the HS-DPCCH and the DPCCH, this could potentially lead to a power step of up to 7 dB, depending on the β factors used. The standard introduces test cases to measure the accuracy of the power steps when the HS-DPCCH time is not aligned with the DPCCH time. Due to the varying timing offset between the DPCCH and HS-DPCCH, a half-slot timing offset between the DPCCH and HS-DPCCH is recommended as a standard for test cases that measure the power-step accuracy.

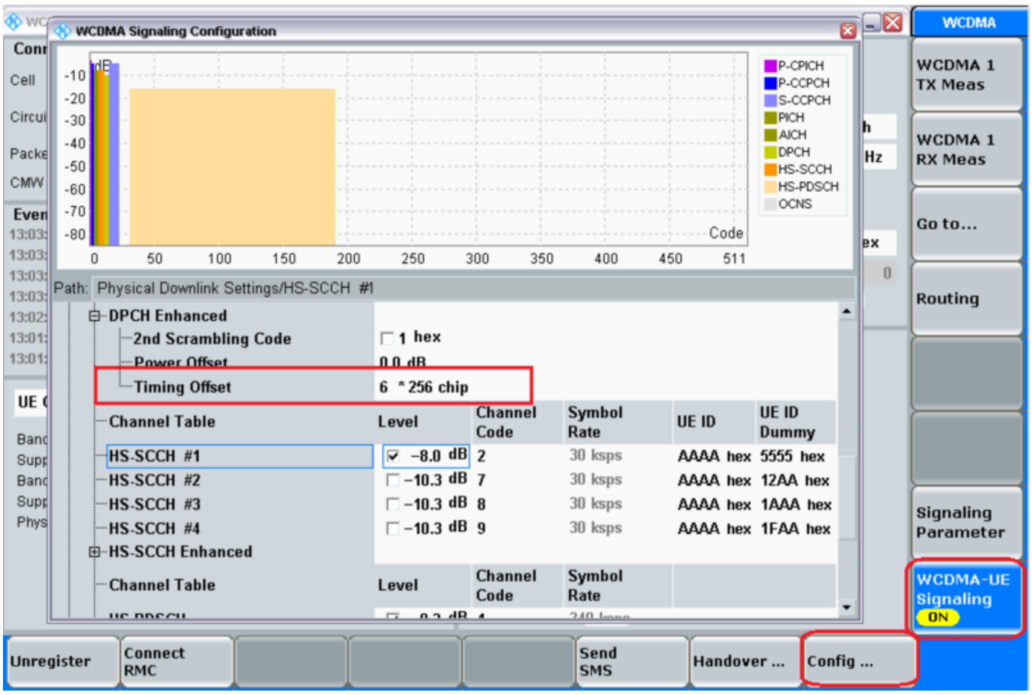

Fig. 3: DL DPCH timing offset configuration.

Table 3(a) shows the β values for transmitter characteristic tests with HS-DPCCH.

β values for transmitter characteristic tests with HS-DPCCH							
Subtest	**βc**	**βd**	**βd *(SF)***	**βc / βd**	**β_{HS} (Note1, Note *2)***	**CM, dB *(*Note 3*)***	**MPR, dB (Note 3)**
1	2/15	15/15	64	2/15	4/15	0.0	0.0
2	12/15 (Note 4)	15/15 (Note 4)	64	12/15 (Note 4)	24/15	1.0	0.0
3	15/15	8/15	64	15/8	30/15	1.5	0.5
4	15/15	4/15	64	15/4	30/15	1.5	0.5

Notes:
1. ΔACK, ΔNACK and ΔCQI = 30/15 with β_{HS} = 30/15 *βc.
2. For clauses 5.2C, 5.7A, 5.13.1A and 5.13.1AA, ΔACK and ΔNACK = 30/15 with β_{HS} = 30/15 *βc, and ΔCQI = 24/15 with β_{HS} = 24/15 * βc.
3. CM = 1 for βc/βd =12/15, β_{HS} /βc = 24/15. For all other combinations of DPDCH, DPCCH and HS-DPCCH, the MPR is based on the relative CM difference. This is applicable for only UEs that support HSDPA in release 6 and later releases.
4. For Subtest 2, the βc/βd ratio of 12/15 for the TFC during the measurement period (TF1, TF0) is achieved by setting the signaled gain factors for the reference TFC (TF1, TF1) to βc = 11/15 and βd = 15/15.

Table 3(a): β values for transmitter characteristics tests with HS-DPCCH (Table C.10.1.4 of TS 34.121 [1]).

Tables 3(b), 3(c) and 3(d) show the signaled value for the gain factors βc, βd, ΔACK, ΔNACK and ΔCQI on the R&S®CMW500 and a summary of gain factor settings on the R&S®CMW500 respectively.

Signaled value for gain factors βc and βd	
Signaled value for βc and βd	**Quantized amplitude ratio for βc and βd**
15	15/15
14	14/15
13	13/15
12	12/15
11	11/15
10	10/15
9	9/15
8	8/15
7	7/15
6	6/15
5	5/15
4	4/15
3	3/15
2	2/15
1	1/15

Table 3(b): Signaled value for gain factors βc and βd on the R&S®CMW500.

Signaled value for gain factors ΔACK, ΔNACK and ΔCQI	
Signaled value for ΔACK, ΔNACK and ΔCQI	**Quantized amplitude ratio (β_{HS} / βc)**
8	30/15
7	24/15
6	19/ 5
5	15/15
4	12/15
3	9/15
2	8/15
1	6/15
0	5/15

Table 3(c): Signaled value for gain factors ΔACK, ΔNACK and ΔCQI on the R&S®CMW500.

Summary of gain factor settings on the R&S®CMW500					
Subtest	**βc**	**βd**	**ΔACK**	**ΔNACK**	**ΔCQI**
1	2	15	8	8	8
2	11	15	8	8	8
3	15	8	8	8	8
4	15	4	8	8	8

Table 3(d): Summary of gain factor settings on the R&S®CMW500.

Configuration to set the β gain factors on the R&S®CMW500:
WCDMA-UE Signaling → Config. → Physical Uplink Settings → Gain Factors → HSDPA → βc → 2 (Subtest 1), 11 (Subtest 2) or 15 (Subtests 3 and 4)
WCDMA-UE Signaling → Config. → Physical Uplink Settings → Gain Factors → HSDPA → βd → 15 (Subtests 1 and 2), 8 (Subtest 3) or 4 (Subtest 4)
WCDMA-UE Signaling → Config. → Physical Uplink Settings → Gain Factors → HSDPA → ΔACK → 8
WCDMA-UE Signaling → Config. → Physical Uplink Settings → Gain Factors → HSDPA → ΔNACK → 8
WCDMA-UE Signaling → Config. → Physical Uplink Settings → Gain Factors → HSDPA → ΔCQI → 8 (for Subtests 1, 2, 3 and 4 of all clauses except clauses 5.2C, 5.7A, 5.13.1A and 5.13.1AA) or 7 (for Subtests 1, 2, 3 and 4 in clauses 5.2C, 5.7A, 5.13.1A and 5.13.1AA)

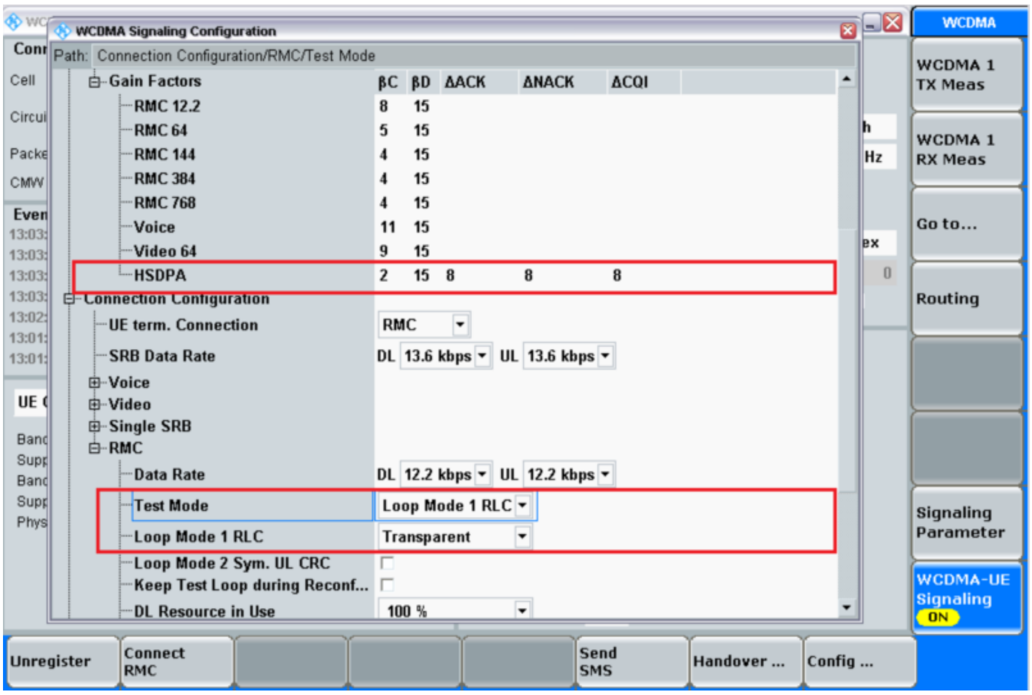

Fig. 4: β ***values and test mode configuration for transmitter characteristics tests with an HS-DPCCH configuration.***

Unless stated otherwise, all parameters for transmitter characteristics in this application note are defined using a fixed reference channel (FRC H-Set 1, QPSK version or 16QAM version) as specified in Table 4.

H-Set 1 refers to an inter-TTI distance of 3. This H-Set is used in all the TX test cases, because all commercially available UE supports it. Please note that the R&S®CMW-KS401 option is required for QPSK and 16QAM, and R&S®CMW-KS403 is required for 64QAM.

Table 4 shows the definition for the fixed reference channel H-Set 1.

Fixed reference channel H-Set 1			
Parameter	**Unit**	**Value**	
Nominal avg. inf. bit rate	kbps	534	777
Inter-TTI distance	TTIs	3	3
Number of HARQ processes	Processes	2	2
Information bit payload (N_{INF})	Bits	3202	4664
MAC-d PDU size	Bits	336	336
Number of code blocks	Blocks	1	1
Binary channel bits per TTI	Bits	4800	7680
Total available SMLs in UE	SMLs	19200	19200
Number of SMLs per HARQ proc.	SMLs	9600	9600
Coding rate		0.67	0.61
Number of physical channel codes	Codes	5	4
Modulation		QPSK	16QAM

Note:
The HS-DSCH shall be transmitted continuously with constant power, but only every third TTI shall be allocated to the UE under test.

Table 4: Fixed reference channel H-Set 1 (Table C.8.1.1 of TS 34.121 [1])

Configuration of the HSDPA channels in the R&S®CMW500:

Signaling Parameter → HSDPA → Channel Configuration Type → Fixed Reference Channel

Signaling Parameter → HSDPA → Channel Configuration → Fixed Reference → H-Set → H-Set1 QPSK [or H-Set1 16QAM]

Table 5(a) shows the downlink physical channels for HSDPA measurement for subclauses 5.2A, 5.2AA, 5.2C, 5.7A, 5.9A, 5.10A, 5.13.1A, 5.13.1AA, 5.13.2A, 6.3A and 6.3B as specified in Table E.5.1 of TS 34.121 [1].

Downlink physical channels for HSDPA receiver testing for single-link performance		
Physical Channel	**Parameter**	**Value**
P-CPICH	P-CPICH_Ec/Ior	–10 dB
P-CCPCH	P-CCPCH_Ec/Ior	–12 dB (Note 1)
SCH	SCH_Ec/Ior	–12 dB (Note 2)
PICH	PICH_Ec/Ior	–15 dB
DPCH	DPCH_Ec/Ior	Test-specific
HS-SCCH-1	HS-SCCH_Ec/Ior	Test-specific (Note 3)
HS-SCCH-2	HS-SCCH_Ec/Ior	DTX (Note 4)
HS-SCCH-3	HS-SCCH_Ec/Ior	DTX (Note 4)
HS-SCCH-4	HS-SCCH_Ec/Ior	DTX (Note 4)
HS-PDSCH	HS-PDSCH_Ec/Ior	Test-specific
OCNS		Necessary power so that total transmit power spectral density of Node B (Ior) adds to one

Notes:
1. Mean power level is shared with SCH.
2. Mean power level is shared with PCCPCH – SCH and includes P- and S-SCH, with power split between both.
3. Specifies fraction of Node-B radiated power transmitted when TTI is active (i.e. due to minimum inter-TTI interval). During TTIs in which the HS-SCCH is not allocated to the UE, the HS-SCCH shall be transmitted continuously with constant power.
4. No signaling scheduled, or power radiated, on this HS-SCCH, but signaled to the UE as present.

Table 5(a): Downlink physical channels for HSDPA receiver testing for single-link performance (Table E.5.1 of TS 34.121 [1])

Table 5(b) shows the downlink's physical channels for transmitter characteristics with HS-DPCCH in subclauses 5.2A, 5.2AA, 5.2C, 5.7A, 5.9A, 5.10A, 5.13.1A, 5.13.1AA and 5.13.2A, as specified in Table E.5.10 of TS 34.121 [1].

Downlink physical channels for transmitter characteristics with HS-DPCCH		
Physical Channel	**Parameter**	**Value (dB)**
DPCH	DPCH_Ec/Ior	–9
HS-SCCH_1	HS-SCCH_Ec/Ior	–8
HS-PDSCH	HS-PDSCH_Ec/Ior	–3

Table 5(b): Downlink physical channels for transmitter characteristics with HS-DPCCH (Table E.5.10 of TS 34.121 [1]).

Configuration of the Physical Downlink channels on the R&S®CMW500:

WCDMA-UE Signaling → Config. → RF Settings → RF Power Downlink → Output Power (Ior) → –86 dBm
WCDMA-UE Signaling → Config. → Physical Downlink Settings → P-CPICH → –10.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings Channels → P-CCPCH → –12.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → P-SCH → –15.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → S-SCH → –15.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → PICH → –15.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → DPDCH → –9.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-SCCH#1 → –8.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-SCCH#2 → Off
WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-SCCH#3 → Off
WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-SCCH#4 → Off
WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-SCCH Enhanced → Selection → No. 1
WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-SCCH Enhanced → Number of HSSCCH → 4
WCDMA-UE Signaling → Config. → Physical Downlink Settings → OCNS → Release 5
WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-SCCH Enhanced → Unscheduled Subframes → Transmit Dummy UEID
WCDMA-UE Signaling → Physical Downlink Settings → HS-PDSCH → –3.0 dB

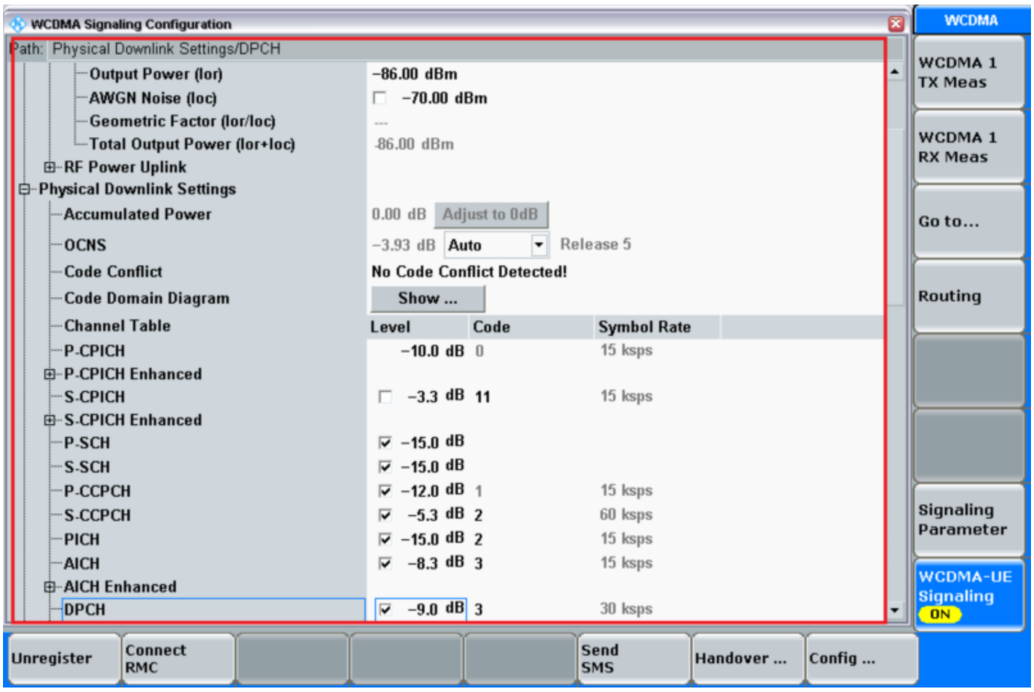

Fig. 5: Configuration of downlink physical channels in line with Table 5(a) and Table 5(b).

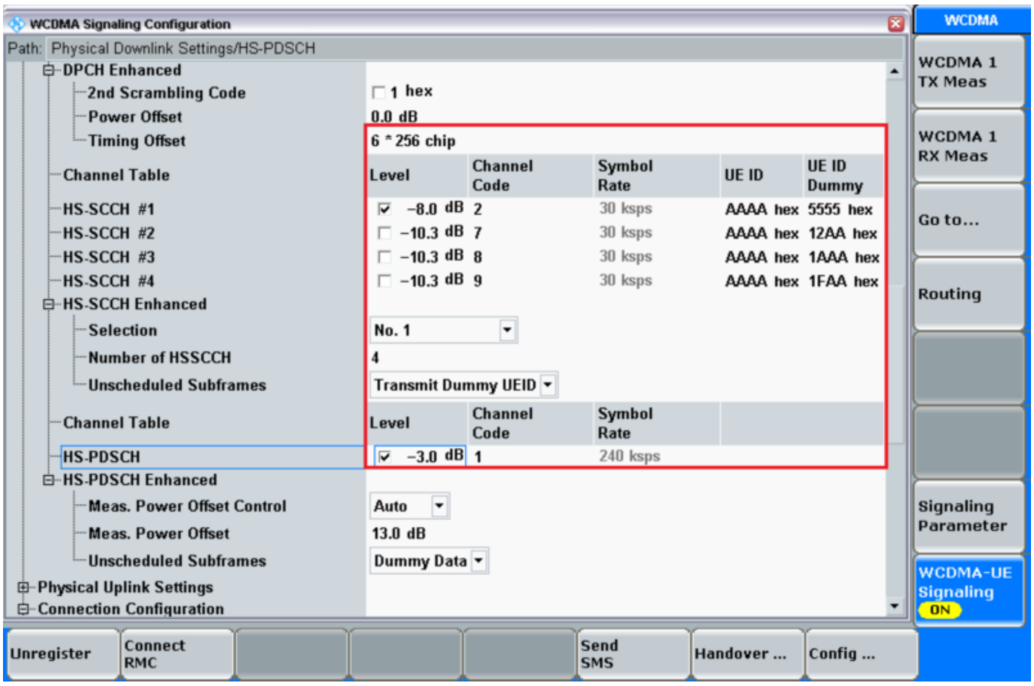

Fig. 6: Configuration of downlink physical channels in line with Table 5(a) and Table 5(b).

Table 6 shows the settings for the serving cell.

Settings for the serving cell during measurement with HS-DPCCH		
Parameter	**Unit**	**Cell 1**
Cell type		Serving cell
UTRA RF Channel Number		Test-dependent value
Qqualmin	dB	–24
Qrxlevmin	dBm	–115
UE_TXPWR_MAX_RACH	dBm	+21
Ior	dBm/3.84 MHz	–86

Table 6: Settings for the serving cell during measurement with HS-DPCCH (Tables 5.2A.1A, 5.2AA.1A, 5.2C.2, 5.7A.1A, 5.9A.2, 5.10A.2, 5.13.1A.2, 5.13.1AA.3 and 5.13.2A.3 of TS 34.121 [1]).

Configuration in the R&S®CMW500:
WCDMA-UE Signaling → Config. → Network → Cell Reselection → Qqualmin → –24 dB
WCDMA-UE Signaling → Config. → Network → Cell Reselection → Qrxlevmin → –115 dBm

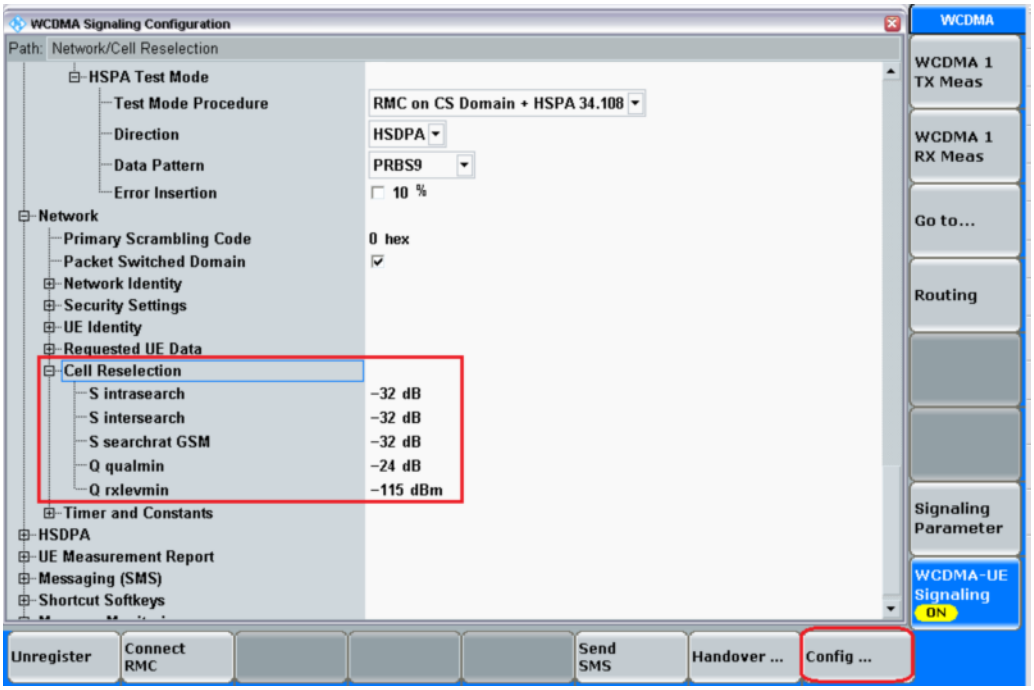

Fig. 7: Cell reselection parameters to be set for the serving cell.

The WCDMA "Multi-Evaluation" application is best prepared to work with the "WCDMA-UE Signaling" application by configuring the "Go to …" shortcut as shown in Fig. 8.

Example: The "Combined Signal Path" scenario is automatically configured when you navigate using the "Go to…" shortcut configured to WCDMA "Multi-Evaluation," which otherwise needs to be configured manually in the WCDMA "Multi-Evaluation" application.

WCDMA – UE Signaling → Config. → Shortcut Softkeys → Select Menu1 → WCDMA FDD UE TX Measurement
WCDMA – UE Signaling → Config. → Shortcut Softkeys → Select as fixed Target1 → Checkmark [√]
WCDMA – UE Signaling → Config. → Shortcut Softkeys → Select Menu1 → WCDMA FDD UE Rx Measurement
WCDMA – UE Signaling → Config. → Shortcut Softkeys → Select as fixed Target1 → Checkmark [√]

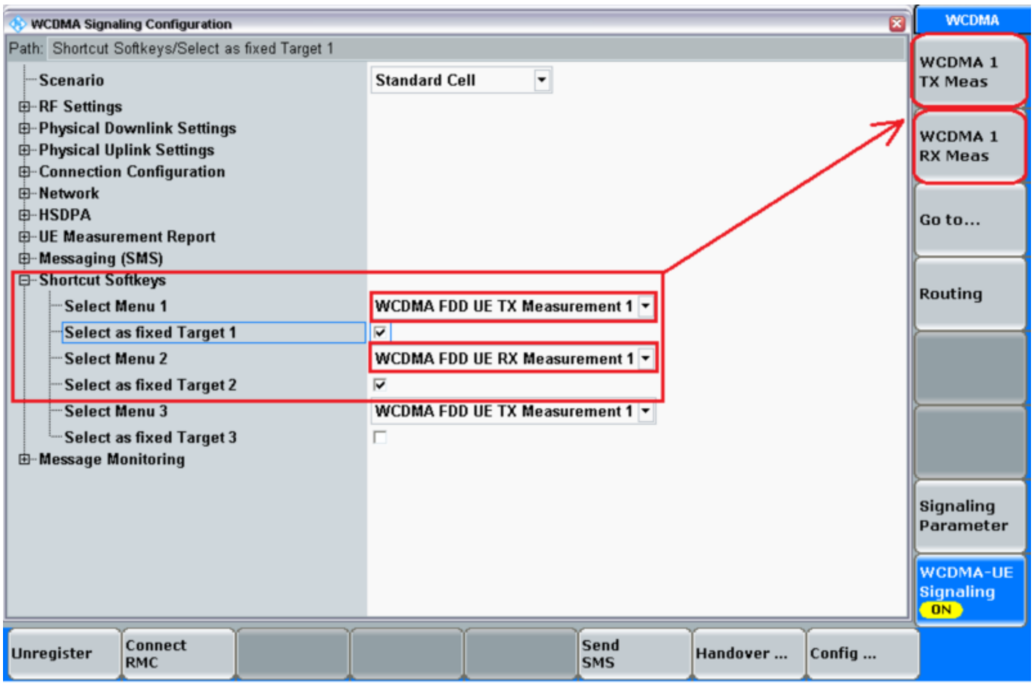

Fig. 8: Configuring the "Go to" shortcut key.

An HSDPA call is setup in line with TS 34.108 [2], subclause 7.3.6. To establish an HSDPA connection, press "Connect RMC" on the R&S®CMW500 once the UE is circuit-switched (CS) "Registered" and packet-switched (PS) "Attached" with the R&S®CMW500.

Note: With a 12.2 kbps + HSPA 34.108 reference channel, the packet-switched connection is set up automatically after the circuit-switched connection so that the R&S®CMW500 reaches this signaling state:
Circuit-switched: "Call Established"
Packet-switched: "Connection Established"

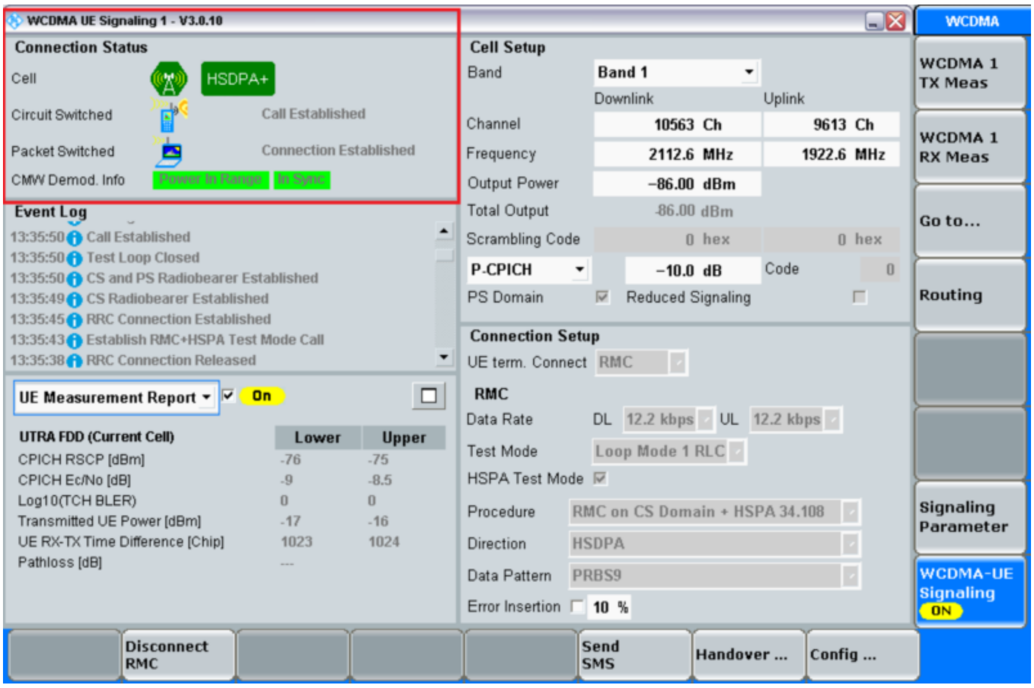

Fig. 9: Packet-switched connection established.

<u>Trigger settings required for HSDPA measurements:</u>

The HS-DPCCH trigger is necessary to ensure that the measurement period contains the transmitted UL HS-DPCCH.

Configuration on the R&S®CMW500:
WCDMA Multi-Evaluation → Trigger → Trigger Source → WCDMA Sig: HS-DPCCH Trigger

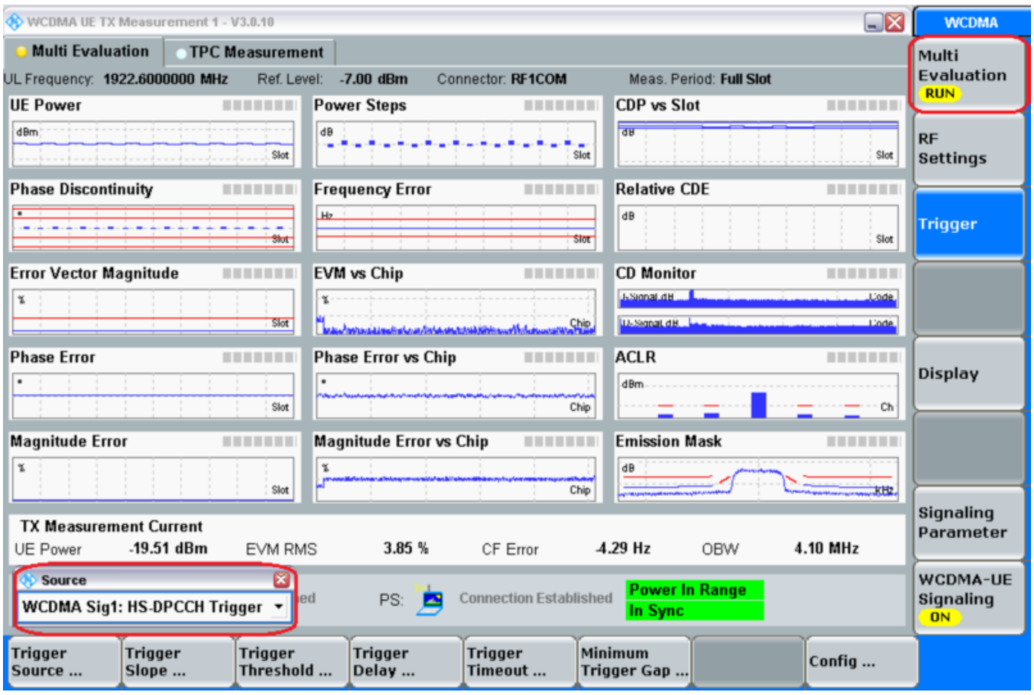

Fig. 10: "Multi-Evaluation" on the R&S®CMW500 – trigger settings.

<u>Measurement Control Settings required for HSDPA measurements:</u>

The "Chn. Detect Threshold" setting needs to be changed in line with the β factors set (Subtests 1 – 4) during the testing. The "Chn. Detect Threshold" corresponds to the ratio of the DPDCH power to the DPCCH power in dB and defines the minimum signal strength of the DPDCH in the WCDMA signal that is to be detected and considered for the measurement. A set of recommended values for the "Chn. Detect Threshold" value to be set for each set of β factors (Subtests 1- 4) is shown below:

WCDMA Multi-Evaluation → Measurement Control → Modulation / CDP → Chn. Detect Threshold → –1 dB (Subtest 1), –10 dB (Subtests 2 and 3) or –20 dB (Subtest 4)

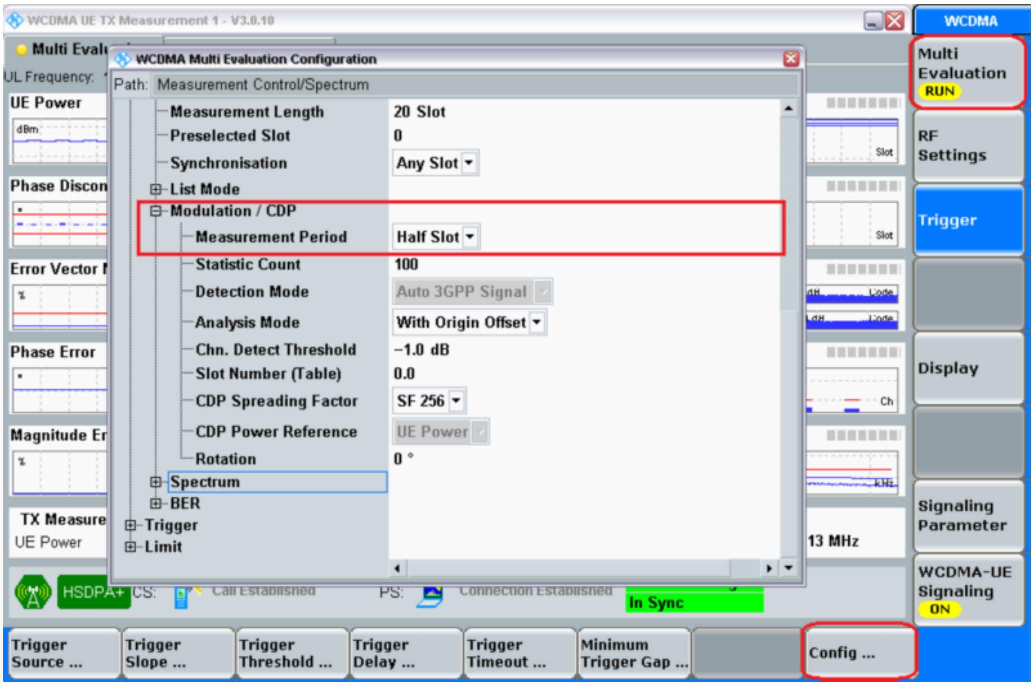

Fig. 11: Measurement control settings for HSDPA measurements.

The parameter settings required for the four different subtests are stored as four different files that can be directly recalled on an R&S®CMW500 to start the testing right away with very little modification of parameters such as the operating band, frequency and path loss.

For Subtest 1, recall HSDPATx1.dfl, and establish an RMC call.

For Subtest 2, recall HSDPATx2.dfl, and establish an RMC call.

For Subtest 3, recall HSDPATx3.dfl, and establish an RMC call.

For Subtest 4, recall HSDPATx4.dfl, and establish an RMC call.

2.1.1 Parameters That Need to Be Set or Changed Frequently During Testing

Once the call has been established, and you have navigated to the "Multi-Evaluation" application, the test set is ready to start the measurements. However, there are parameters (outlined in the section below) that need to be set or changed frequently during testing. Many test cases require the tests to be repeated with changes in the parameters below, to ensure that the test requirements are met as part of the test coverage as intended in the specification. Furthermore, some of the settings mentioned below are required to obtain meaningful results. For this reason, Rohde & Schwarz recommends that you go through the section below before you start the actual testing.

These parameters, which are frequently changed during the course of testing, are grouped under the "Signaling Parameter" function to provide easy access, and they are available from the WCDMA "Multi-Evaluation" application while the measurement is in progress.

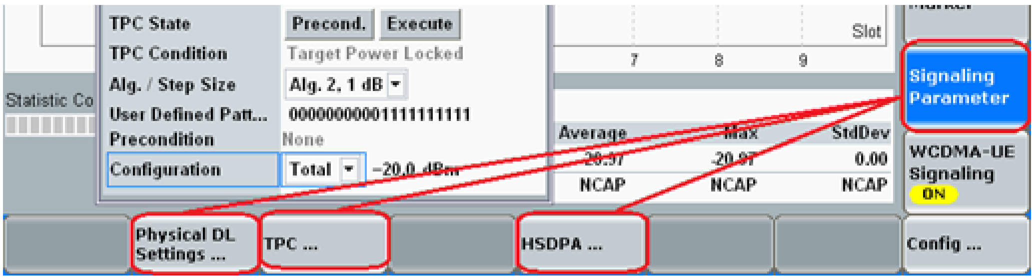

Figure 12: Options available under "Signaling Parameter."

Configuring the TPC commands sent to the UE, to control the UL Tx power:

a) To stimulate the UE to transmit at its maximum power:

Signaling Parameter → TPC → Active TPC Setup → All 1

Signaling Parameter → TPC → Alg. /Step Size → Alg. 2, 1 dB

b) To stimulate the UE to transmit at a particular target power and stay at that power level: Example for target a power of –20.0 dBm (see Fig. 10 below):

Please make sure that the target power is selected with reference to the DPCH channel power and not to the total power (default value). This is necessary to meet the specification requirement that the target power must be selected in the presence of HSDPA UL channels. Otherwise, you might get greater variation of the target power.

Signaling Parameter → TPC → Active TPC Setup → Closed Loop

Signaling Parameter → TPC → Alg. /Step Size → Alg. 2, 1 dB

Signaling Parameter → TPC → Configuration → DPCH (reference)

Signaling Parameter → TPC → Configuration → Target –20.0 dBm

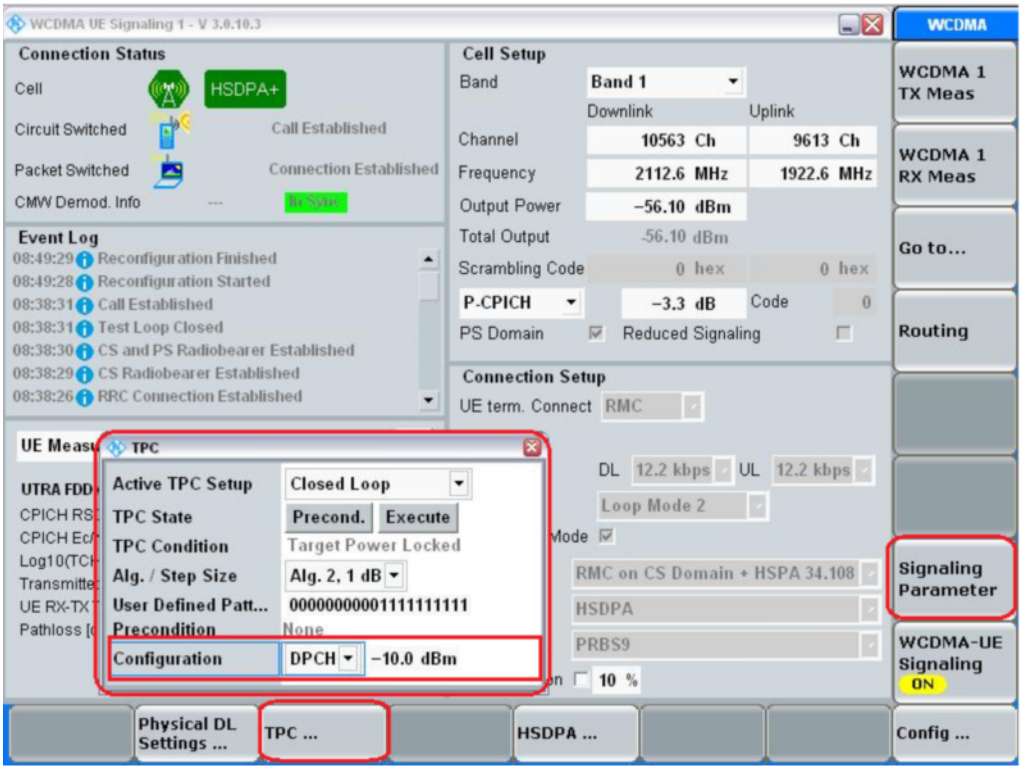

Fig. 13: TPC setting to stimulate the UE to transmit at –10 dBm.

Differences between "Total" or "DPCH" power reference during the target power handling:

You can define the target power with respect to the "Total Power" or the "DPCH Power." When the test case states to set the "UE Output Power" to a specific power, it is appropriate to set the configuration to "Total." When the test case states to set the "UL DPCH power" to a specific power, the configuration has to be set to "DPCH."

c) Measurement time – full or half-slot measurement:

For HSDPA measurements, the signal configuration – in line with the specification – leads the UE to change the power within the slot (e.g.: DPCH + HSDPA channel configuration with appropriate timing offset). A half-slot measurement excluding the 25 µs guard period at the beginning and end of the half slot is required and is set as shown in Fig. 14 below.

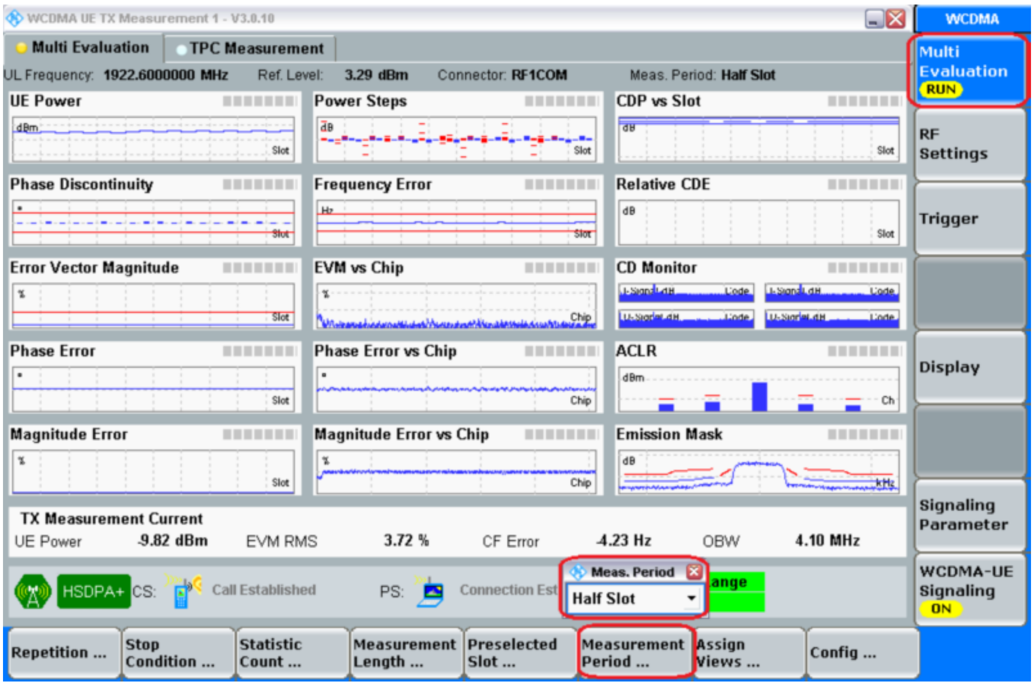

Fig. 14: Setting a half-slot measurement.

2.2 Maximum Output Power with HS-DPCCH (Release 5 only; 5.2A)

The maximum output power with HS-DPCCH measurement determines the maximum power that the UE can transmit when HS-DPCCH is fully or partially transmitted during a DPCCH timeslot. The measurement period is to be at least one timeslot. An excess maximum output power may interfere with other channels or other systems. Table 7 shows the test requirements for maximum output power with HS-DPCCH. When HS-DPCCH is not transmitted, the maximum output power is not to exceed the tolerance prescribed in the Rel-99 specification. This test applies to all Release-5 FDD user equipment that supports HSDPA.

Maximum output power with HS-DPCCH				
Ratio of βc to βd for all values of β_{HS}	Power Class 3		Power Class 4	
	Power (dBm)	Tol. (dB)	Power (dBm)	Tol. (dB)
βc / βd = 2/15, 12/15	+24	+1.7/–3.7	+21	+2.7/–2.7
βc / βd = 15/8	+23	+2.7/–3.7	+20	+3.7/–2.7
βc / βd = 15/4	+22	+3.7/–3.7	+19	+4.7/–2.7

Note: ΔACK, ΔNACK and ΔCQI = 30/15 with β_{HS} = 30/15 *βc

Table 7: Maximum output power with HS-DPCCH (Table 5.2A.2 of TS 34.121 [1]).

Configure the downlink physical channels, Subtest 1, the serving cell and the HS-DPCCH trigger in the R&S®CMW500 as specified in section 2.1. Configure the fixed reference channel (FRC H-Set 1, QPSK version) in the R&S®CMW500 as shown in Fig. 2.

Establish an HSDPA call. The R&S®CMW500 continuously sends an "UP" power control command to the UE, and the system measures the UE's mean power. The mean power must be averaged over at least one timeslot. To continuously send an UP power control command to the UE, configure the "Active TPC Setup" in the R&S®CMW500 to be "All 1."

Repeat the "maximum output power with HS-DPCCH" measurement using different combinations of β values as shown in Table 3(a). The relevant details for setting the β gain factors are provided in section 2.1 for your reference.

Case (i) – βc / βd = 2/15
Case (ii) – βc / βd = 11/15
Case (iii) – βc / βd = 15/8
Case (iv) – βc / βd = 15/4

The measurement results for the maximum output power with HS-DPCCH are available in the "Multi-Evaluation" application in the "UE Power" view.

Configuration in the R&S®CMW500:
Multi-Evaluation → Display → Select View → UE Power
Multi-Evaluation → Signaling Parameter → TPC → Active TPC Setup → All 1
Multi-Evaluation → Signaling Parameter → TPC → Alg. /Step Size → Alg. 2, 1 dB
Multi-Evaluation → Signaling Parameter → TPC → Precondition → Maximum Power

In line with the test description, the measurement period must be at least one timeslot. Consequently, the configuration on the R&S®CMW500 will be:
Multi-Evaluation → Measurement Period → Full Slot

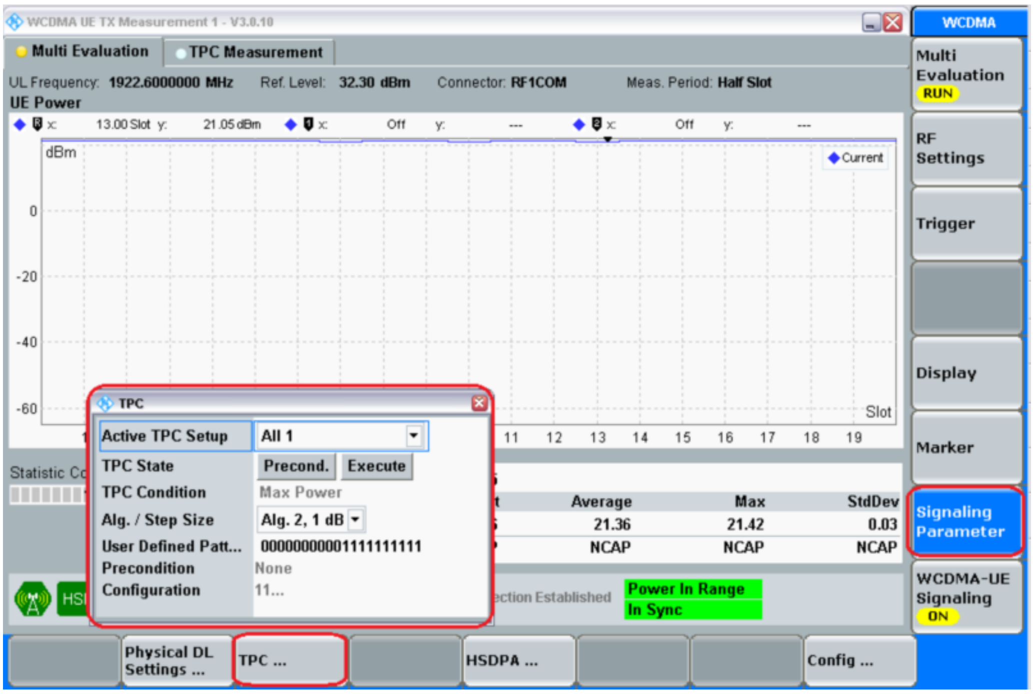

Fig. 15: TPC settings for stimulating the UE to transmit at its maximum power.

Fig. 16 shows the maximum output power measurement results.

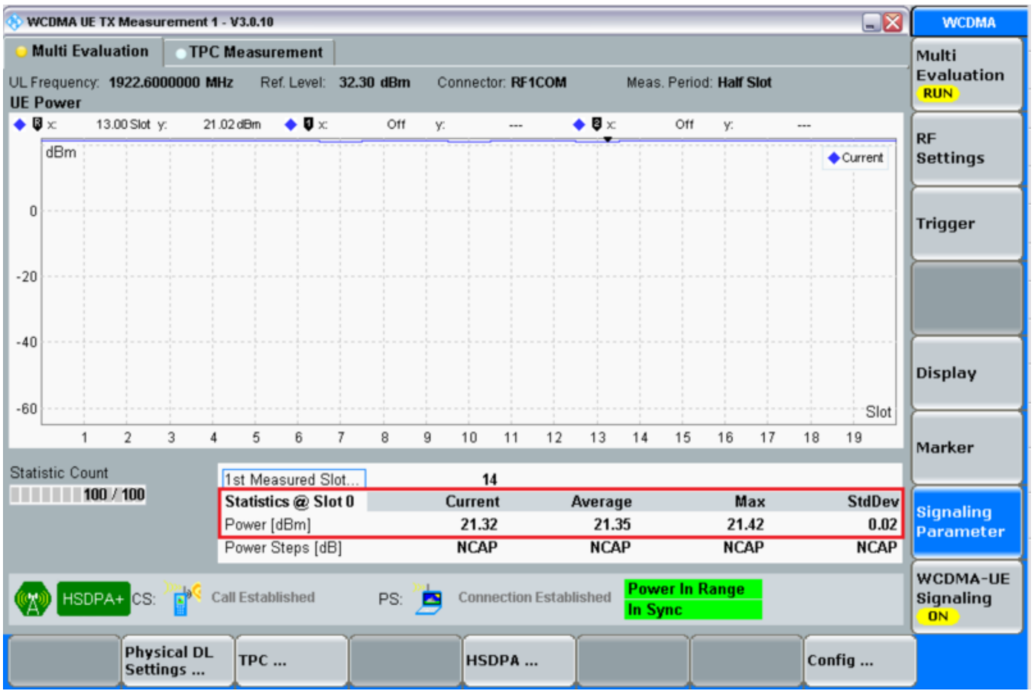

Fig. 16: Maximum output power with HS-DPCCH measurement results.

The maximum output power with HS-DPCCH for all subtests, as derived using the steps above, is not to exceed the range prescribed by the maximum output power and tolerance specified in Table 7.

For Subtest 1, recall HSDPATx1.dfl, and establish an RMC call.

For Subtest 2, recall HSDPATx2.dfl, and establish an RMC call.

For Subtest 3, recall HSDPATx3.dfl, and establish an RMC call.

For Subtest 4, recall HSDPATx4.dfl, and establish an RMC call.

The measurement results are available at:
WCDMA TX Meas. → Multi-Evaluation → Display → Select View → UE Power
WCDMA TX Meas. → Multi-Evaluation → Measurement period → Full Slot

2.3 Maximum Output Power with HS-DPCCH (Release 6 and Later; 5.2AA)

The maximum output power with HS-DPCCH measures the maximum power at which the UE can transmit when HS-DPCCH is fully or partially transmitted during a DPCCH timeslot. The measurement period must be at least one timeslot. An excess maximum output power may interfere with other channels or other systems. An insufficient maximum output power decreases the coverage area. Table 8 shows the test requirements for the maximum output power with HS-DPCCH. The maximum output power, where HS-DPCCH is not transmitted, is not to exceed the tolerance prescribed in the Rel-99 specification for the maximum output power. This test applies to all FDD UE for Release 6, and to later releases that support HSDPA without E-DCH.

Maximum output power with HS-DPCCH				
Subtest in Table 3(a)	Power Class 3		Power Class 4	
	Power (dBm)	Tol. (dB)	Power (dBm)	Tol. (dB)
1	+24	+1.7/–3.7	+21	+2.7/–2.7
2	+24	+1.7/–3.7	+21	+2.7/–2.7
3	+23.5	+2.2/–3.7	+20.5	+3.2/–2.7
4	+23.5	+2.2/–3.7	+20.5	+3.2/–2.7

Table 8: Maximum output power with HS-DPCCH (Table 5.2AA.2 of TS 34.121 [1]).

Configure the downlink physical channels, Subtest 1, the serving cell and the HS-DPCCH trigger in the R&S®CMW500 as specified in section 2.1. Establish an HSDPA call. UP power control commands are sent to the UE continuously. The R&S®CMW500 can be configured to send "UP" power control commands continuously by setting the Active TPC Setup to "All 1" in the R&S®CMW500.

Repeat the maximum output power with HS-DPCCH measurement using different combinations of β values, as shown in Table 3(a), and with the channel set to low, mid and high.

Case (i) –
Fixed reference channel (FRC H-Set 1, QPSK version) and all four of the possible βc/βd values.

Case (ii) –
Fixed reference channel (FRC H-Set 1, 16QAM version) and all four of the possible βc/βd values.

Different β values and fixed reference channels can be configured in the R&S®CMW500 by referring to Figs. 4 and 2 respectively.

The measurement results for the maximum output power with HS-DPCCH are available in the WCDMA "Multi-Evaluation" application in the "UE Power" view.

Configuration in the R&S®CMW500:
Multi-Evaluation → Display → Select View → UE Power
Multi-Evaluation → Signaling Parameter → TPC → Active TPC Setup → All 1
Multi-Evaluation → Signaling Parameter → TPC → Alg. /Step Size → Alg. 2, 1 dB

In line with the test description, the measurement period must be at least one timeslot. Consequently, the R&S®CMW500 is to be configured as follows:
Multi-Evaluation → Measurement Period → Full Slot

Fig. 17 shows the maximum output power measurement results for FRC H-Set 1 16QAM.

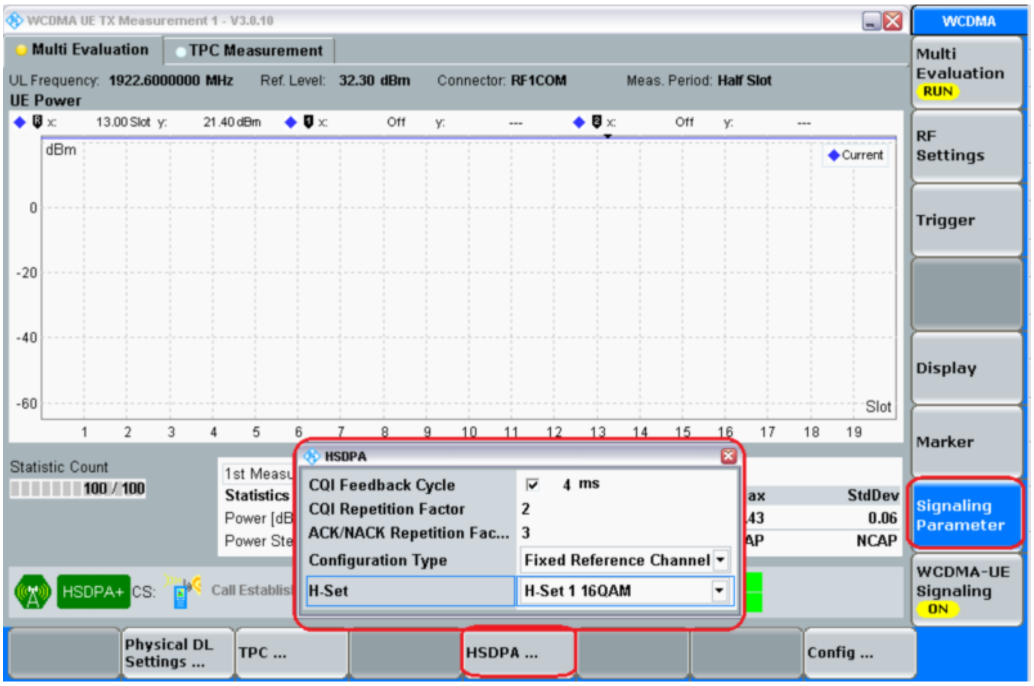

Fig. 137: Maximum output power with HS-DPCCH measurement result for Rel-6 UE.

The maximum output power with HS-DPCCH for all subtests, and for both FRC H-Set 1QPSK and 16QAM as derived in the above steps, is not to exceed the range prescribed by the maximum output power or the tolerance specified in Table 8.

1. For Subtest 1 with FRC H-Set 1, QPSK version, recall HSDPATx1.dfl, and establish an RMC call. Start the UE power measurement using the WCDMA "Multi-Evaluation" application:
WCDMA TX Meas. → Multi-Evaluation → Display → Select View → UE Power
WCDMA Multi-Evaluation → Measurement Period → Full Slot

Repeat the test with the FRC H-Set 1, 16QAM version, by modifying the following configuration:
Signaling Parameter → HSDPA → H-Set → H-Set 1, 16QAM

2. For Subtest 2 with the FRC H-Set 1, QPSK version, recall HSDPATx2.dfl, and establish an RMC call. Start the UE power measurement using the WCDMA "Multi-Evaluation" application:
WCDMA TX Meas. → Multi-Evaluation → Display → Select View → UE Power
WCDMA TX Meas. → Multi-Evaluation → Measurement Period → Full Slot

Repeat the test with FRC H-Set 1, 16QAM version, by modifying the following configuration:
Signaling Parameter → HSDPA → H-Set → H-Set 1, 16QAM

3. For Subtest 3 with FRC H-Set 1, QPSK version, recall HSDPATx3.dfl, and establish a CS call. Start the UE Power measurement using the WCDMA "Multi-Evaluation" application:
WCDMA TX Meas. → Multi-Evaluation → Display → Select View → UE Power
WCDMA TX Meas. → Multi-Evaluation → Measurement Period → Full Slot

Repeat the test with FRC H-Set 1, 16QAM version, by modifying the following configuration:
Signaling Parameter → HSDPA → H-Set → H-Set 1, 16QAM

4. For Subtest 4 with the FRC H-Set 1, QPSK version, recall HSDPATx4.dfl, and establish a CS call. Start the UE power measurement using the WCDMA "Multi-Evaluation" application:
WCDMA TX Meas. → Multi-Evaluation → Display → Select View → UE Power
WCDMA TX Meas. → Multi-Evaluation → Measurement Period → Full Slot

Repeat the test with the FRC H-Set 1, 16QAM version, by modifying the following configuration:
Signaling Parameter → HSDPA → H-Set → H-Set 1 16QAM

2.4 UE Relative Code-Domain Power Accuracy (5.2C)

UE relative code-domain power accuracy measures the UE's ability to correctly set the level of the individual code power relative to the total power of all active codes. The measure of accuracy is the difference between two dB ratios:

UE Relative CDP accuracy = (Measured CDP ratio) – (Nominal CDP ratio)
Where:

$$\text{Measured CDP ratio} = 10 * \log\left(\frac{\text{Measured code power}}{\text{Measured total power of all active codes}}\right)$$

$$\text{Nominal CDP ratio} = 10 * \log\left(\frac{\text{Nominal CDP}}{\text{Sum of all nominal CDPs}}\right)$$

A code's nominal CDP is relative to the total of all codes and is derived from beta factors. By definition, the sum of all nominal CDPs will equal 1. The UE relative CDP accuracy shall be maintained over the period during which the total of all active code powers remains unchanged, or for one timeslot, whichever is longer. This test applies to all Release-6 FDD user equipment and to later releases that support HSDPA.

Fig. 18 shows the 12 ms transmit-power profile. The relative code-domain power of each active code is measured at the measurement points specified in Fig. 15. Each measurement is performed over a half-slot period. Point 1 is the half slot prior to the ACK/NACK. Point 2 is the first half-slot of the ACK/NACK. Point 3 is the first half-slot of the CQI, and Point 4 is the first half-slot after the CQI. The 25 µs transient periods at the end of each half-slot period are not to be included.

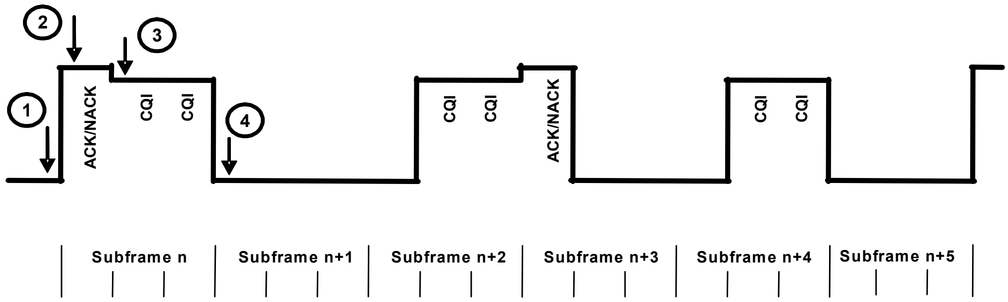

Fig. 14: Transmit power profile showing measurement points (Fig. 5.2C.1 of TS 34.121 [1]).

Table 9 shows the nominal UE relative code domain power for each active code at each point. Table 10 shows the test requirements for the required accuracy, i.e. the difference between the expected and measured code-domain power.

Nominal ratios for the UE relative code-domain power				
Subtest in Table 3(a)	Measurement point	Expected relative code-domain power in dB		
		DPCCH	DPDCH	HS-DPCCH
1	1	–17.6	–0.08	OFF
	2	–17.9	–0.4	–11.8
	3	–17.8	–0.3	–13.7
	4	–17.6	–0.08	OFF
2	1	–4.1	–2.1	OFF
	2	–8.2	–6.2	–2.1
	3	–7.1	–5.2	–3
	4	–4.1	–2.1	OFF
3	1	–1.1	–6.5	OFF
	2	–7.2	–12.7	–1.2
	3	–5.8	–11.3	–1.8
	4	–1.1	–6.5	OFF
4	1	–0.3	–11.8	OFF
	2	–7.1	–18.5	–1
	3	–5.6	–17.1	–1.5
	4	–0.3	–11.8	OFF

Table 9: The nominal ratios for the UE relative code-domain power (Table 5.2C.3 of TS 34.121 [1]).

Test requirements for the UE relative code-domain power accuracy	
Nominal CDP ratio	Accuracy (dB)
≥ –10 dB	±1.7
–10 dB to ≥ –15 dB	±2.3
–15 dB to ≥ –20 dB	±2.9

Table 10: Test requirements for the UE relative code-domain power accuracy (Table 5.2C.4 of TS 34.121 [1]).

Configure the downlink physical channels, the serving cell and the HS-DPCCH trigger settings in the R&S®CMW500 as specified in section 2.1. Configure the fixed reference channel (FRC H-Set 1, QPSK version) in the R&S®CMW500 as shown in Fig. 2.

Configure βc and βd for Subtest 1 as shown in Fig. 4. ΔACK and ΔNACK = 30/15, where β_{HS} = 30/15 *βc, and ΔCQI = 24/15, where β_{HS} = 24/15 * βc for all subtests. Configure ΔACK, ΔNACK and ΔCQI in the R&S®CMW500 by referring to Fig. 4.

Configuration in the R&S®CMW500:
WCDMA-UE Signaling → Config. → Physical Uplink Settings → Gain Factors → HSDPA → ΔACK → 8

WCDMA-UE Signaling → Config. → Physical Uplink Settings → Gain Factors → HSDPA → ΔNACK → 8
WCDMA-UE Signaling → Config. → Physical Uplink Settings → Gain Factors → HSDPA → ΔCQI → 7

Configure the UE for Test Mode 1 in the presence of HSDPA as shown in figure 16. Configure the DPCH frame offset to match the HS-DPCCH half-slot offset to create a signal with a repeat pattern of 12 ms. Table 11 shows the specific message content for the transport channel reconfiguration for this test.

Specific message content	
Information Element	**Value/remark**
– Ack-Nack repetition factor	1
– CQI repetition factor	1

Table 11: Specific message content (section 5.2C.4.2, section 5.7A.4.2, section 5.13.1A.4.2 and section 5.13.1AA.4.2 of TS 34.121 [1]).

Configuration in the R&S®CMW500:
WCDMA-UE Signaling → Config. → Connection Configuration → RMC → Test Mode → Loop Mode 1 RLC
WCDMA-UE Signaling → Config. → Connection Configuration → RMC → Test Mode → Loop Mode 1 RLC → Transparent

*WCDMA-UE Signaling → Config. → Physical Downlink Settings → DPCH Enhanced → Timing Offset → 6 * 256 chip [half-slot offset]*
Signaling Parameter → HSDPA → CQI Feedback Cycle → [checkmark] 4 ms
Signaling Parameter → HSDPA → CQI Repetition Factor → 1
Signaling Parameter → HSDPA → ACK/NACK Repetition Factor → 1

DL DPCH timing offset and the transport channel reconfiguration can be configured as shown in Fig. 3 and by referring to Fig. 2.

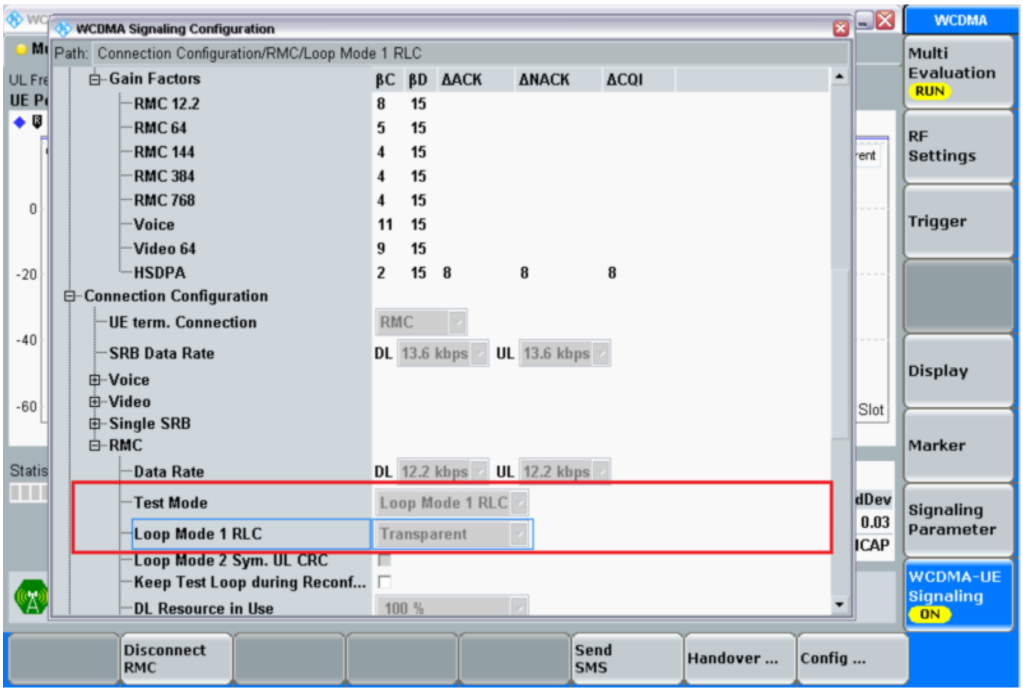

Fig. 15: Loop-back Test Mode 1 configuration.

Establish an HSDPA call. Configure Algorithm 2 to interpret TPC commands. When the HS-DPCCH channel is not active, configure the UE's output power to be in the range of 0 dBm ± 2 dB. This is a nominal setting and is not part of the test requirements. Configure TPC commands to alternate between "0" and "1" in the downlink to satisfy the "TPC_cmd = 0" status requirement, which is automatically set when you configure the R&S®CMW500 to use Algorithm 2.
Configuration in the R&S®CMW500:
Signaling Parameter → TPC → Alg. /Step Size → Alg. 2, 1 dB
Signaling Parameter → TPC → Active TPC Setup → Closed Loop
Signaling Parameter → TPC → Configuration → DPCH (reference)
Signaling Parameter → TPC → Configuration → Target 0.0 dBm

Start transmission of HSDPA data. Repeat the UE relative code-domain power accuracy measurement with different combinations of βc and βd values as shown in

Table 3(a). Depending on the gain factor values, the measurement threshold may require adjustment. Rohde & Schwarz recommends a measurement threshold of –1 dB and –20 dB for Subtests 1 and 4 respectively.

Case (i) – $\beta c / \beta d$ = 2/15
Case (ii) – $\beta c / \beta d$ = 11/15
Case (iii) – $\beta c / \beta d$ = 15/8
Case (iv) – $\beta c / \beta d$ = 15/4

Configuration in the R&S®CMW500:
WCDMA Multi-Evaluation → Config. → Measurement Control → Modulation / CDP → Chn. Detect Threshold → –1 dB (Subtest 1), –10 dB (Subtests 2 and 3) or –20 dB (Subtest 4)

The measurement results for the UE relative code-domain power are available in the "CDP vs. Slot" in the R&S®CMW500's WCDMA Multi-Evaluation function.

Configuration in the R&S®CMW500:
WCDMA Multi-Evaluation → Display → Select View → CDP vs. Slot

The test description requires the measurement period to be set to a half timeslot:
WCDMA Multi-Evaluation → Measurement Period → Half Slot

Fig. 11 shows the measurement results for the UE's relative code-domain power accuracy.

Set the length for the multi-evaluation measurement's modulation evaluation:
WCDMA Multi-Evaluation → Measurement Length → 18

For each subtest, there are 4 measurement points at which the relative code-domain power has to be measured and its accuracy has to be complied, in line with Tables 9 and 10.
The measurement value's read out in the table on the display can be set in line with the measurement points by changing the measurement points in the R&S®CMW500.

Configuration in the R&S®CMW500:
WCDMA Multi-Evaluation → Display → Slot Number Table → 0.0 [Measurement Point 1]
WCDMA Multi-Evaluation → Display → Slot Number Table → 0.5 [Measurement Point 2]
WCDMA Multi-Evaluation → Display → Slot Number Table → 1.5 [Measurement Point 3]
WCDMA Multi-Evaluation → Display → Slot Number Table → 3.5 [Measurement Point 4]
This displays the measurement results for the code-domain power for DPCCH, DPDCH or HS-DPCCH.

Configuration in the R&S®CMW500:
WCDMA Multi-Evaluation → Display → Select View → CDP vs. Slot
WCDMA Multi-Evaluation → Display → Select Trace CDP → HS-DPCCH

The span of the diagram's X and Y scale can be configured by changing the Scale X and Scale Y settings in the R&S®CMW500.

Configuration in the R&S®CMW500:
Display → X Scale CDP → X Max. → 18 slots
Display → Y Scale CDP → Y Max. → 0 dB
Display → Y Scale CDP → Y Min. → –40 dB

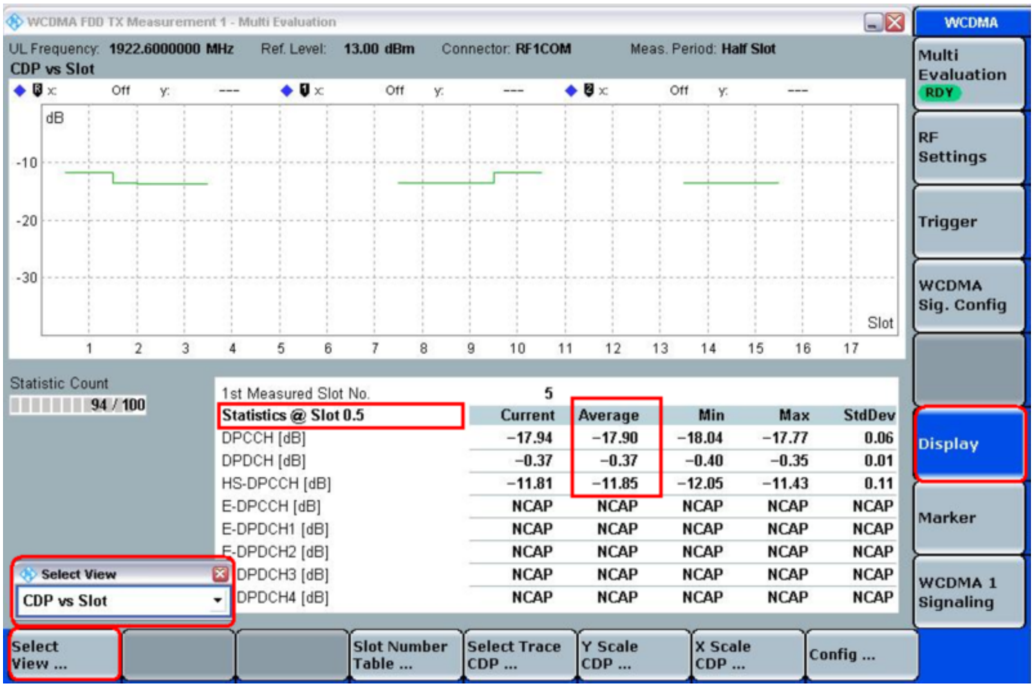

Fig. 20: Measurement results for the relative code-domain power.

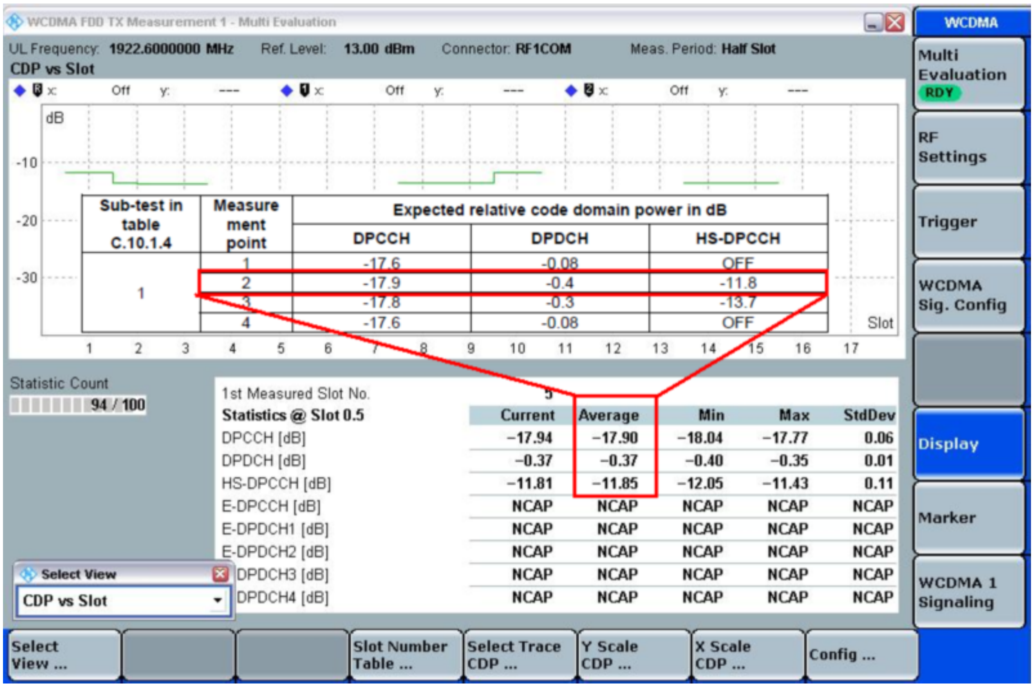

Fig. 16: Measurement results for the relative code-domain power for Measurement Point 2, Subtest 1.

The measurement results for the relative code domain power must be within the accuracy tolerances specified in Table 10.

1. For Subtest 1 with FRC H-Set 1, QPSK version, recall HSDPATx1.dfl, modify the following configurations, and establish an RMC call.
Signaling Parameter → HSDPA → CQI Feedback Cycle → 4 ms
Signaling Parameter → HSDPA → CQI Repetition Factor → 1
Signaling Parameter → HSDPA → ACK/NACK Repetition Factor → 1
WCDMA-UE Signaling → Config. → Physical Uplink Settings → Gain Factors → HSDPA → ΔCQI → 7
Signaling Parameter → TPC → Active TPC Setup → Closed Loop
Signaling Parameter → TPC → Configuration → DPCH (reference)
Signaling Parameter → TPC → Configuration → Target 0.0 dBm

2. For Subtest 2 with FRC H-Set 1, QPSK version, recall HSDPATx2.dfl, modify the following configurations, and establish a CS call.
Signaling Parameter → HSDPA → CQI Feedback Cycle → 4 ms
Signaling Parameter → HSDPA → CQI Repetition Factor → 1
Signaling Parameter → HSDPA → ACK/NACK Repetition Factor → 1
WCDMA-UE Signaling → Config. → Physical Uplink Settings → Gain Factors → HSDPA → ΔCQI → 7
Signaling Parameter → TPC → Active TPC Setup → Closed Loop
Signaling Parameter → TPC → Configuration → DPCH (reference)
Signaling Parameter → TPC → Configuration → Target 0.0 dBm

3. For Subtest 3 with FRC H-Set 1, QPSK version, recall HSDPATx3.dfl, modify the following configurations, and establish a CS call.
Signaling Parameter → HSDPA → CQI Feedback Cycle → 4 ms
Signaling Parameter → HSDPA → CQI Repetition Factor → 1
Signaling Parameter → HSDPA → ACK/NACK Repetition Factor → 1
WCDMA-UE Signaling → Config. → Physical Uplink Settings → Gain Factors → HSDPA → ΔCQI → 7
Signaling Parameter → TPC → Active TPC Setup → Closed Loop
Signaling Parameter → TPC → Configuration → DPCH (reference)
Signaling Parameter → TPC → Configuration → Target 0.0 dBm

4. For Subtest 4 with FRC H-Set 1, QPSK version, recall HSDPATx4.dfl, modify the following configurations, and establish a CS call.
Signaling Parameter → HSDPA → CQI Feedback Cycle → 4 ms
Signaling Parameter → HSDPA → CQI Repetition Factor → 1
Signaling Parameter → HSDPA → ACK/NACK Repetition Factor → 1
WCDMA-UE Signaling → Config. → Physical Uplink Settings → Gain Factors → HSDPA → ΔCQI → 7
Signaling Parameter → TPC → Active TPC Setup → Closed Loop
Signaling Parameter → TPC → Configuration → DPCH (reference)
Signaling Parameter → TPC → Configuration → Target 0.0 dBm

The measurement results are available here:
Multi-Evaluation → Display → Select View → CDP vs. Slot

Change the slot number to take readings for different measurement points:
WCDMA Multi-Evaluation → Display → Slot Number Table → 0.0 [Measurement Point 1]
WCDMA Multi-Evaluation → Display → Slot Number Table → 0.5 [Measurement Point 2]
WCDMA Multi-Evaluation → Display → Slot Number Table → 1.5 [Measurement Point 3]
WCDMA Multi-Evaluation → Display → Slot Number Table → 3.5 [Measurement Point 4]

2.5 HS-DPCCH Power Control (5.7A)

Transmitting ACK/NACK or CQI over the HS-DPCCH may cause the UE output power to vary in the uplink. This happens when the UE output power, with ACK/NACK or CQI transmitted, exceeds the maximum output power with HS-DPCCH as specified in Table 5.2A.1 of TS 34.121 [1] or falls below the minimum output power specified in section 5.4.3.2 of TS 34.121 [1]. The UE may then apply additional scaling to the total transmit power as specified in section 5.1.2.6 of TS 25.214 [3]. This test applies to all Release-5 FDD UE and to later releases that support HSDPA.

The composite transmitted power (DPCCH + DPDCH + HS-DPCCH) shall be rounded to the closest integer dB value. If rounding is done, a power step exactly half-way between two integers shall be rounded to the closest integer of greater magnitude.

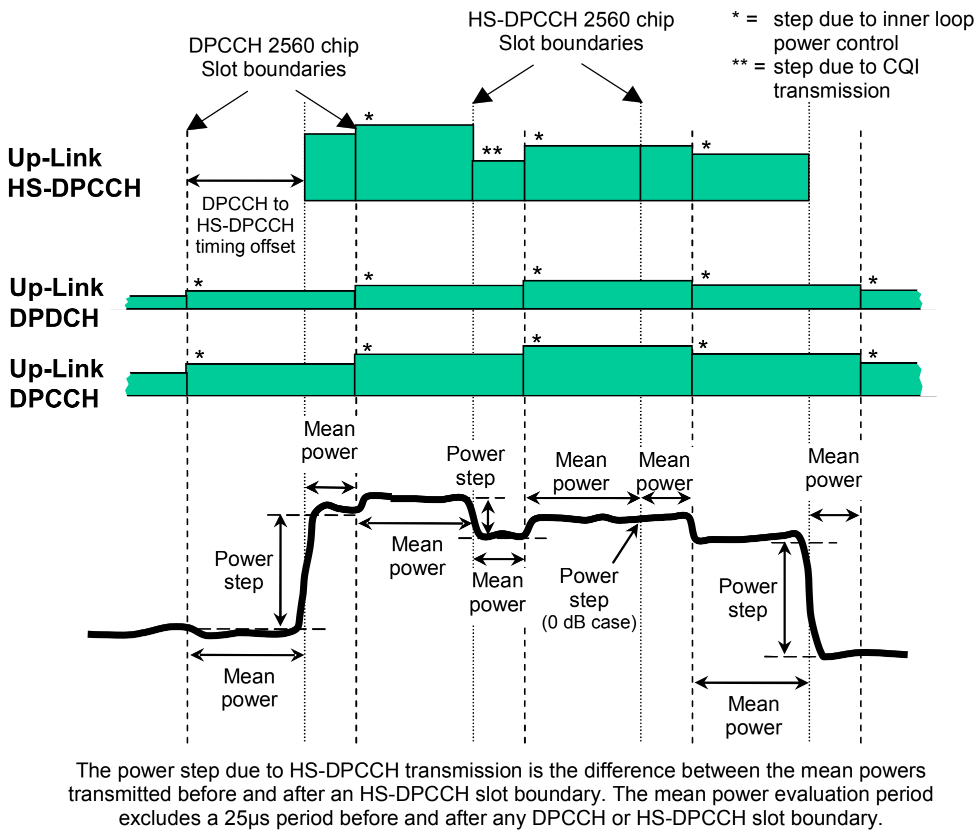

Fig. 22: Transmit-power template during HS-DPCCH transmission (Fig. 5.7A.1 of TS 34.121 [1]).

The nominal power step due to transmission of ACK/NACK or CQI is defined as the difference between the nominal mean powers of two power evaluation periods on either side of an HS-DPCCH boundary. The first evaluation period starts 25 µs after a DPCCH slot boundary and ends 25 µs before the following HS-DPCCH slot boundary. The second evaluation period starts 25 µs after the same HS-DPCCH slot boundary and ends 25 µs before the following DPCCH slot boundary.

This test verifies the changes in the uplink transmit power when transmitting the HS-DPCCH (ACK/NACK and CQI) and ensures that the power between HS-DPCCH transmissions is within the allowed power step tolerances as shown in Tables 12 and 13. The test is carried out at max. power with TPC_cmd = 1 and at a nominal power of 0 dBm at the minimum point of the 12 ms transmit pattern (HS-DPCCH off).

Fig. 23 shows the 12 ms transmit power profile with TPC_cmd = 0. The mean power during the half-slot periods is measured on either side of the measurement points specified in Fig. 23. The 25 µs transient periods at the end of each half-slot period are not to be included. Measurement points 4, 8 and 11 are at the DPCCH slot boundaries just after and just before the HS-DPCCH transmission. The difference in mean power is evaluated to determine the power steps around the measurement points as shown in Fig. 23. The power steps must meet the test requirements in Table 12.

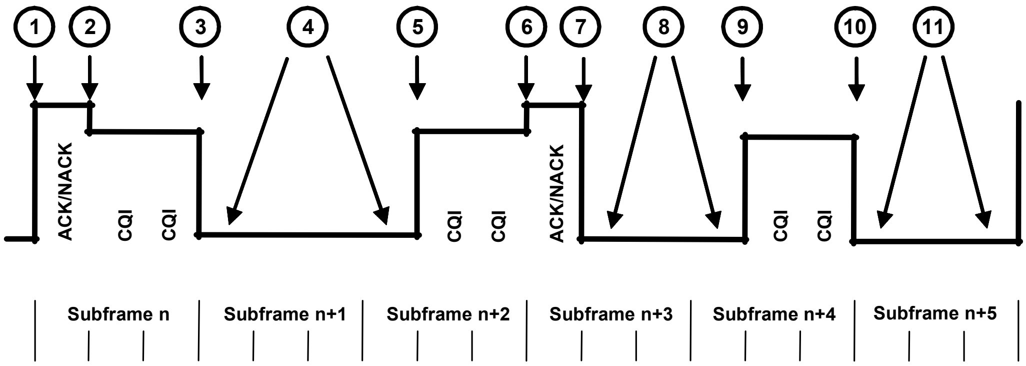

Fig. 23: Transmit power template below max. power with TPC_cmd = 0 (Fig. 5.7A.2 of TS 34.121 [1]).

Transmitter power test requirements for TPC_cmd = 0					
Subtest in Table 3(a)	**Power step**	**Nominal power step size, ΔP [dB]**	**Rounded power step size, ΔP [dB]**	**Transmitter power step Tolerance [dB]**	**Allowed transmitter power step range [dB]**
3	1	6.14	6	+/– 2.3	3.7 to 8.44
	2	–1.38	–1	+/– 0.6	–1.98 to –0.4
	3	–4.76	–5	+/– 2.3	–7.3 to –2.46
	4*	0	0	+/– 0.6	–0.6 to 0.6
	5	4.76	5	+/– 2.3	2.46 to 7.3
	6	1.38	1	+/– 0.6	0.4 to 1.98
	7	–6.14	–6	+/– 2.3	–8.44 to –3.7
	8*	0	0	+/– 0.6	–0.6 to 0.6
	9	4.76	5	+/– 2.3	2.46 to 7.3
	10	–4.76	–5	+/– 2.3	–7.3 to –2.46
	11*	0	0	+/– 0.6	–0.6 to 0.6

* Two test points

Table 12: Transmitter-power test requirements for TPC_cmd = 0 (Table 5.7A.2 of TS 34.121 [1]).

Fig. 24 shows the 12 ms cycle created when using TPC_cmd = 1. The mean power during the half-slot periods is measured on either side of the measurement points specified in Fig. 22. The 25 µs transient periods at the end of each half-slot period are not to be included. Measurement Points 5, 10 and 13 are at the DPCCH slot boundaries in between the HS-DPCCH transmissions. The last downward step prior to the HS-DPCCH transmission is not tested due to the accumulation of tolerances, which makes the test requirements vary widely. The difference in mean power is evaluated to determine the power steps around the measurement points as shown in Fig. 22. The transmitter power steps must meet the test requirements in Table 13.

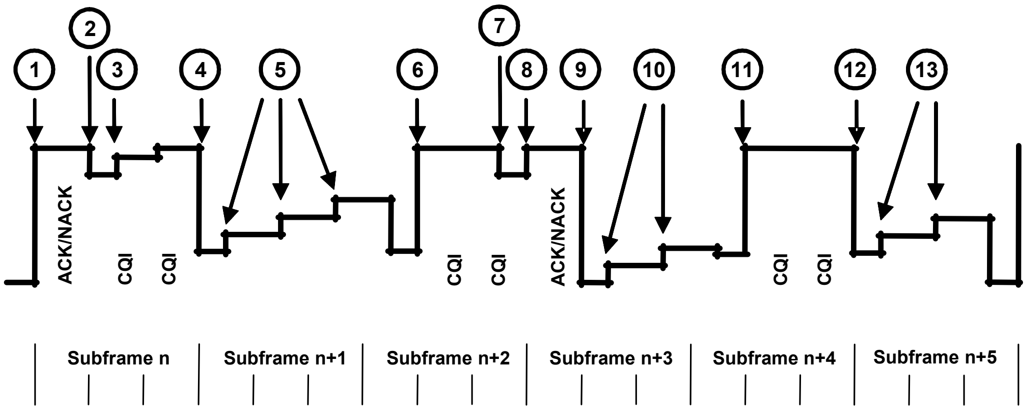

Fig. 24: Transmit-power template at max. power with TPC_cmd = 1 (Fig. 5.7A.3 of TS 34.121 [1]).

Transmitter power test requirements for TPC_cmd = 1					
Subtest in Table 3(a)	**Power step**	**Nominal power step size, ΔP [dB]**	**Rounded power step size, ΔP [dB]**	**Transmitter power step Tolerance [dB]**	**Allowed transmitter power-step range [dB]**
3	1	6.14	6	+/– 2.3	3.7 to 8.44
	2	–1.38	–1	+/– 0.6	–1.98 to –0.4
	3[3]	No requirements	No requirements	NA	No requirements
	4	–4.76	–5	+/– 2.3	–7.3 to –2.46
	5[1]	1	1	+/– 0.6	0.4 to 1.6
	6	4.76	5	+/– 2.3	2.46 to 7.3
	7[3]	No Requirements	No requirements	NA	No requirements
	8	1.38	1	+/– 0.6	0.40 to 1.98
	9	–6.14	–6	+/– 2.3	–8.44 to –3.7
	10[2]	1	1	+/– 0.6	0.4 to 1.6
	11	4.76	5	+/– 2.3	2.46 to 7.3
	12	–4.76	–5	+/– 2.3	–7.3 to –2.46
	13[2]	1	1	+/– 0.6	0.4 to 1.6

Notes:
1. Three test points.
2. Two test points.
3. In these test points, Rel-6 UE performs additional power scaling due to changes in allowed MPR; therefore, there are no requirements specified for transmitter power steps.

Table 13: Transmitter-power test requirements for TPC_cmd = 1 (Table 5.7A.3 of TS 34.121 [1]).

Configure the downlink physical channels, Subtest 3, the serving cell and the HS-DPCCH trigger in the R&S®CMW500 as specified in section 2.1. Configure the fixed reference channel (FRC H-Set 1, QPSK version) in the R&S®CMW500 as shown in Fig. 2.

Configure βc and βd for Subtest 3 by referring to Fig. 4. For this test: ΔACK and ΔNACK = 30/15, where β_{HS} = 30/15 *βc, and ΔCQI = 24/15, where β_{HS} = 24/15 * βc. Refer to Fig. 4 to configure ΔACK, ΔNACK and ΔCQI in the R&S®CMW500.

Configuration in the R&S®CMW500:
WCDMA-UE Signaling → Config. → Physical Uplink Settings → Gain Factors → HSDPA → βc → 15
WCDMA-UE Signaling → Config. → Physical Uplink Settings → Gain Factors → HSDPA → βd → 8
WCDMA-UE Signaling → Config. → Physical Uplink Settings → Gain Factors → HSDPA → ΔACK → 8
WCDMA-UE Signaling → Config. → Physical Uplink Settings → Gain Factors → HSDPA → ΔNACK → 8
WCDMA-UE Signaling → Config. → Physical Uplink Settings → Gain Factors → HSDPA → ΔCQI → 7

Set the UE to "Loop-back Test Mode 1" in the presence of HSDPA. Configure the DPCH frame offset in line with the HS-DPCCH half-slot offset to create a signal with a repeat pattern of 12 ms. Table 11 shows the specific content of the transport channel reconfiguration message for this test. These settings can be configured as shown in Figs. 16 and 3 and by referring to Fig. 2.

Configuration in the R&S®CMW500:
WCDMA-UE Signaling → Config. → Connection Configuration → RMC → Test Mode → Loop Mode 1 RLC
WCDMA-UE Signaling → Config. → Connection Configuration → RMC → Test Mode → Loop Mode 1 RLC → Transparent
*WCDMA-UE Signaling → Config. → Physical Downlink Settings → DPCH Enhanced → Timing Offset → 6 * 256 chip*
WCDMA-UE Signaling → Config. → HSDPA → CQI Feedback Cycle → [checkmark] 4 ms
WCDMA-UE Signaling → Config. → HSDPA → CQI Repetition Factor → 1
WCDMA-UE Signaling → Config. → HSDPA → ACK/NACK Repetition Factor → 1

Establish an HSDPA call. Configure Algorithm 2 to interpret TPC commands. Configure the UE's output power – which is measured at the UE antenna connector while the HS-DPCCH is not being transmitted – to be in the range of 0 dBm ± 2 dB. This is a nominal setting, and it is not part of the test requirements. These configurations can be set as shown in Fig. 10.

Configuration in the R&S®CMW500 for TPC_cmd = 0:
Signaling Parameter → TPC → Active TPC Setup → Closed Loop
Signaling Parameter → TPC → Alg. /Step Size → Alg2_1dB
Signaling Parameter → TPC → Configuration → DPCH (reference)
Signaling Parameter → TPC → Target Power → 0 dBm

Repeat the HS-DPCCH power control measurement at maximum power. Configure Algorithm 1 with a 1 dB step size to interpret TPC commands. Send UP power control commands to the UE continuously until the UE output power reaches the maximum output power during HS-DPCCH ACK / NACK transmission as specified in section 2.2. The transmitter power step is measured as shown in Fig. 26 at TPC_cmd = 1.

Configuration in the R&S®CMW500 for TPC_cmd = 1:
Signaling Parameter → TPC → Active TPC Setup → All 1
Signaling Parameter → TPC → Alg. /Step size → Alg1_1dB

The measurement results for HS-DPCCH power control are available on the R&S®CMW500 in the WCDMA "Multi-Evaluation" application's "UE Power and Power Steps" view. There are 14 and 17 measurement points as well as TPC_cmd=0 and TPC_cmd=1 to be measured. By setting the slot number, you can configure the readout values in the table to display readings for a particular measurement point.
Alternatively, you can also employ the marker to check the measurement values at different measurement points in steps of 0.5 (half-slot measurement).

Configuration in the R&S®CMW500:
WCDMA Multi-Evaluation → Assign Views → UE Power [√]
WCDMA Multi-Evaluation → Display → X Scale UE Pwr. → X Max. → 18 Slots
WCDMA Multi-Evaluation → Display → Y Scale UE Pwr. → Y Max. → 20 dB
WCDMA Multi-Evaluation → Display → Y Scale UE Pwr. → Y Min. → 0 dB

WCDMA Multi-Evaluation → Assign Views → Power Steps [√]
WCDMA Multi-Evaluation → Display → Select View → Power Steps

WCDMA Multi-Evaluation → Display → Select Number Table → 0.5 (change the slot to measure UE power steps at all the measurement points as in Figs. 20 and 21).

The figures below illustrate the measurement steps and results as they are to be obtained for the TPC_cmd=1 case. However, the measurements results for TPC_cmd=0 are also available under the same menu; you just need to change the limit setting for the HS-DPCCH power steps as required for TPC_cmd=0.

WCDMA Multi-Evaluation → Config. → Limit → Power Control → HS-DPCCH Power Steps → Test Case → TPC 0 dB (for TPC_cmd=0 **OR** *TPC 1 dB for TPC_cmd=1)*

The requirement that "the evaluation period starts 25 µs after the DPCCH slot boundary and ends 25 µs before the following HS-DPCCH slot boundary," combined with the second requirement of 50 % slot alignment, means that a half-slot measurement period must be used.

WCDMA Multi-Evaluation → Measurement Period → Half Slot

Set the length for modulation evaluation of the multi-evaluation measurement:
WCDMA Multi-Evaluation → Measurement Length → 18

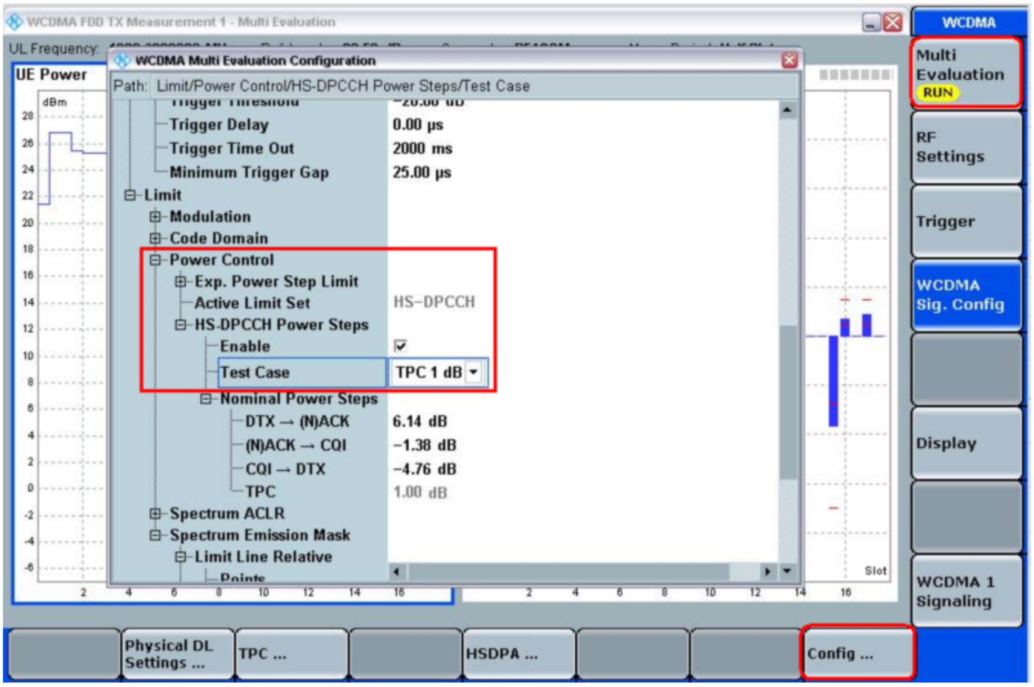

Fig. 175: Setting the limits for power step measurement for TPC_cmd=1.

Fig. 186: Power step measurement around Measurement Point 1 for TPC_cmd=1.

The diagram in Fig. 27 displays the UE power which the transmit power profile in Fig. 24 (TPC_cmd = 1).

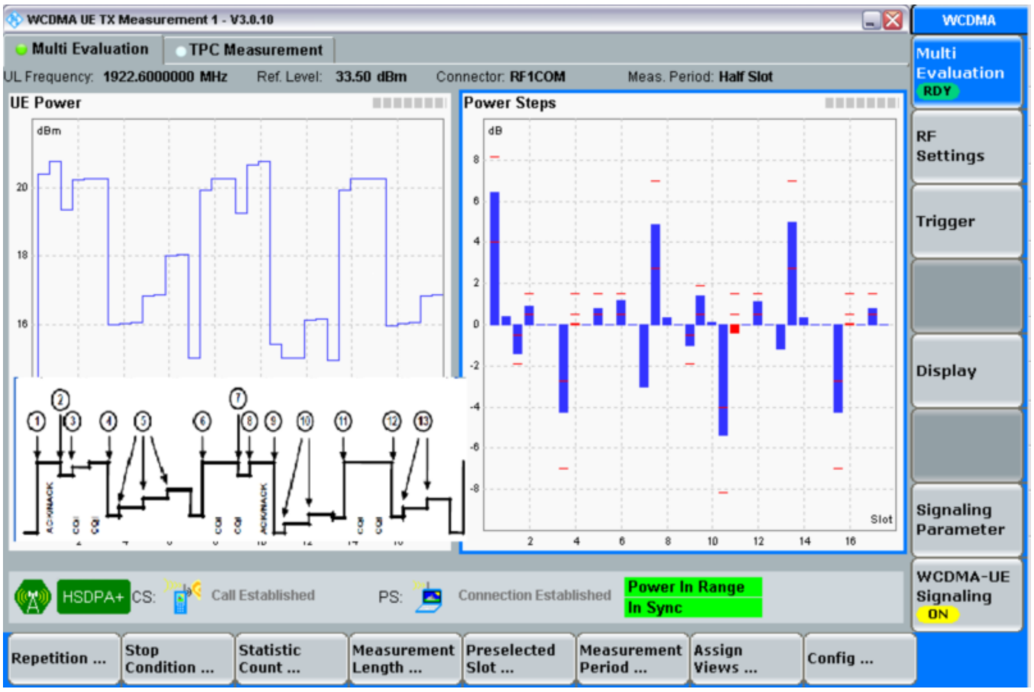

Fig. 27(a): Overview of the power step measurement for TPC_cmd=1.

Fig. 28 shows the HS-DPCCH power control measurement result.

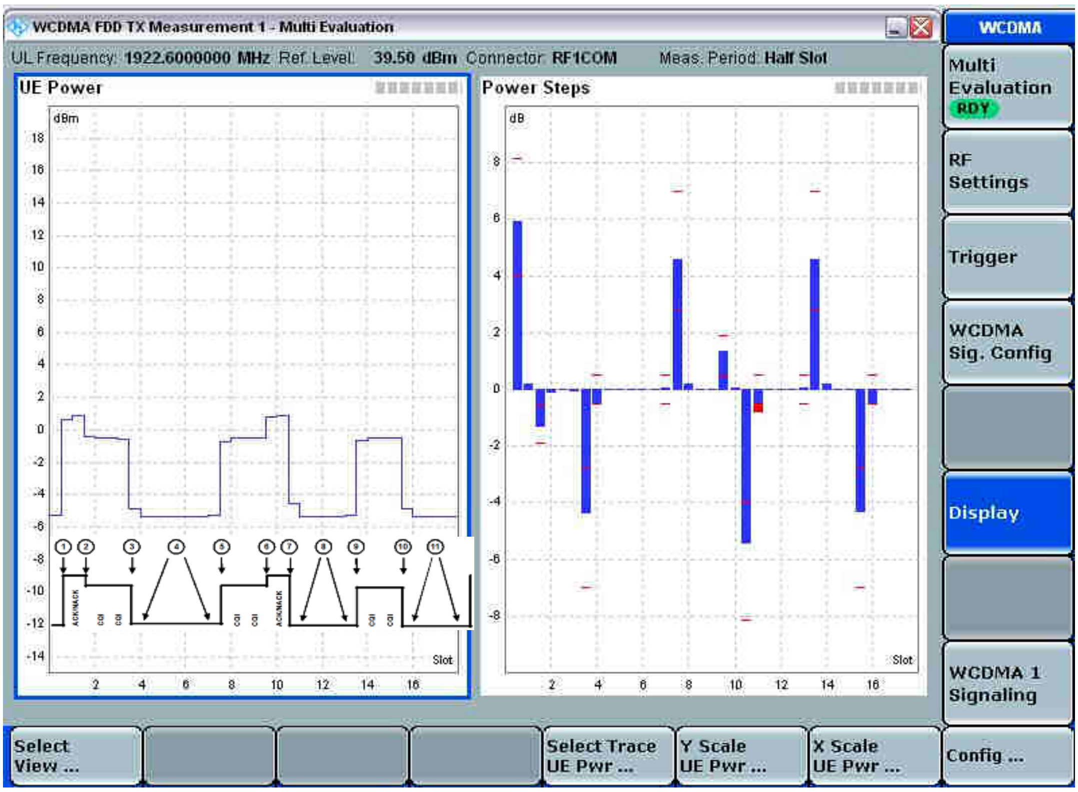

Fig. 27(b): Overview of the power step measurement for TPC_cmd=0.

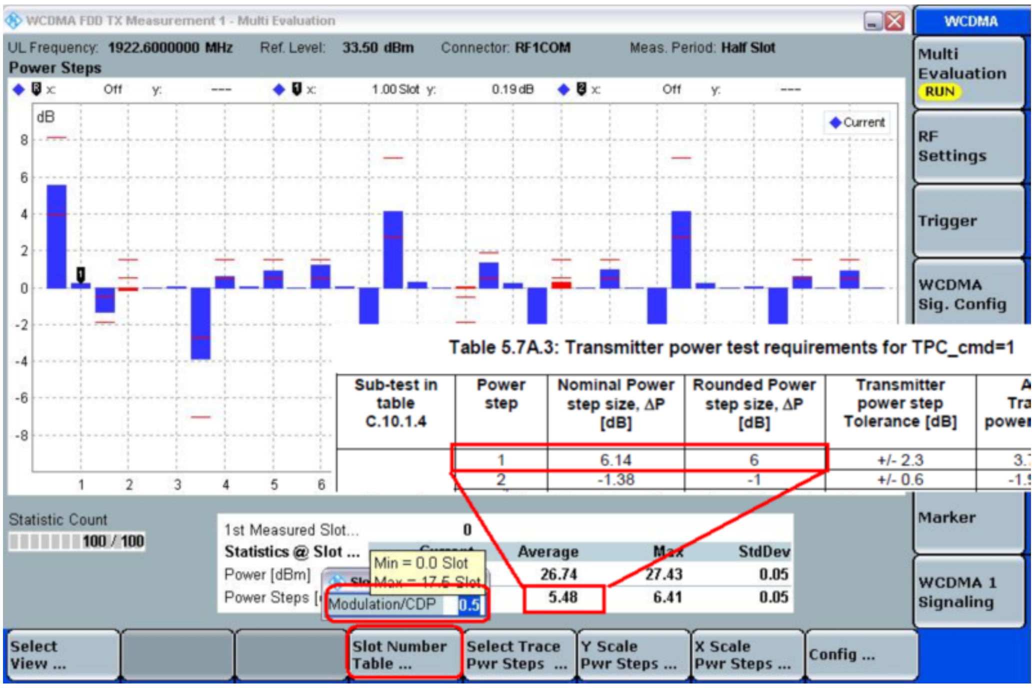

Fig. 28: HS-DPCCH power control measurement result for Measurement Point 1 TPC_cmd=1.

The measurement results for all measurement points mentioned in Tables 12 and 13 for TPC_cmd=0 and TPC_cmd=1 respectively must be within the specified tolerances.

For a transmit power template with TPC_cmd = 0, recall HSDPATx3.dfl, establish an RMC call and modify the following configurations:
Signaling Parameter → HSDPA → CQI Feedback Cycle → 4 ms
Signaling Parameter → HSDPA → CQI Repetition Factor → 1
Signaling Parameter → HSDPA → ACK/NACK Repetition Factor → 1

WCDMA Signaling → Config. → Physical Uplink Settings → Gain Factors → HSDPA → ΔCQI → 7
Signaling Parameter → TPC → Active TPC Setup → Closed Loop
Signaling Parameter → TPC → Configuration → DPCH (reference)
Signaling Parameter → TPC → Configuration → Target Power 0.0 dBm
Signaling Parameter → TPC → Alg. / Step Size → Alg2 1 dB

For the transmit power template at maximum power with TPC_cmd = 1, recall HSDPATx3.dfl, establish an RMC call and modify the following configurations:
Signaling Parameter → HSDPA → CQI Feedback Cycle → 4 ms
Signaling Parameter → HSDPA → CQI Repetition Factor → 1
Signaling Parameter → HSDPA → ACK/NACK Repetition Factor → 1

WCDMA Signaling → Config. → Physical Uplink Settings → Gain Factors → HSDPA → ΔCQI → 7
Signaling Parameter → TPC → Active TPC Setup → All 1
Signaling Parameter → TPC → Alg. / Step Size → Alg1 1 dB

The measurement results are available here:

WCDMA Multi-Evaluation → Display → Select View → Power Step
WCDMA Multi-Evaluation → Config. → Limit → Power Control → HS-DPCCH Power Steps → Test Case → TPC 0 dB (for TPC_cmd=0 **OR** *TPC 1 dB for TPC_cmd=1)*

2.6 Spectrum Emission Mask with HS-DPCCH (5.9A)

The UE's spectrum emission mask applies to frequencies that are between 2.5 MHz and 12.5 MHz away from the UE's center carrier frequency. The out-of-channel emission is specified relative to the UE carrier's RRC-filtered mean power. This test applies to all Release-5 FDD UE and to later releases that support HSDPA.

This test verifies that the UE's emission power does not exceed the limits in Table 14, even in the presence of the HS-DPCCH, for all values of βc, βd and β_{HS} as specified in Table 3(a). The maximum output power with HS-DPCCH is specified in section 2.2. Excess emission increases interference with other channels or systems.

Tables 14, 14(a), 14(b) and 14(c) show the spectrum emission mask requirements and the additional spectrum emission limits. Δf is the separation between the carrier frequency and the center of the measurement bandwidth. The minimum requirement is calculated from the relative requirement or from the absolute requirement, depending on which has the higher power.

Spectrum emission mask requirements

Δf in MHz	Minimum requirements		Measurement bandwidth
	Relative requirements	Absolute requirements	
2.5 – 3.5	$\left\{-33.5-15\left(\frac{\Delta f}{MHz}-2.5\right)\right\}$ dBc	–69.6 dBm	30 kHz
3.5 – 7.5	$\left\{-33.5-1\left(\frac{\Delta f}{MHz}-3.5\right)\right\}$ dBc	–54.3 dBm	1 MHz
7.5 – 8.5	$\left\{-37.5-10\left(\frac{\Delta f}{MHz}-7.5\right)\right\}$ dBc	–54.3 dBm	1 MHz
8.5 – 12.5	–47.5 dBc	–54.3 dBm	1 MHz

Table 14: Spectrum emission mask requirements (Table 5.9A.3 of TS 34.121 [1]).

Additional spectrum emission limits for Bands II, IV, X

Δf in MHz	Frequency offset of measurement filter center frequency, f_offset	Additional requirements Band II, IV, X	Measurement bandwidth
2.5 MHz ≤ Δf < 3.5 MHz	2.515 MHz ≤ f_offset < 3.485 MHz	–15 dBm	30 kHz
3.5 MHz ≤ Δf ≤ 12.5 MHz	4.0 MHz ≤ f_offset < 12.0 MHz	–13 dBm	1 MHz

Table 14(a): Additional spectrum emission limits for Bands II, IV, X (Table 5.9A.3A of TS 34.121 [1]).

Additional spectrum emission limits for Band V

Δf in MHz	Frequency offset of measurement filter center frequency, f_offset	Additional requirements Band V	Measurement bandwidth
2.5 MHz ≤ Δf < 3.5 MHz	2.515 MHz ≤ f_offset < 3.485 MHz	–15 dBm	30 kHz
3.5 MHz ≤ Δf ≤ 12.5 MHz	3.55 MHz ≤ f_offset < 12.45 MHz	–13 dBm	100 kHz

Table 14(b): Additional spectrum emission limits for Bands V (Table 5.9A.3B of TS 34.121 [1]).

Additional spectrum emission limits for Bands XII, XIII, XIV			
Δf in MHz	**Frequency offset of measurement filter center frequency, f_offset**	**Additional requirements Band XII, XIII, XIV**	**Measurement bandwidth**
2.5 MHz ≤ Δf < 2.6 MHz	2.515 MHz ≤ f_offset < 2.585 MHz	–13 dBm	30 kHz
2.6 MHz ≤ Δf ≤ 12.45 MHz	2.65 MHz ≤ f_offset < 12.45 MHz	–13 dBm	100 kHz

Table 14(c): Additional spectrum emission limits for Bands XII, XIII, XIV (Table 5.9A.3C of TS 34.121 [1]).

Configure the downlink physical channels, Subtest 1, the serving cell and the HS-DPCCH trigger in the R&S®CMW500 as specified in section 2.1. Configure the fixed reference channel (FRC H-Set 1, QPSK version) in the R&S®CMW500 as shown in Fig. 2. Establish an HSDPA call.

UP power control commands are sent to the UE continuously until the UE reaches its maximum output power (this is determined by referring to Fig. 15).

Configuration in the R&S®CMW500:
Signaling Parameter → TPC → Active TPC Setup → All 1
Signaling Parameter → TPC → Alg. / Step Size → Alg. 2, 1 dB

Repeat the spectrum emission mask with HS-DPCCH with different combinations of β values as specified in Table 3(a).

Case (i) – βc / βd = 2/15
Case (ii) – βc / βd = 11/15
Case (iii) – βc / βd = 15/8
Case (iv) – βc / βd = 15/4

The measurement results for the spectrum emission mask with HS-DPCCH are available on the R&S®CMW500 in the "Emission Mask."

Configuration in the R&S®CMW500:
WCDMA Multi-Evaluation → Display → Select View → Emission Mask

The measurement period should be inside the HS-DPCCH "ON" periods in line with the test requirement.

WCDMA Multi-Evaluation → Measurement Period → Half Slot

Fig. 29 shows the spectrum emission mask with HS-DPCCH measurement results.

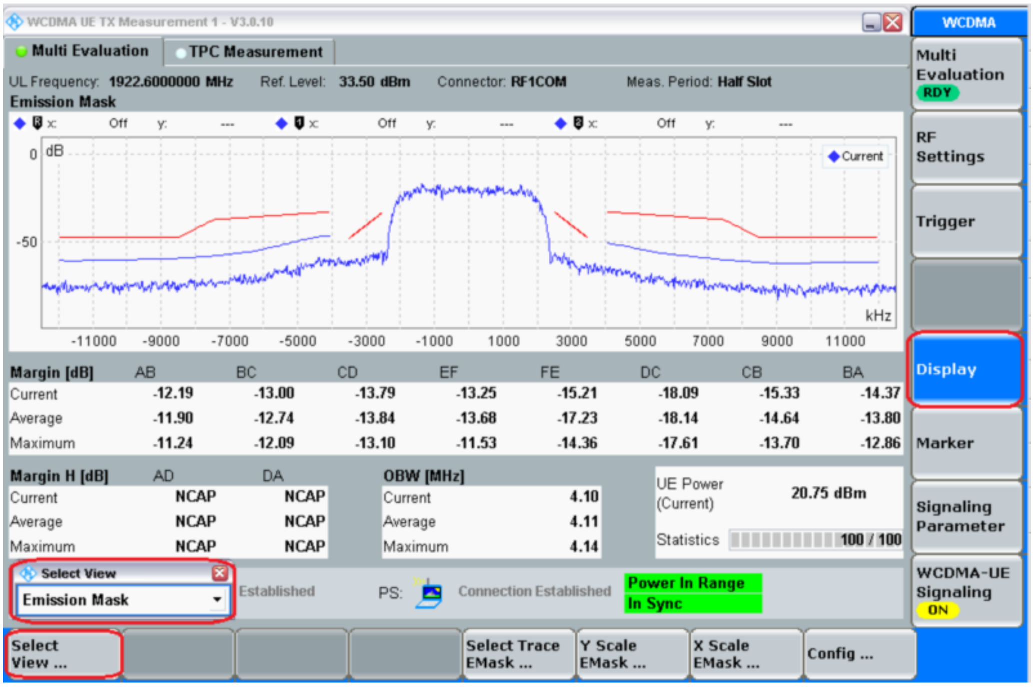

Fig. 29: Spectrum emission-mask measurement results.

The results must fulfill the requirements specified in Table 14.

For Subtest 1 with FRC H-Set 1, QPSK version, recall HSDPATx1.dfl, and establish an RMC call.

For Subtest 2 with FRC H-Set 1, QPSK version, recall HSDPATx2.dfl, and establish an RMC call.

For Subtest 3 with FRC H-Set 1, QPSK version, recall HSDPATx3.dfl, and establish an RMC call.

For Subtest 4 with FRC H-Set 1, QPSK version, recall HSDPATx4.dfl, and establish an RMC call.

The measurement results are available here:
WCDMA Multi-Evaluation → Display → Select View → Emission Mask

2.7 Adjacent Channel Leakage Power Ratio (ACLR) with HS-DPCCH (5.10A)

The ACLR is defined as the ratio of the RRC-filtered mean power centered on the assigned channel frequency to the RRC-filtered mean power centered on an adjacent channel frequency. Excess ACLR increases interference with other channels or systems. This test applies to all Release-5 FDD UE and to later releases that support HSDPA.

This test verifies that the power of UE emissions do not exceed the limits in Table 15 for all values of βc, βd and β_{HS}, as specified in Table 3(a). The maximum output power with HS-DPCCH is specified in section 2.2.

UE ACLR		
Power Class	**UE channel**	**ACLR limit**
3	+5 MHz or –5 MHz	32.2 dB
3	+10 MHz or –10 MHz	42.2 dB
4	+5 MHz or –5 MHz	32.2 dB
4	+10 MHz or –10 MHz	42.2 dB

Table 15: UE ACLR (Table 5.10A.3 of TS 34.121 [1]).

Configure the downlink physical channels, Subtest 1, the serving cell and the HS-DPCCH trigger in the R&S®CMW500 as specified in section 2.1. Configure the fixed reference channel (FRC H-Set 1, QPSK version) in the R&S®CMW500 as shown in Fig. 2. Establish an HSDPA call.

UP power control commands are sent to the UE continuously until the UE reaches its maximum output power (which is determined by referring to Fig. 15).

Configuration in the R&S®CMW500:
WCDMA-UE Signaling → Signaling Parameter → TPC → Active TPC Setup → All 1
WCDMA-UE Signaling → Signaling Parameter → TPC → Alg. / Step Size → Alg. 2, 1 dB

Repeat the ACLR with HS-DPCCH with different combinations of β values as shown in Table 3(a).

Case (i) – βc / βd = 2/15
Case (ii) – βc / βd = 11/15
Case (iii) – βc / βd = 15/8
Case (iv) – βc / βd = 15/4

The measurement results for ACLR with HS-DPCCH are available in the *ACLR Filter* measurement in the R&S®CMW500.

Configuration in the R&S®CMW500:
WCDMA Multi-Evaluation → Display → Select View → ACLR

The measurement period must include the HS-DPCCH's "ON" period.

WCDMA Multi-Evaluation → Measurement Period → Half Slot

Fig. 30 shows the ACLR with HS-DPCCH measurement results.

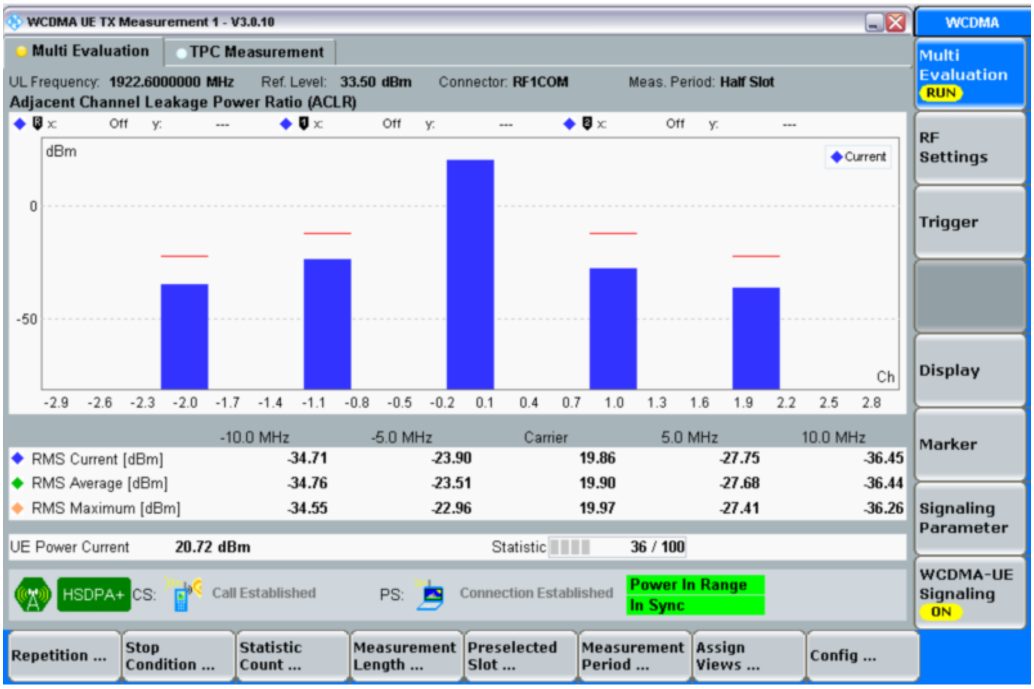

Fig. 30: ACLR with HS-DPCCH measurement results.

The measured emission from the UE matches the requirements stated in Table 15.

For Subtest 1 with FRC H-Set 1, QPSK version, recall HSDPATx1.dfl, and establish a CS call.

For Subtest 2 with FRC H-Set 1, QPSK version, recall HSDPATx2.dfl, and establish a CS call.

For Subtest 3 with FRC H-Set 1, QPSK version, recall HSDPATx3.dfl, and establish a CS call.

For Subtest 4 with FRC H-Set 1, QPSK version, recall HSDPATx4.dfl, and establish a CS call.

The measurement results are available here:
WCDMA Multi-Evaluation → Display → Select View → ACLR

2.8 Error Vector Magnitude (EVM) with HS-DPCCH (5.13.1A)

The EVM measures the difference between the reference waveform and the measured waveform. Both waveforms pass through a matched root raised cosine (RRC) filter with a bandwidth of 3.84 MHz and roll-off = 0.22. The waveforms are further modified by selecting the frequency, absolute phase, absolute amplitude and chip clock timing to minimize the error vector. The EVM result is defined as the square root of the ratio of the mean error vector power to the mean reference power, expressed as a percentage. This test applies to all Release-5 FDD UE and to later releases that support HSDPA.

The EVM measurement is performed in two instances:
Case(i): When the UE transmits at its maximum power
Case(ii): When the UE transmits at –18.0 dBm

The measurement interval is one timeslot, except when the mean power between slots is expected to change, whereupon the measurement interval is reduced by 25 µs at each end of the slot. The EVM shall not exceed 17.5 % for the parameters specified in Table 16.

<table>
<tr><th colspan="4">Parameters for the EVM / peak code-domain error</th></tr>
<tr><th colspan="2">Parameter</th><th>Level / Status</th><th>Unit</th></tr>
<tr><td colspan="2">Output power</td><td>≥ –20</td><td>dBm</td></tr>
<tr><td colspan="2">Operating conditions</td><td>Normal conditions</td><td></td></tr>
<tr><td colspan="2">Power control step size</td><td>1</td><td>dB</td></tr>
<tr><td rowspan="2">Measurement period[1]</td><td>PRACH</td><td>3904</td><td rowspan="2">Chips</td></tr>
<tr><td>Any DPCH</td><td>From 1280 to 2560 [2]</td></tr>
</table>

Notes:
1. Less any 25 µs transient periods
2. The longest period over which the nominal power remains constant

Table 16: Parameters for the EVM / peak code-domain error (Tables 5.13.1A.1, 5.13.1AA.1 and 5.13.2A.2 of TS 34.121 [1]).

Fig. 31 shows the 12 ms transmit power profile for measuring the EVM. The EVM is measured during the last half-slot period of the ACK/NACK in subframe n+3 when the UE is at its maximum power in the 12 ms cycle (Measurement Point 3) and in the following half-slot period when the CQI is off (Measurement Point 4) and the UE is at its minimum power in the cycle. The EVM is also measured in the last half slot before subframe n when the UE is at its minimum power (Measurement Point 1) and immediately following that in the first half slot of subframe n when the ACK/NACK is transmitting and the UE is at its maximum power in the 12 ms cycle (Measurement Point 2). The 25 µs transient periods at the beginning and end of each measurement period are excluded.

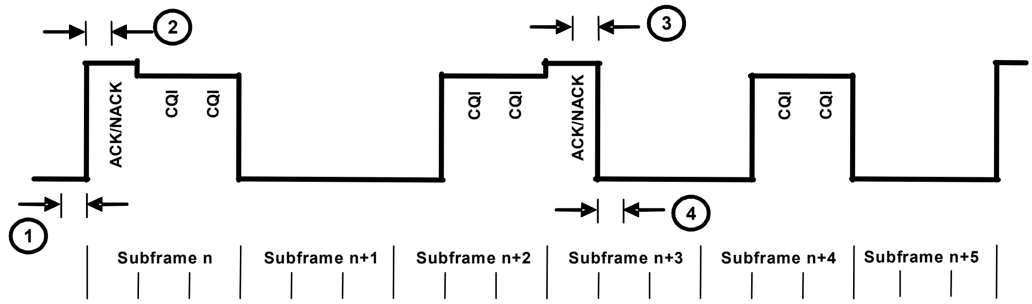

Fig. 31: HS-DPCCH on/off pattern showing measurement positions (Figs. 5.13.1A.1 and 5.13.1AA.1 of TS 34.121 [1]).

Configure the downlink physical channels, Subtest 3, the serving cell and the HS-DPCCH trigger in the R&S®CMW500 as specified in section 2.1. Configure the fixed reference channel (FRC H-Set 1, QPSK version) in the R&S®CMW500 as shown in Fig. 2.
Configure βc and βd for Subtest 3 by referring to Fig. 4. For this test, ΔACK and ΔNACK = 30/15, where β_{HS} = 30/15 *βc, and ΔCQI = 24/15, where β_{HS} = 24/15 * βc. Refer to Fig. 4 to configure ΔACK, ΔNACK and ΔCQI in the R&S®CMW500.

Repeat the EVM measurement twice:
Case (i): When UE transmission is at its maximum
Case (ii): When the UE is transmitting at –18.0 dBm

Configuration in the R&S®CMW500:
WCDMA-UE Signaling → Config. → Physical Uplink Settings → HSDPA → βc → 15
WCDMA-UE Signaling → Config. → Physical Uplink Settings → HSDPA → βd → 8
WCDMA-UE Signaling → Config. → Physical Uplink Settings → HSDPA → ΔACK → 8
WCDMA-UE Signaling → Config. → Physical Uplink Settings → HSDPA → ΔNACK → 8
WCDMA-UE Signaling → Config. → Physical Uplink Settings → HSDPA → ΔCQI → 7

Configure the DPCH frame offset to match the HS-DPCCH half-slot offset to create a signal with a repeat pattern of 12 ms. Table 11 shows the message-specific content for the transport channel reconfiguration for this test. These settings can be configured as shown in Figs. 2 and 3.

Configuration in the R&S®CMW500:
WCDMA-UE Signaling → Config. → Connection Configuration → RMC → Test Mode → Loop Mode 1 RLC
WCDMA-UE Signaling → Config. → Connection Configuration → RMC → Test Mode → Loop Mode 1 RLC → Transparent
*WCDMA-UE Signaling → Config. → Physical Downlink Settings → DPCH Enhanced → Timing Offset → 6 * 256 chip*
Signaling Parameter → HSDPA → CQI Feedback Cycle → 4 ms
Signaling Parameter → HSDPA → CQI Repetition Factor → 1
Signaling Parameter → HSDPA → ACK/NACK Repetition Factor → 1

Establish an HSDPA call. Configure Algorithm 2 to interpret TPC commands. Configure the maximum output power as specified in section 2.3. This power level is maintained by sending alternating "0" and "1" TPC commands in the downlink to satisfy the

condition "TPC_cmd = 0." These settings can be configured by referring to Figs. 15 and 13.
Configuration in the R&S®CMW500:
Signaling Parameter → TPC → Active TPC Setup → All 1
Signaling Parameter → TPC → Alg. / Step Size → Alg2, 1 dB

In the R&S®CMW500, the HS-DPCCH trigger with a slot delay of zero is used to measure phase discontinuity at measurement points (i.e. Slot 0.5 and Slot 10.5) as shown in Fig. 32. This setting can be configured in the R&S®CMW500 as follows:

Multi-Evaluation → Trigger → Trigger Delay → 0 µs
Multi-Evaluation → Measurement Period → Half Slot
Multi-Evaluation → Display → Select View → Phase Discontinuity
Multi-Evaluation → Display → Slot Number Table → 0 [Measurement Point 1]
Multi-Evaluation → Display → Slot Number Table → 0.5 [Measurement Point 2]
Multi-Evaluation → Display → Slot Number Table → 10 [Measurement Point 3]
Multi-Evaluation → Display → Slot Number Table → 10.5 [Measurement Point 4]
Multi-Evaluation → Display → X Scale PhDisc → X Max. → 20 Slots

Repeat the EVM and phase discontinuity measurement at a UE power level of –18 dBm with a tolerance of ±2 dB. This power level is maintained by sending alternating "0" and "1" TPC commands in the downlink to satisfy the "TPC_cmd = 0" condition. These settings can be configured by referring to Figs. 15 and 13.

Configuration in the R&S®CMW500:
Signaling Parameter → TPC → Active TPC Setup → Closed Loop
Signaling Parameter → TPC → Alg. /Step size → Alg2_1dB
Signaling Parameter → TPC → Configuration → DPCH (reference)
Signaling Parameter → Configuration → Target –18.0 dBm

The measurement results for the EVM and phase discontinuity with HS-DPCCH are available on the R&S®CMW500 in the "Multi-Evaluation" application's "Phase Discontinuity" view.
Configuration in the R&S®CMW500:

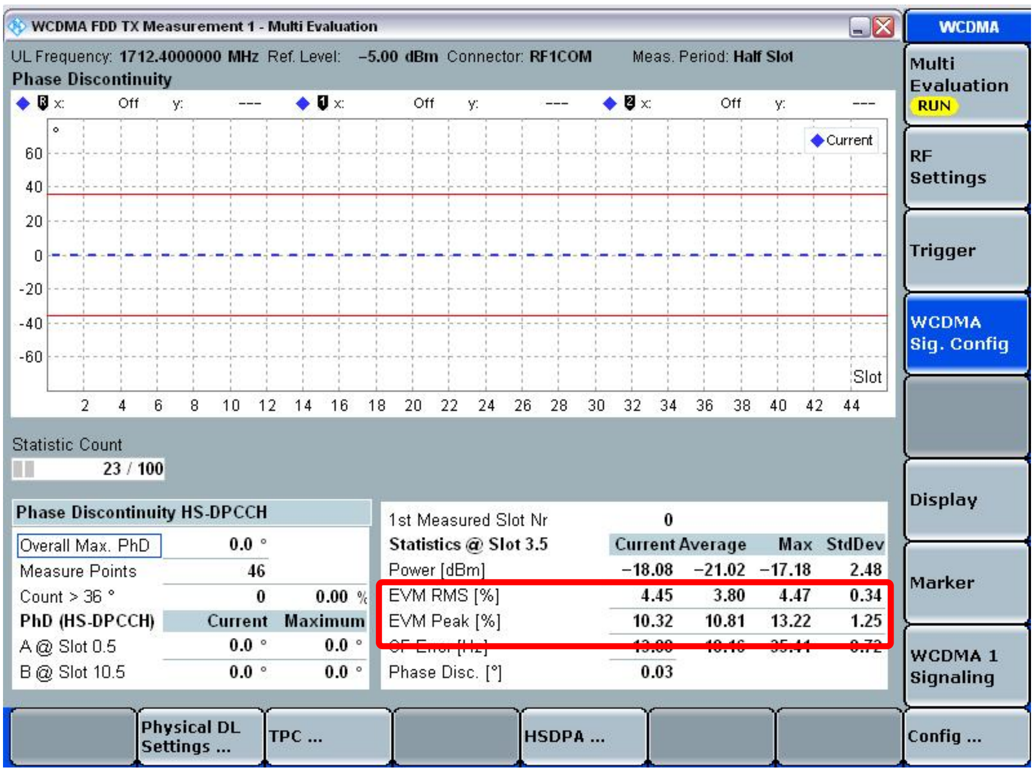

Fig. 32: The EVM and phase discontinuity with HS-DPCCH measurement results.

For both cases (i and ii), the EVM measured is not to exceed 17.5 % at any time during the measurement.

The EVM measurement, 5.13.1A, can be performed simultaneously with the phase discontinuity measurement, 5.13.1AA, using the R&S®CMW500's "Multi-Evaluation" / phase discontinuity application.

1. For the EVM with HS-DPCCH at maximum power, recall HSDPATx3.dfl, establish an RMC call, and modify the following configurations:

Signaling Parameter → HSDPA → CQI Feedback Cycle → 4 ms
Signaling Parameter → HSDPA → CQI Repetition Factor → 1
Signaling Parameter → HSDPA → ACK/NACK Repetition Factor → 1

WCDMA-UE Signaling → Config. → Physical Uplink Settings → Gain Factors → HSDPA → ΔCQI → 7
Signaling Parameter → TPC → Active TPC Setup → All 1
Signaling Parameter → TPC → Alg. /Step Size → Alg2 1 dB

2. For EVM with HS-DPCCH at –18 dBm ±2 dB, recall HSDPATx3.dfl, establish a CS call and modify the following configurations:

Signaling Parameter → HSDPA → CQI Feedback Cycle → 4 ms
Signaling Parameter → HSDPA → CQI Repetition Factor → 1
Signaling Parameter → HSDPA → ACK/NACK Repetition Factor → 1

WCDMA-UE Signaling → Config. → Physical Uplink Settings → Gain Factors → HSDPA → ΔCQI → 7
Signaling Parameter → TPC → Active TPC Setup → Closed Loop
Signaling Parameter → TPC → Alg. /Step Size → Alg2 1 dB
Signaling Parameter → TPC → Configuration → DPCH (reference)
Signaling Parameter → TPC → Configuration → Target Power → –18.0 dBm

The measurement results are available here:
Multi-Evaluation → Display → Select View → Phase Discontinuity

2.8.1 Alternative Method for Performing the EVM Measurement in Line with 5.13.1A

Measurement points and trigger configuration in the R&S®CMW500:

- To trigger a half-slot EVM measurement at minimum power (i.e. where the HS-DPCCH is inactive), use the HS-DPCCH trigger with a trigger-slot delay of zero. This corresponds to points 1 and 4 in Fig. 31.

- To trigger a half-slot EVM measurement at maximum power (i.e. during the ACK/NACK slot of the HS-DPCCH), use the HS-DPCCH trigger plus a trigger slot delay of 1 slot. This corresponds to points 2 and 3 in Fig. 31.

The trigger-slot settings can be adjusted to different HS-DPCCH configurations in a straight forward way. In particular, the slot delay can be increased to obtain EVM half-slot results in the following HSDPA subframes:

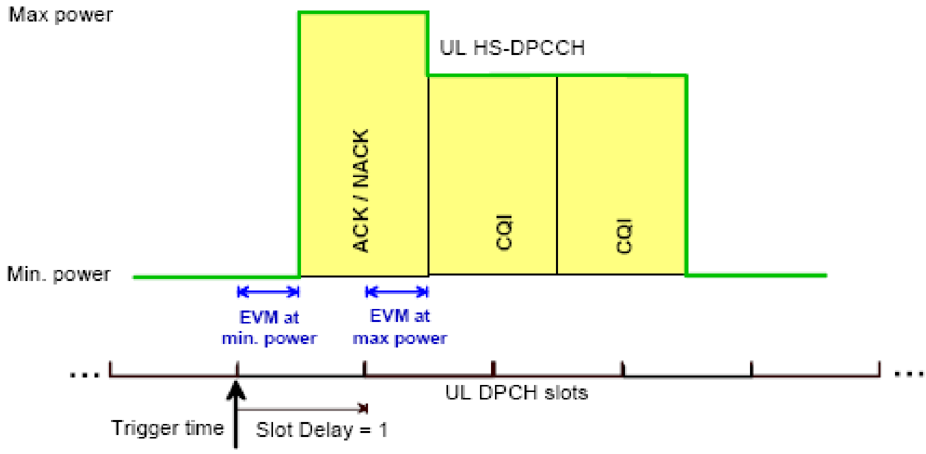

Fig. 33: Trigger configuration in the R&S®CMW500.

Configuration in the R&S®CMW500:
WCDMA Multi-Evaluation → Trigger → Trigger Delay → 0 µs (minimum power) or 666.7 µs (1-slot delay for maximum power)

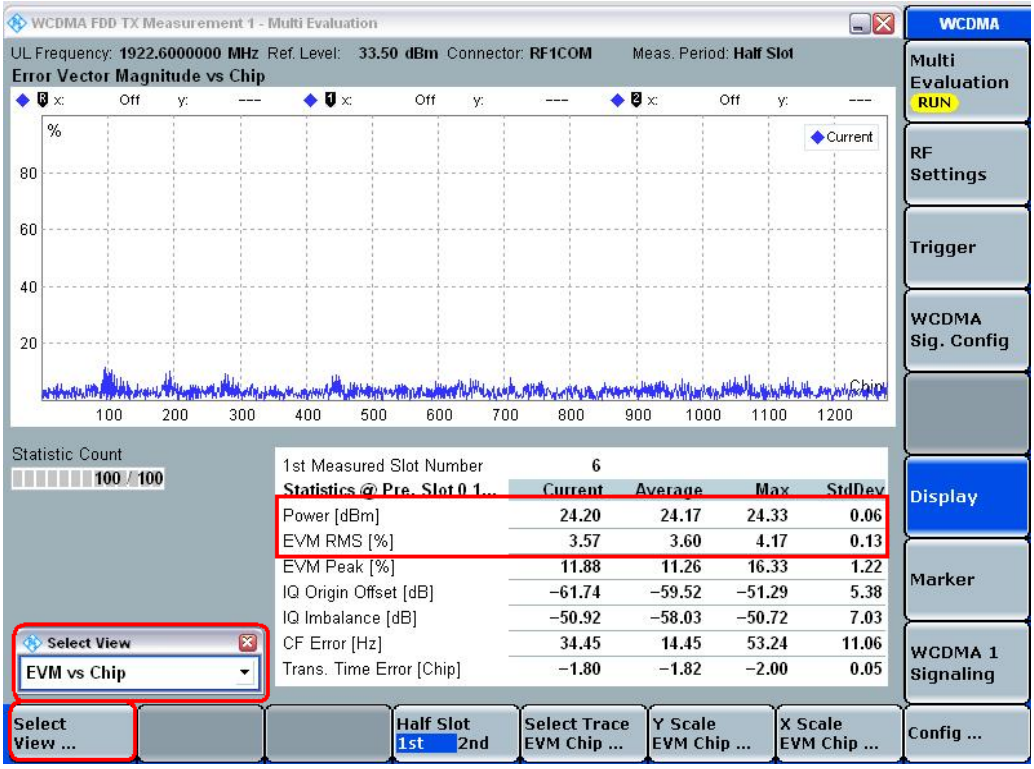

Fig. 34: EVM results when the UE is transmitting at its maximum power.

Repeat the EVM measurement at the UE power level of –18 dBm with a tolerance of ± 2 dB. This power level is maintained by sending alternating "0" and "1" TPC commands in the downlink to satisfy the "TPC_cmd = 0" condition. These settings can be configured in the R&S®CMW500 by referring to Fig. 13.

Configuration in the R&S®CMW500:
Signaling Parameter → TPC → Active TPC Setup → Closed Loop
Signaling Parameter → TPC → Alg. / Step Size → Alg2_1dB
Signaling Parameter → TPC → Configuration → DPCH (reference)
Signaling Parameter → TPC → Configuration → Target –18.0 dBm

The measurement results for the EVM with HS-DPCCH are available in the "EVM vs. Chip" menu in the "Multi-Evaluation" application. Set the measurement period to "Half Slot."

Configuration in the R&S®CMW500:
Multi-Evaluation → Display → Select View → EVM vs. Chip
Multi-Evaluation → Display → X Scale EVM Chip → X Max. → 1280
Multi-Evaluation → Measurement Period → Half Slot

Along with the EVM measurements, additional measurement results for the magnitude error, phase error and other IQ impairments are available in the "TX Measurement (Scalar)" results in the "Multi-Evaluation" application.

Configuration in the R&S®CMW500:
Multi-Evaluation → Display → Select View → TX Measurement (Scalar), Magnitude Error vs. Chip, Phase Error vs. Chip.

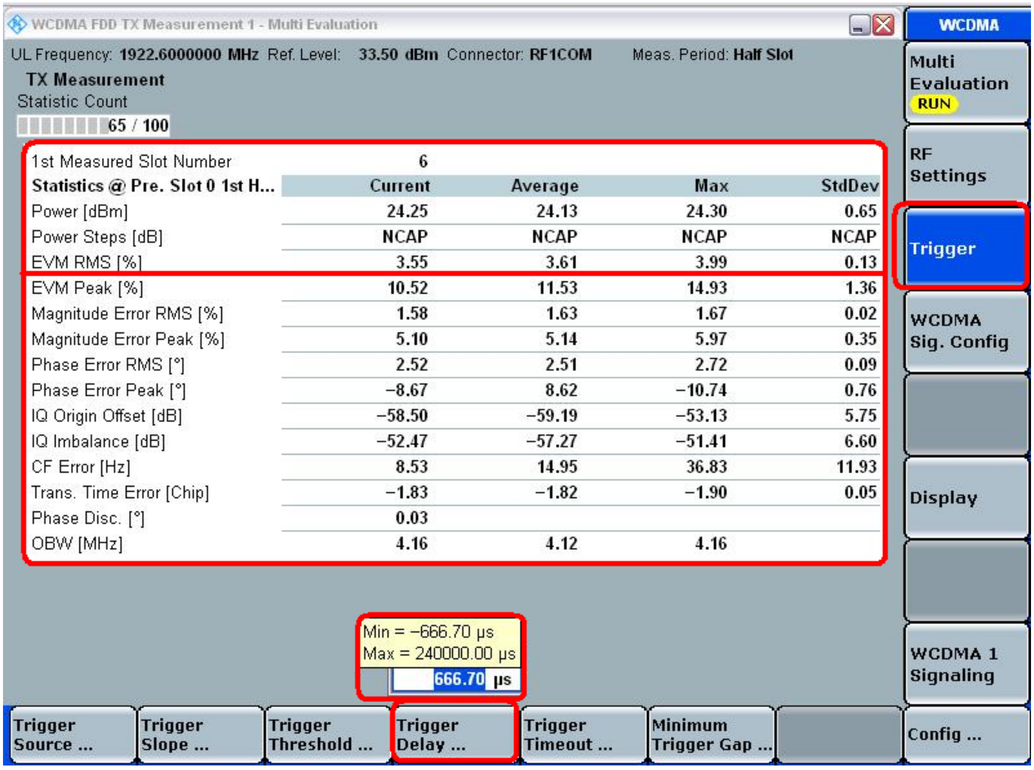

Fig. 35: EVM with HS-DPCCH measurement results with the slot delay set to 1 slot.

In both cases, the measured EVM is not to exceed 17.5 % for the β factor set in line with the requirements for Subtest 3.

1. For the EVM with HS-DPCCH at max. power, recall HSDPATx3.dfl, establish an RMC call and modify the following configurations:

Signaling Parameter → HSDPA → CQI Feedback Cycle → 4 ms
Signaling Parameter → HSDPA → CQI Repetition Factor → 1
Signaling Parameter → HSDPA → ACK/NACK Repetition Factor → 1

WCDMA Signaling → Config. → Physical Uplink Settings → Gain Factors → HSDPA → ΔCQI → 7
WCDMA Multi-Evaluation → Trigger → Trigger Delay → 666.7 µs (1 Slot)

2. *For EVM with HS-DPCCH at –18 dBm ± 2 dB, recall HSDPATx3.dfl, establish a CS call and modify the following configurations:*

Signaling Parameter → HSDPA → CQI Feedback Cycle → 4 ms
Signaling Parameter → HSDPA → CQI Repetition Factor → 1
Signaling Parameter → HSDPA → ACK/NACK Repetition Factor → 1
WCDMA Signaling → Config. → Physical Uplink Settings → Gain Factors → HSDPA → ΔCQI → 7
Signaling Parameter → TPC → Active TPC Setup → Closed Loop
Signaling Parameter → TPC → Alg. /Step Size → Alg2 1 dB
Signaling Parameter → TPC → Configuration → DPCH (reference)
Signaling Parameter → TPC → Configuration → Target Power → –18.0 dBm

The measurement results are available here:
WCDMA Multi-Evaluation → Display → Select View → EVM vs. Chip

2.9 Error Vector Magnitude (EVM) and Phase Discontinuity with HS-DPCCH (5.13.1AA)

The EVM measures the difference between the reference waveform and the measured waveform. Both waveforms pass through a matched root raised cosine (RRC) filter with a bandwidth of 3.84 MHz and a roll-off of $\alpha = 0.22$. The waveforms are further modified by selecting the frequency, absolute phase, absolute amplitude and chip clock timing to minimize the error vector. The EVM result is defined as the square root of the ratio of the mean error vector power to the mean reference power, expressed as a percentage. This test applies to all Release-6 FDD UE and to later releases that support HSDPA.

The phase discontinuity measurement is performed twice:
Case(i): When the UE is transmitting at its maximum power
Case(ii): When the UE is transmitting at –18.0 dBm

The measurement interval is one timeslot, except when the mean power between slots is expected to change, whereupon the measurement interval is reduced by 25 µs at each end of the slot. The EVM shall not exceed 17.5 % for the parameters specified in Table 16.

Phase discontinuity for HS-DPCCH measures the change in phase caused by transmission of the HS-DPCCH. If the HS-DPCCH timeslot is offset from the DPCCH timeslot, the DPCCH timeslot that contains the HS-DPCCH slot boundary is used as the period for evaluating phase discontinuity. The phase discontinuity for HS-DPCCH measures the difference between the absolute phase used to calculate the EVM for that part of the DPCCH timeslot prior to the HS-DPCCH slot boundary, and the absolute phase used to calculate the EVM for the remaining part of the DPCCH timeslot following the HS-DPCCH slot boundary. The EVM measurement excludes the transient periods of 25 µs in all cases.

The phase discontinuity for HS-DPCCH is only defined for non-aligned timeslots when the offset is 0.5 slots. Table 17 shows the phase discontinuity test requirement for HS-DPCCH at the HS-DPCCH slot boundary.

Phase discontinuity test requirement for HS-DPCCH at the HS-DPCCH slot boundary	
Phase discontinuity for HS-DPCCH Δθ in degrees	$\Delta\theta \leq 36$

Table 17: Phase discontinuity test requirement for the HS-DPCCH at the HS-DPCCH slot boundary (Table 5.13.1AA.4 of TS 34.121 [1]).

Fig. 31 shows the 12 ms transmit power profile for measuring the EVM. The EVM is measured during the last half-slot period of the ACK/NACK in subframe n+3, when the UE is at its maximum power in the 12 ms cycle (Measurement Point 3), and in the following half-slot period, when the CQI is off and the UE is at its minimum power in the cycle (Measurement Point 4). The phase discontinuity between the two half-slot periods is computed from these two EVM results.

The EVM is also measured in the last half slot before subframe n, when the UE is at its minimum power (Measurement Point 1), and immediately following that in the first half slot of subframe n, when the ACK/NACK is transmitting and the UE is at its maximum power in the 12 ms cycle (Measurement Point 2). The phase discontinuity between the two half-slot periods is computed from these two EVM results. The 25 µs transient periods at the beginning and end of each measurement period are excluded.

Configure the downlink physical channels, Subtest 3, the serving cell and the HS-DPCCH trigger in the R&S®CMW500 as specified in section 2.1. Configure the fixed reference channel (FRC H-Set 1, QPSK version) in the R&S®CMW500 as shown in Fig. 2.

Refer to Fig. 4 to configure βc and βd for Subtest 3. For this test, ΔACK and ΔNACK = 30/15, where β_{HS} = 30/15 *βc, and ΔCQI = 24/15, where β_{HS} = 24/15 * βc. Refer to Fig. 4 to configure ΔACK, ΔNACK and ΔCQI in the R&S®CMW500.

Configuration in the R&S®CMW500:
WCDMA-UE Signaling → Config. → Physical Uplink Settings → HSDPA → βc → 15
WCDMA-UE Signaling → Config. → Physical Uplink Settings → HSDPA → βd → 8
WCDMA-UE Signaling → Config. → Physical Uplink Settings → HSDPA → ΔACK → 8
WCDMA-UE Signaling → Config. → Physical Uplink Settings → HSDPA → ΔNACK → 8
WCDMA-UE Signaling → Config. → Physical Uplink Settings → HSDPA → ΔCQI → 7

Configure the DPCH frame offset to match the HS-DPCCH half-slot offset to create a signal with a repeat pattern of 12 ms. Table 11 shows the transport channel reconfiguration's message-specific content for this test. These settings can be configured as shown in Figs. 3 and 4 and by referring to Fig. 2.

Configuration in the R&S®CMW500:
WCDMA-UE Signaling → Config. → Connection Configuration → RMC → Test Mode → Loop Mode 1 RLC
WCDMA-UE Signaling → Config. → Connection Configuration → RMC → Test Mode → Loop Mode 1 RLC → Transparent
*WCDMA-UE Signaling → Config. → Physical Downlink Settings → DPCH Enhanced → Timing Offset → 6 * 256 chip*
WCDMA-UE Signaling → Config. → HSDPA → CQI Feedback Cycle → 4 ms
WCDMA-UE Signaling → Config. → HSDPA → CQI Repetition Factor → 1
WCDMA-UE Signaling → Config. → HSDPA → ACK/NACK Repetition Factor → 1

Establish an HSDPA call. Configure Algorithm 2 to interpret TPC commands. Configure the maximum output power as specified in section 2.3. This power level is maintained by sending alternating "0" and "1" TPC commands in the downlink to satisfy the condition "TPC_cmd = 0." These settings can be configured by referring to Figs. 15 and 13.

Configuration in the R&S®CMW500:
Signaling Parameter → TPC → Active TPC Setup → All 1
Signaling Parameter → TPC → Alg. /Step size → Alg2_1dB

In the R&S®CMW500, the HS-DPCCH trigger with a slot delay of zero is used to measure phase discontinuity at measurement points (i.e. Slot 0.5 and Slot 10.5) as shown in Fig. 27. This setting can be configured in the R&S®CMW500 as follows:

Multi-Evaluation → Trigger → Trigger Delay → 0 µs

Repeat the EVM and phase discontinuity measurement at a UE power level of –18 dBm with a tolerance of ±2 dB. This power level is maintained by sending alternating "0" and "1" TPC commands in the downlink to satisfy the "TPC_cmd = 0" condition. These settings can be configured by referring to Figs. 15 and 13.

Configuration in the R&S®CMW500:
Signaling Parameter → TPC → Active TPC Setup → Closed Loop
Signaling Parameter → TPC → Alg. /Step size → Alg2_1dB
Signaling Parameter → TPC → Configuration → DPCH (reference)
Signaling Parameter → Configuration → Target –18.0 dBm

The measurement results for the EVM and phase discontinuity with HS-DPCCH is available on the R&S®CMW500 in the "Multi-Evaluation" application's "Phase Discontinuity" view.

Configuration in the R&S®CMW500:
Multi-Evaluation → Display → Select View → Phase Discontinuity
Multi-Evaluation → Measurement Period → Half Slot
Multi-Evaluation → Measurement Length → 45
Multi-Evaluation → Display → X Scale PhDisc → X Max. → 45 Slots
Multi-Evaluation → Display → Select View → Phase Discontinuity
Multi-Evaluation → Display → Slot Number Table → 0 [Measurement Point 1]
Multi-Evaluation → Display → Slot Number Table → 0.5 [Measurement Point 2]
Multi-Evaluation → Display → Slot Number Table → 10 [Measurement Point 3]
Multi-Evaluation → Display → Slot Number Table → 10.5 [Measurement Point 4]

Fig. 36 shows the measurement results for the EVM and phase discontinuity with HS-DPCCH.

Fig. 36: The EVM and phase discontinuity with HS-DPCCH measurement results.

For both cases (i and ii), the EVM measured is not to exceed 17.5 % at any time during the measurement, and the measured phase discontinuity is not to exceed 36˚.

1. For the EVM and phase discontinuity with HS-DPCCH at maximum power, recall HSDPATx3.dfl, establish an RMC call and modify the following configurations:

Signaling Parameter → HSDPA → CQI Feedback Cycle → 4 ms
Signaling Parameter → HSDPA → CQI Repetition Factor → 1
Signaling Parameter → HSDPA → ACK/NACK Repetition Factor → 1

WCDMA Signaling → Config → Physical Uplink Settings → Gain Factors → HSDPA → ΔCQI → 7
Signaling Parameter → TPC → Active TPC Setup → All 1
Signaling Parameter → TPC → Alg. /Step Size → Alg2 1 dB

2. For EVM and phase discontinuity with HS-DPCCH at –18 dBm ±2 dB, recall HSDPATx3.dfl, establish a CS call, and modify the following configurations:

Signaling Parameter → HSDPA → CQI Feedback Cycle → 4 ms
Signaling Parameter → HSDPA → CQI Repetition Factor → 1
Signaling Parameter → HSDPA → ACK/NACK Repetition Factor → 1

WCDMA Signaling → Config → Physical Uplink Settings → Gain Factors → HSDPA → ΔCQI → 7
Signaling Parameter → TPC → Active TPC Setup → Closed Loop
Signaling Parameter → TPC → Alg. /Step Size → Alg2 1 dB
Signaling Parameter → TPC → Configuration → DPCH (reference)
Signaling Parameter → TPC → Configuration → Target Power → –18.0 dBm

The measurement results are available here:
Multi-Evaluation → Display → Select View → Phase Discontinuity

2.10 Relative Code-Domain Error with HS-DPCCH (5.13.2A)

The relative code-domain error for every non-zero beta code in the domain measures the ratio of the mean power of the projection onto the non-zero beta code to the mean power of the non-zero beta code in the composite reference waveform. The measurement interval is one timeslot, except when the mean power between slots is expected to change, whereupon the measurement interval is reduced by 25 μs at each end of the slot.

The relative code-domain error is affected by both the spreading factor and beta values of the various code channels in the domain. The effective code-domain power (ECDP) for each used code k is defined using the nominal CDP ratio as specified in TS 25.101 [4]:

$$ECDP_k = (\text{Nominal CDP ratio})_k + 10 * \log 10 (SF_k / 256)$$

The relative code-domain error is not applicable when either or both of the following channel conditions occur:

i) The ECDP of any code channel is < –30 dB
ii) The nominal code domain power of any code channel is < –20 dB

The relative code-domain error only considers code channels with a non-zero beta in the composite reference waveform. It does not apply to the PRACH preamble and message parts. This test applies to all Release-6 FDD UE and to later releases that support HSDPA but not EDCH.

Tables 18 and 19 show the nominal ECDP ratios and relative code-domain error test requirement respectively. The measured relative code domain error must meet the test requirements in Table 19 for all combinations of beta factors as specified in Table 18.

Nominal ECDP ratios				
Subtest in Table 3(a)	**Code**	**Nominal code-domain power**	**Spreading factor**	**Nominal ECDP**
1	DPCCH	–17.9	256	–17.9
	DPDCH	–0.4	64	–6.4
	HS-DPCCH	–11.8	256	–11.8
3	DPCCH	–7.2	256	–7.2
	DPDCH	–12.7	64	–18.7
	HS-DPCCH	–1.2	256	–1.2
4	DPCCH	–7.1	256	–7.1
	DPDCH	–18.5	64	–24.5
	HS-DPCCH	–1	256	–1

Table 18: Nominal ECDP ratios (Table 5.13.2A.4 of TS 34.121 [1]).

Relative code-domain error test requirements	
ECDP (dB)	**Relative code-domain error (dB)**
–21 < ECDP	≤ –15.5
–30 ≤ ECDP ≤ –21	≤ –36.5 – ECDP
ECDP < –30	No requirement

Table 19: Test requirements for the relative code-domain error (Table 5.13.2A.5 of TS 34.121 [1]).

Configure the downlink physical channels, Subtest 1, the serving cell and the HS-DPCCH trigger in the R&S®CMW500 as specified in section 2.1. Configure the fixed reference channel (FRC H-Set 1, QPSK version) in the R&S®CMW500 as shown in Fig. 2.

Establish an HSDPA call. UP power control commands are sent to the UE continuously until the UE reaches its maximum output power (which is determined by referring to Fig. 15).

Configuration in the R&S®CMW500:
Signaling Parameter → TPC → Active TPC Setup → All 1
Signaling Parameter → TPC → Alg. / Step Size → Alg2_1dB

Repeat the relative code-domain error measurement at the UE power level of –18 dBm with a tolerance of ±2 dB. These settings can be configured in the R&S®CMW500 by referring to Figs. 15 and 13.

Configuration in the R&S®CMW500:
Signaling Parameter → TPC → Active TPC Setup → Closed Loop
Signaling Parameter → TPC → Alg. / Step Size → Alg2_1dB
Signaling Parameter → TPC → Configuration → DPCH (reference)
Signaling Parameter → TPC → Configuration → Target –18.0 dBm

Repeat the relative code-domain error measurement with different combinations of β values for Subtest 3 and 4, as shown in Table 3(a).

Case (i):

- βc / βd = 2/15 – UE transmitting at its maximum power
- βc / βd = 2/15 – UE transmitting at –18.0 dBm

Case (ii):

- βc / βd = 15/8 – UE transmitting at its maximum power
- βc / βd = 15/8 – UE transmitting at –18.0 dBm

Case (iii):

- βc / βd = 15/4 – UE transmitting at its maximum power
- βc / βd = 15/4 – UE transmitting at –18.0 dBm

Depending on the gain factor values, the measurement threshold may require adjustment. Measurement thresholds of –1 dB and –20 dB are recommended for Subtests 1 and 4 respectively. This setting can be configured by referring to Fig. 11.

Configuration in the R&S®CMW500:
WCDMA Multi-Evaluation → Config. → Measurement Control → Modulation/CDP → Chn. Detect Threshold → –1 dB (Subtest 1), –10 dB (Subtest 3) or –20 dB (Subtest 4)

The measurement results for the relative code-domain error with HS-DPCCH is available on the R&S®CMW500 in the WCDMA "Multi-Evaluation" application's "Relative CDE" view.

Configuration in the R&S®CMW500:
WCDMA Multi-Evaluation → Display → Select View → Relative CDE
WCDMA Multi-Evaluation → Measurement Period → Half Slot

To calculate the ECDP and the nominal CDP, the instrument must know the configured channels, their beta factors and the spreading factors (SF). Use the "Expected ECDP" section of the configuration dialog to specify this information. If the combined signal path scenario is active, the required information is delivered by the signaling application and displayed. In such cases, you only need to select which set of values is to be used for the HS-DPCCH, as shown in the Fig. 37.

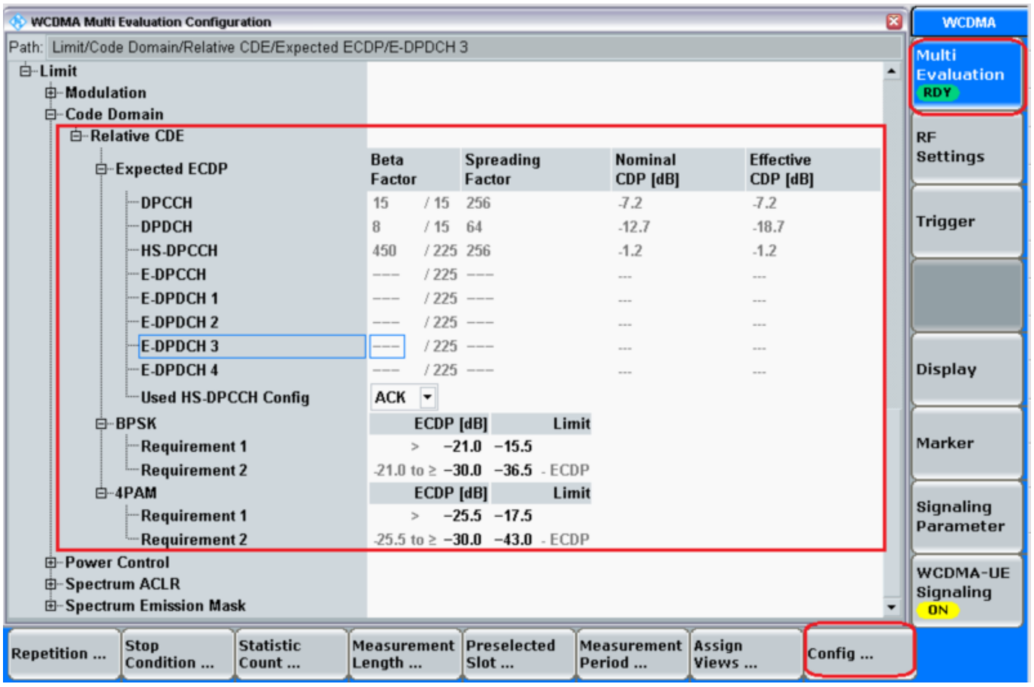

Fig. 37: Expected Nominal CDP and ECDP for β factors set as required for Subtest 4.

Fig. 38 shows the measurement results for the relative code domain error with HS-DPCCH. The measured relative code-domain error must meet the test requirements in Table 19 for all combinations of beta factors as specified in Table 18.

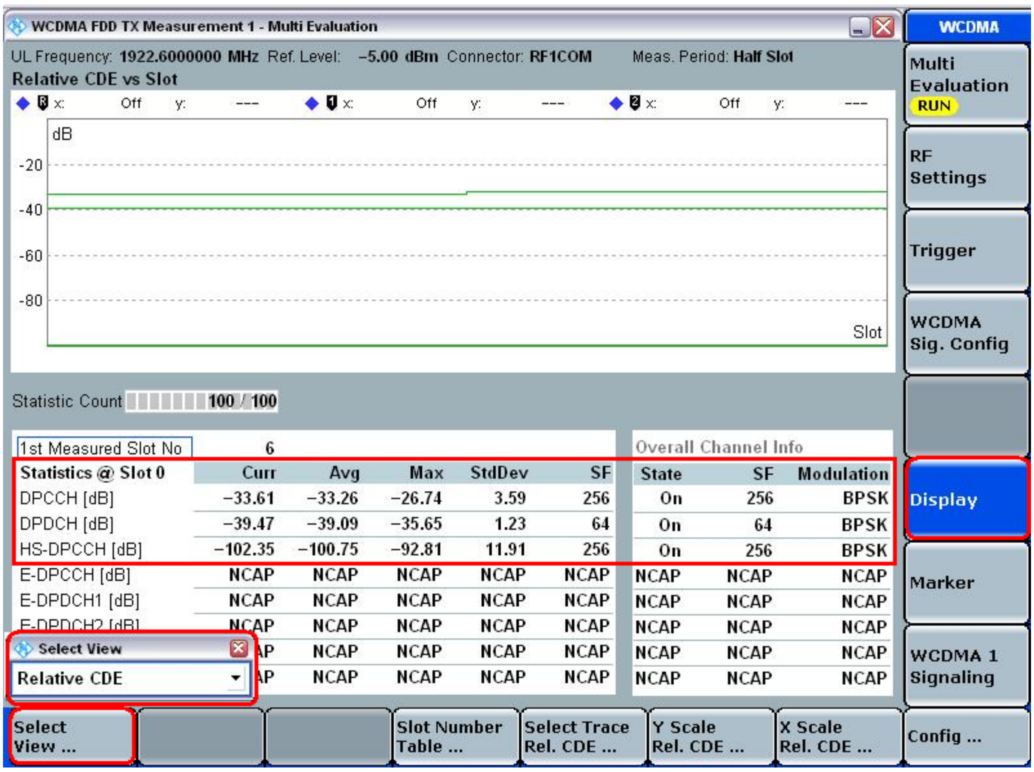

Fig. 38: Measurement results for the relative code-domain error with HS-DPCCH.

1. For Subtest 1 with FRC H-Set 1, QPSK version, at max. power, recall HSDPATx1.dfl, establish an RMC call, and modify the following configuration:

WCDMA Multi-Evaluation → Display → Select View → Relative CDE

Repeat the test at –18 dBm by modifying the following configurations:
Signaling Parameter → TPC → Active TPC Setup → Closed Loop
Signaling Parameter → TPC → Configuration → DPCH (reference)
Signaling Parameter → Configuration → Target Power → –18.0 dBm

2. For Subtest 3 with FRC H-Set 1, QPSK version, at max. power, recall HSDPATx3.dfl, and establish an RMC call.

WCDMA Multi-Evaluation → Display → Select View → Relative CDE

Repeat the test at –18 dBm

3. For Subtest 4 with FRC H-Set 1, QPSK version, at max. power, recall HSDPATx4.dfl, and establish an RMC call:

WCDMA Multi-Evaluation → Display → Select View → Relative CDE

Repeat the test at –18 dBm.

3 Rel-5 Receiver Characteristics

3.1 Maximum Input Level for HS-PDSCH Reception (16QAM; 6.3A)

The measurement of the maximum input level for HS-PDSCH reception determines the maximum power received at the UE antenna port that will not degrade the specified HSDPA throughput performance. An inadequate maximum input level causes loss of coverage near the Node B. This test applies to all FDD user equipment that supports HSDPA (16QAM).

The measured throughput must meet or exceed 700 kbit/s as specified in Table 20 for FRC H-Set 1, 16QAM version, and in Table 4, with additional parameters as in Table 21.

Minimum throughput requirement	
HS-PDSCH Ec/Ior (dB)	**T-put *R* (kbps)**
–3	700

Table 20: Minimum throughput requirement (Table 6.3A.2 of TS 34.121 [1]).

Test requirement parameters for 16QAM maximum input level		
Parameter	**Unit**	**Value**
Phase reference		P-CPICH
Ior	dBm/3.84 MHz	–25.7
UE transmitted mean power	dBm	20 (for Power Class 3 and 3bis) 18 (for Power Class 4)
DPCH_Ec/Ior	dB	–13
HS-SCCH_1_Ec/Ior	dB	–13
Redundancy and constellation version		6
Maximum number of HARQ transmissions		1

Note:
The HS-SCCH and corresponding HS-DSCH shall be transmitted continuously with constant power, but the HS-SCCH shall only use the identity of the UE under test every third TTI.

Table 21: Test requirement parameters for 16QAM maximum input level (Table 6.3A.4 of TS 34.121 [1]).

Configuration in the R&S®CMW500:
Signaling Parameter → HSDPA → Configuration Type → Fixed Reference Channel
Signaling Parameter → HSDPA → H-Set → H-Set 1 Max. Input

Configure an HSDPA call in the R&S®CMW500 as shown in Fig. 1. Then set the device to FRC H-Set 1, 16QAM version, for the maximum input level. The H-Set 1 maximum input is equivalent to H-Set 1 16QAM with parameters optimized for the maximum input level. Adjust the downlink physical channels shown in Tables 5(a) and 21 in the

R&S®CMW500 by referring to Fig. 6. After that, start the measurement by establishing an HSDPA call.

Signaling Parameter → Physical DL Settings → Output Power (Ior) → –25.7 dBm
Signaling Parameter → Physical DL Settings → DPCH → –13.0 dB
Signaling Parameter → Physical DL Settings → HS-SCCH#1 → Level → –13.0 dB
Signaling Parameter → Physical DL Settings → HS-PDSCH → –3.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → P-CPICH → –10.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → P-CCPCH → –12.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → P-SCH → –15.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → S-SCH → –15.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → PICH → –15.0 dB
WCDMA-UE Signaling → Config. → Connection Configuration → Test Mode → Loop Mode1
WCDMA-UE Signaling → Config. → Connection Configuration → Loop Mode1 RLC → Acknowledge
WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-SCCH 1 → ON
WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-SCCH 2 → OFF
WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-SCCH 3 → OFF
WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-SCCH 4 → OFF
WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-SCCH Enhanced → Selection → No.1
WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-SCCH Enhanced → Number of HS-SCCH → 4
WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-SCCH Enhanced → Unscheduled Subframes → Transmit Dummy UEID

Table 22 shows the contents of the radio bearer setup message for this test. The results measured for the UE output power must be kept at the specified power level with a tolerance of ±1 dB. These settings can be configured by referring to Figs. 15 and 13.

Contents of the radio bearer setup message: AM or UM	
Information element	**Value/Remark**
CHOICE channel requirement	Uplink DPCH info
– Power control algorithm	Algorithm2

Table 22: Contents of the radio bearer setup message: AM or UM (Table 6.3A.3 of TS 34.121 [1]).

Configuration in the R&S®CMW500:
Signaling Parameter → TPC → Alg. / Step Size → Alg. 2, 1 dB
Signaling Parameter → TPC → Active TPC Setup → Closed Loop
Signaling Parameter → TPC → Configuration → Total
Signaling Parameter → TPC → Configuration → Target Power → 20 dBm (Power Class 3 and 3bis) or 18 dBm (Power Class 4)

Table 23 shows the statistical test requirements for the maximum input level for HS-PDSCH reception (16QAM).

Maximum input level for HS-PDSCH reception (16QAM)						
Maximum input level for HS-PDSCH reception (16QAM) **16QAM H-Set 1**	**Absolute test requirement (kbps)**	**Relative test requirement (normalized to ideal = 777 kbps)** **No. of events / No. of samples**	**Test limit expressed as No. of events / min. No. of samples** **(Bad DUT factor)**	**Min. No. of samples** **(No. of events to pass)** **Mandatory if applicable**	**Test time in s** **Mandatory if fading** **Informative and approx. if statistical**	**BL / RT**
	700	10%	58/467 (M=1.5)	467 (≤58)	2.8 s (stat)	BL

Note:
NACK+ statDTX + ACK is summarized as No. of samples.
NACK+ statDTX is summarized as No. of errors.
ACK is summarized as No. of successes.

– In the BLER (BL) test mode, the ratio "No. of errors/ No. of samples" is recorded. In this mode, a pass is below the test limit.
– In the Relative Throughput (RT) test mode (1 – BLER), the ratio "No. of successes/ No. of samples" is recorded. In this mode, a pass is above the test limit.
– The test mode used is indicated in the rightmost column with BL or RT.
– The transition from the BL to the RT test mode can also be seen in the relative test requirement column: BLER%→ (1-BLER%) .
– The generic term for No. of errors (BLER mode) or No. of successes (Relative Throughput mode) is No. of events. This is used in the Test Limit table column.

Table 23: Maximum input level for HS-PDSCH reception for 16QAM (Table F.6.3.5.1 of TS 34.121 [1]).

All receiver measurements are grouped under "RX Measurement" on the R&S®CMW500.

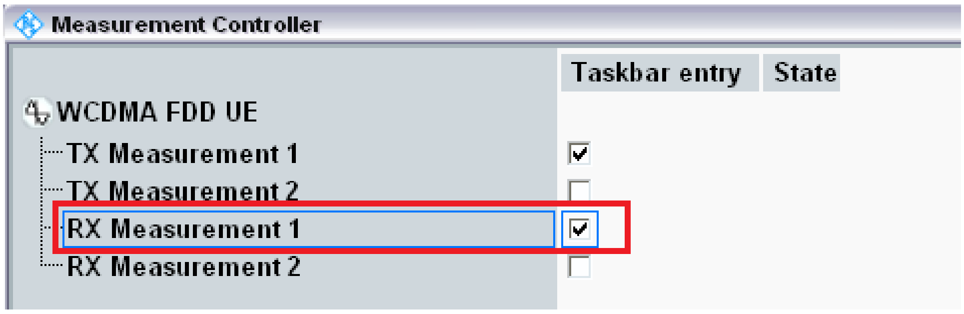

Fig: Enable RX measurements for WCDMA using the "Measure" hard key.

The measurement results for the measured throughput, the BL test mode and RT test mode for the maximum input level for HS-PDSCH reception (16QAM) is available as "HSDPA ACK" under "RX Measurement" on the R&S®CMW500.

Configuration in the R&S®CMW500:
Measure → RX Measurement → ON [check mark]
WCDMA RX Meas. → HSDPA ACK
WCDMA RX Meas. → HSDPA ACK → Measure Subframes → 500
WCDMA RX Meas. → HSDPA ACK → Repetition → Single Shot

Fig. 39 shows the maximum input level for the HS-PDSCH reception (16QAM) measurement results.

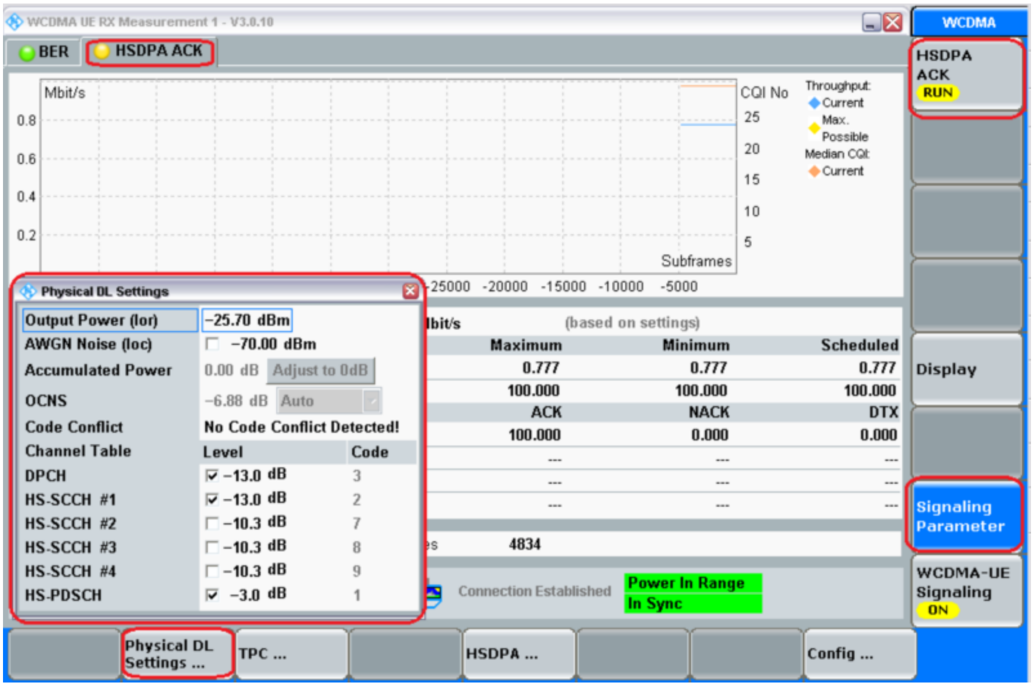

Fig. 39: Physical DL settings required for testing the maximum input level.

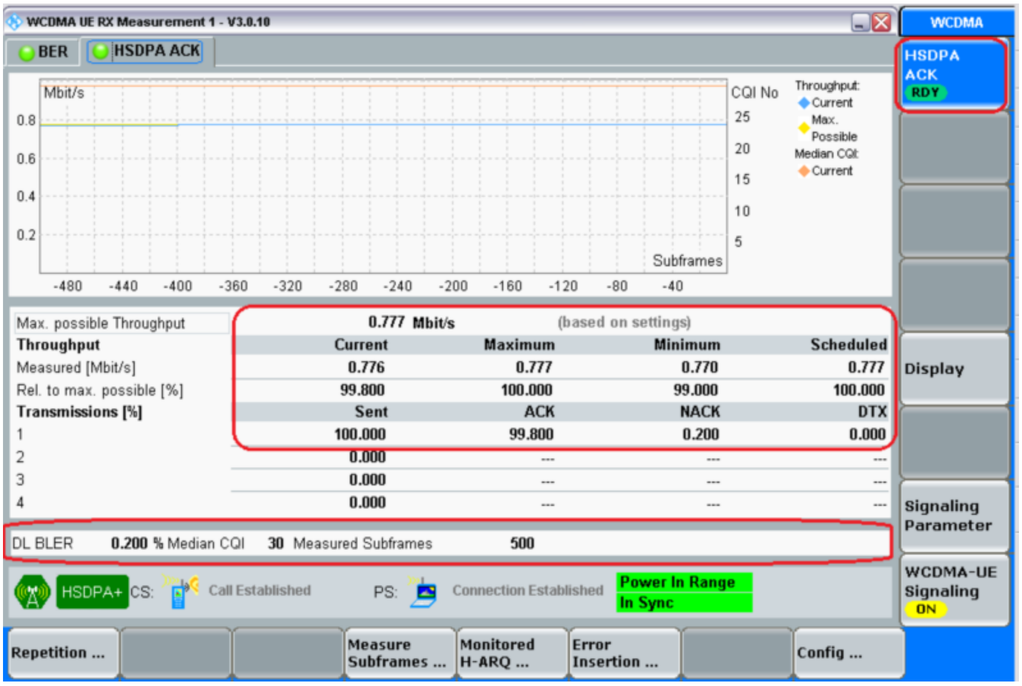

Fig. 19: Measurement results for the maximum input level for HS-PDSCH reception (16QAM).

The measured throughput shall be more than 777 kbps when measured at over 500 subframes or more.

Recall MaxInput.dfl, and establish an RMC call.

The measurement results are available here:
Go to → WCDMA UE FDD HSDPA ACK → ON

3.2 Maximum Input Level for HS-PDSCH Reception (64QAM; 6.3B)

The maximum input level for HS-PDSCH reception measurement determines the maximum power received at the UE antenna port that will not degrade the specified HSDPA throughput performance. An inadequate maximum input level causes loss of coverage near the Node B. This test applies for Release 7 and to later releases for all types of UTRA FDD UEs that support HSDPA (64QAM).

The measured throughput shall meet or exceed 11 800 kbit/s as specified in Table 24 for FRC H-Set 8, 64QAM version, and in Table 4, with additional parameters in Table 25.

Minimum throughput requirement	
HS-PDSCH Ec/Ior (dB)	**T-put *R* (kbps)**
–2	11800

Table 24: Minimum throughput requirement (Table 6.3B.2 of TS 34.121 [1]).

Test requirement parameters for 64QAM maximum input level		
Parameter	**Unit**	**Value**
Phase reference		P-CPICH
Ior	dBm/3.84 MHz	–25.7
UE transmitted mean power	dBm	20 (for Power Classes 3 and 3bis) 18 (for Power Class 4)
DPCH_Ec/Ior	dB	–13
HS-SCCH_1_Ec/Ior	dB	–13
Redundancy and constellation version		6
Maximum number of HARQ transmissions		1

Note:
The HS-SCCH and corresponding HS-DSCH shall be transmitted continuously with constant power, but the HS-SCCH shall only use the identity of the UE under test every third TTI.

Table 25: Test requirement parameters for the 64QAM maximum input level (Table 6.3B.4 of TS 34.121 [1]).

Configuration in the R&S®CMW500:
Signaling Parameter → HSDPA → Configuration Type → Fixed Reference Channel
Signaling Parameter → HSDPA → H-Set → H-Set 8 Max. Input

Configure an HSDPA call in the R&S®CMW500 as shown in Fig. 1. Configure the "Max. Input" version of the FRC H-Set 8 in the R&S®CMW500 by referring to Fig. 2. Configure the downlink physical channels in Table 5(a) and Table 25 in the R&S®CMW500 by referring to Fig. 6. Establish an HSDPA call.

Signaling Parameter → Physical DL Settings → Output Power (Ior) → –25.7
Signaling Parameter → Physical DL Settings → DPCH → –13.0 dB
Signaling Parameter → Physical DL Settings → DPCH → Code → 7
Signaling Parameter → Physical DL Settings → HS-SCCH#1 → –13.0 dB
Signaling Parameter → Physical DL Settings → HS-SCCH Enhanced → Number of HS-SCCH → 2
Signaling Parameter → Physical DL Settings → HS-PDSCH → –2.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → P-CPICH → –10.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → P-CCPCH → –12.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → P-SCH → –15.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → S-SCH → –15.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → PICH → –15.0 dB
WCDMA-UE Signaling → Config. → Connection Configuration → Test Mode → Loop Mode1
WCDMA-UE Signaling → Config. → Connection Configuration → Loop Mode1 RLC → Acknowledge

Table 26 shows the contents of the radio bearer setup message for this test. Apart from this, other specific message content as specified in Table 6.3B.3 of 3GPP specification 34.121[1] must be maintained while performing the 64QAM maximum input level measurement. These settings have been incorporated into the H-Set as "H-Set 8 Max. Input."
The measured UE output power must be kept at the specified power level with a tolerance of ±1 dB. These settings can be configured by referring to Figs. 15 and 13.

Content of the radio bearer setup message: AM or UM (Test Loop Mode 1)	
Information Element	**Value/Remark**
CHOICE channel requirement	Uplink DPCH info
– Power control algorithm	Algorithm2
Downlink information per radio link list – Downlink information for each radio link – Downlink DPCH info for each RL – DL channelization code – Code number	7

Table 26: Content of the radio bearer setup message: AM or UM (Table 6.3B.3 of TS 34.121 [1]).

Configuration in the R&S®CMW500:
Signaling Parameter → TPC → Active TPC Setup → Closed Loop
Signaling Parameter → TPC → Alg. /Step Size → Alg2 1 dB
Signaling Parameter → TPC → Configuration → Total
Signaling Parameter → TPC → Configuration → Target Power → 20 dBm (Power Classes 3 and 3bis) or 18 dBm (Power Class 4)

Table 27 shows the statistical test requirements for the maximum input level for HS-PDSCH reception (64QAM).

Maximum input level for HS-PDSCH reception (64QAM)						
Maximum input level for HS-PDSCH reception (64QAM) **64QAM H-Set 1**	**Absolute test requirement (kbps)**	**Relative test requirement (normalized to ideal=13252 kbps)** **No. of events / No. of samples**	**Test limit expressed as No. of events / min. No. of samples** **(Bad DUT factor)**	**Min. No. of samples** **(No. of events to pass)** **Mandatory if applicable**	**Test time in s** **Mandatory if fading** **Informative and approx. if statistical**	**BL / RT**
	11800	10.96 %	57/422 (M=1.499)	422 (≤57)	0.844 s (stat)	BL

Note:
NACK + statDTX + ACK is summarized as No. of samples.
NACK + statDTX is summarized as No. of errors.
ACK is summarized as No. of successes.

– In the BLER (BL) test mode, the ratio "No. of errors/ No. of samples" is recorded. In this mode, a pass is below the test limit.
– In the Relative Throughput (RT) test mode (1 - BLER), the ratio "No. of successes/ No. of samples" is recorded. In this mode, a pass is above the test limit.
– The test mode used is indicated in the rightmost column with BL or RT.
– The transition from the BL to the RT test mode can also be seen in the column "Relative test requirement": BLER%→ (1-BLER%) .
– The generic term for No. of errors (BLER mode) or No. of successes (Relative Throughput mode) is No. of events. This is used in the table column Test Limit.

Table 27: Maximum input level for HS-PDSCH reception (64QAM; Table F.6.3.5.1A of TS 34.121 [1]).

The measurement results for the measured throughput at the maximum input level for HS-PDSCH reception (64QAM) is available as a separate application: "WCDMA HSDPA ACK" in the R&S®CMW500. Configure the "Go to…" tab to navigate to the "WCDMA HSDPA ACK" application.

Configuration in the R&S®CMW500:
Go to → Select Menu → WCDMA FDD UE HSDPA ACK
WCDMA HSDPA ACK → Measure Subframes → ≥ 422 (when "Repetition" is set to "Single Shot")

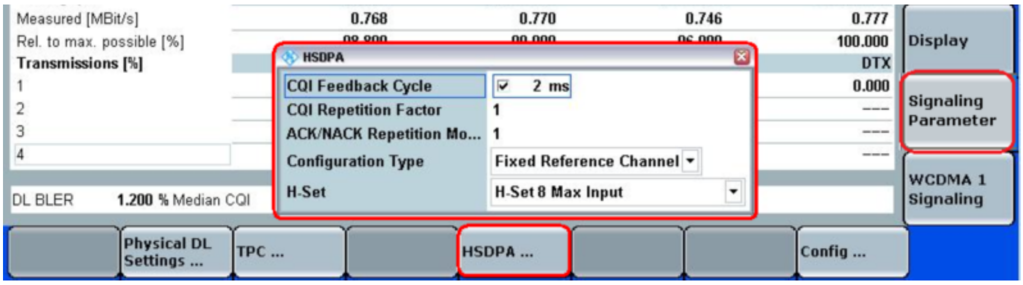

Fig. 41: Change the H-Set to "H-Set 8 Max. Input" for the 64QAM measurement results.

Fig. 42 shows the maximum input level for HS-PDSCH reception (64QAM) measurement results. The measured throughput must reach or exceed at least 11800 kbps when measured over more than 422 subframes or more.

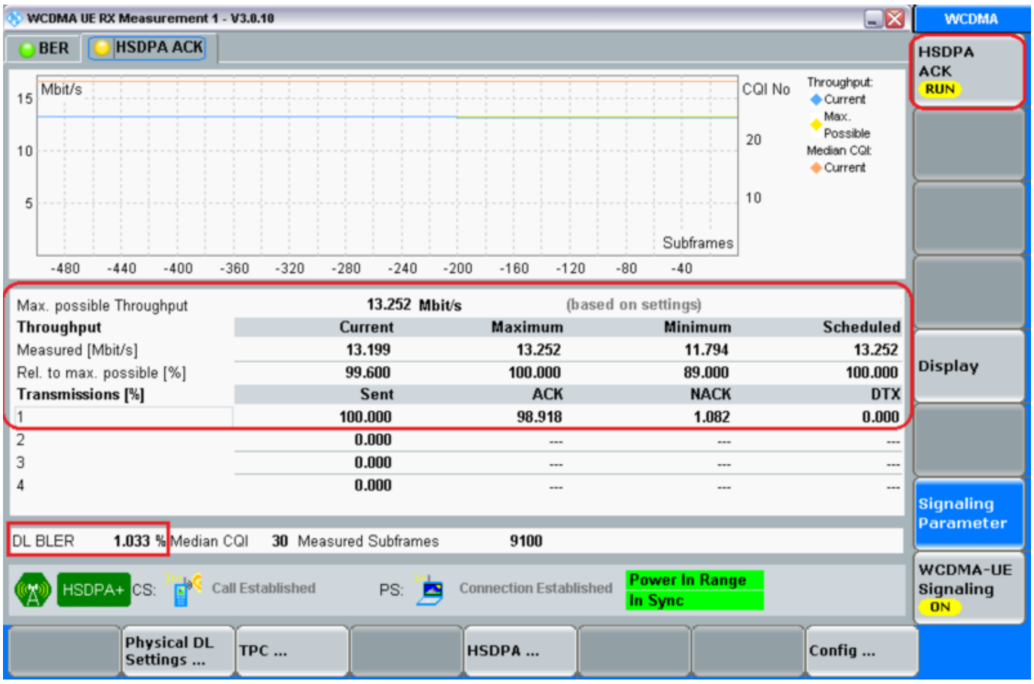

Fig. 42: Maximum input level for HS-PDSCH reception (64QAM).

Recall MaxInput.dfl, and establish an RMC call.
Change the Physical DL level and FRC H-SET:
Signaling Parameter → HSDPA → H-Set → H-Set 8 Max. Input
Signaling Parameter → Physical DL Settings → HS-PDSCH → –2 dB

The measurement results are available here:
WCDMA UE FDD HSDPA ACK → ON

4 Rel-8 Receiver Characteristics

4.1 General Settings for Rel-8 Rx tests

In DC-HSDPA operation, there are dual carriers that are spaced 5 MHz apart in the downlink. The UE must be capable of processing these carriers simultaneously along with a single carrier in the uplink. This poses new requirements for testing the UE's ability to process two carriers in the downlink; consequently, it results in new test cases for characterizing the UE's receiver.

UE that supports DC-HSDPA must meet both minimum requirements as well as additional requirements for DC-HSDPA. For all additional requirements for DC-HSDPA, as included in chapter 6 of 34.121, "Fixed Reference Channel H-Set 12" is to be used unless otherwise specified.

The properties of H-Set 12 are described in detail in C.8.1.12 of TS 34.121, and the physical channel is setup in line with table E.5.4B of TS 34.121.
The cells are to transmit with identical parameters, and the maximum number of transmissions is to be limited to 1 (i.e. no retransmissions are allowed).

Fixed reference channel H-Set 12		
Parameter	**Unit**	**Value**
Nominal avg. inf. bit rate	kbps	600
Inter-TTI distance	TTIs	1
Number of HARQ processes	Processes	6
Information bit payload (N_{INF})	Bits	120
Number of code blocks	Blocks	1
Binary channel bits per TTI	Bits	960
Total available SMLs in UE	SMLs	19200
Number of SMLs per HARQ proc.	SMLs	3200
Coding rate		0.15
Number of physical channel codes	Codes	1
Modulation		QPSK

Note 1: This RMC is intended to be used for DC-HSDPA mode, and both cells shall transmit with identical parameters as listed in the table.
Table 28: Properties of FRC H-Set12.

The following steps prepare the CMW500 for DC-HSDPA testing:

1. Configure the R&S®CMW500 to transmit on adjacent dual carriers that are 5 MHz apart.

2. Set the operating band, frequency and levels for different physical channels, for both carriers.
3. The two DL carriers from the R&S®CMW500 are routed through the two RF ports, which are combined using an external combiner.* The external attenuation due to the combiner and RF cables needs to be compensated appropriately for both ports.
4. Set the relevant H-Set to enable DC-HSDPA operation.
5. Prepare the “Go to” soft keys to navigate to the "Receiver Measurement" application to check the BLER results for both the carriers.

** Use of the external combiner depends on the type of RF frontend that the instrument is equipped with. Instruments with an advanced variant of the RF frontend (R&S®CMW-S590D) do not require an external combiner, because the signals can be combined internally. In the example described here, a basic frontend (R&S®CMW-S590A) is used for demo purposes.*

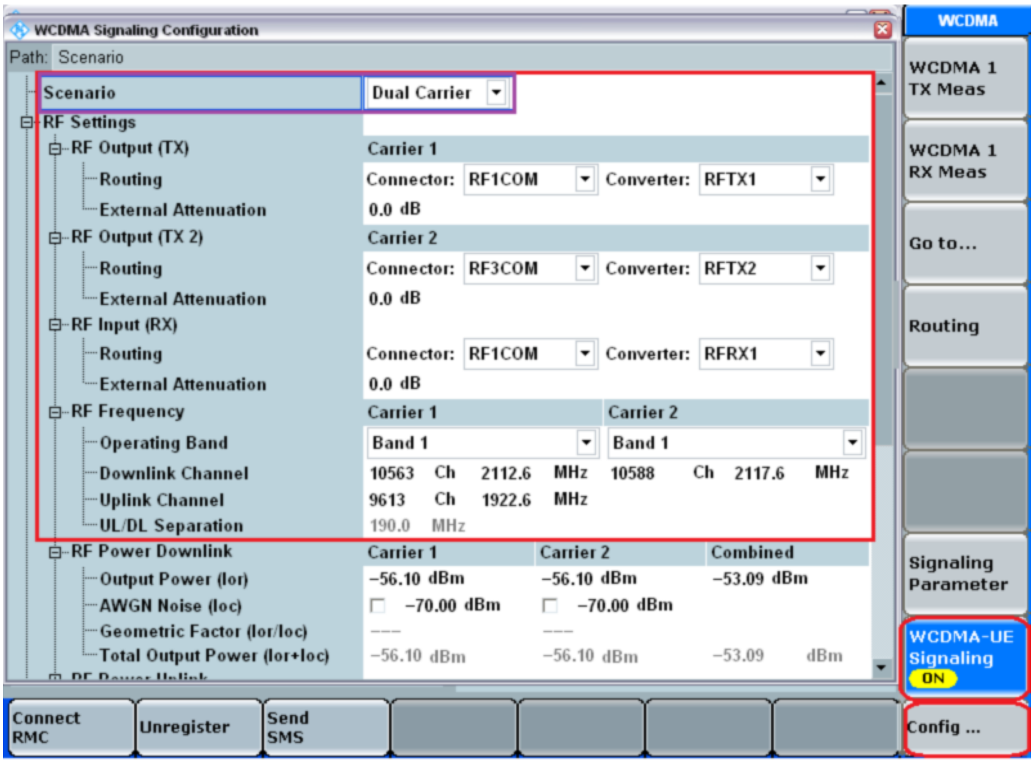

Fig. 43: RF settings for DC-HSDPA.

The TS 34.121 specifies use of a half-timeslot offset between the DPCH and HS-DPCCH and Test Loop Mode 1 (AM or UM); in addition, the relative power levels of the different physical channels need to be set as defined in the relevant table.

Downlink physical channels for DC-HSDPA reference measurement channel testing			
Physical channel	**Parameter**	**Value**	**Note**
P-CPICH	P-CPICH_Ec/Ior	–10 dB	
P-CCPCH	P-CCPCH_Ec/Ior	–12 dB	Mean power level is shared with SCH
SCH	SCH_Ec/Ior	–12 dB	Mean power level is shared with P-CCPCH – SCH (includes P-SCH and S-SCH)
PICH	PICH_Ec/Ior	–15 dB	
DPCH	DPCH_Ec/Ior	Test-specific only for serving the HS-DSCH cell, otherwise omitted	12.2 kbps DL reference measurement channel
HS-SCCH-1	HS-SCCH_Ec/Ior	–9 dB	Specifies fraction of Node-B radiated power transmitted when TTI is active (i.e due to minimum inter-TTI interval)
HS-SCCH-2	HS-SCCH_Ec/Ior	DTX'd	No signalling scheduled, or power radiated, on this HS-SCCH, but signalled to the UE as present
HS-SCCH-3	HS-SCCH_Ec/Ior	DTX'd	As HS-SCCH-2
HS-PDSCH	HS-PDSCH_Ec/Ior	Test-specific	
OCNS		Necessary power so that total transmit power spectral density of Node B (Ior) adds to one	

Table 29: Downlink physical channels for DC-HSDPA receiver testing (Table E.5.4B of TS 34.121 [1]).

Follow the steps below to configure the parameters defined in Table 29:

WCDMA-UE Signaling → Config. → RF Settings → RF Power Downlink → Output Power (Ior) →–75 dBm (for both Carrier 1 and Carrier 2)

<u>For Carrier 1:</u>
WCDMA-UE Signaling → Config. → Physical Downlink Settings → Select Carrier → Carrier 1
WCDMA-UE Signaling → Config. → Physical Downlink Settings → P-CPICH → –10.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → P-CCPCH → –12.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → P-SCH →–15.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → S-SCH →–15.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → PICH →–15.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → DPCH →–5.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-SCCH#1 → –9.0 dB

WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-SCCH Enhanced → Selection → No.1
WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-SCCH Enhanced → Number of HS-SCCH → 3
WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-SCCH Enhanced → Unscheduled Subframes → DTX
WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-PDSCH → –10.3 dB
*WCDMA-UE Signaling → Config. → Physical Downlink Settings → DPCH Enhanced → Timing Offset → 6 * 256 chip*

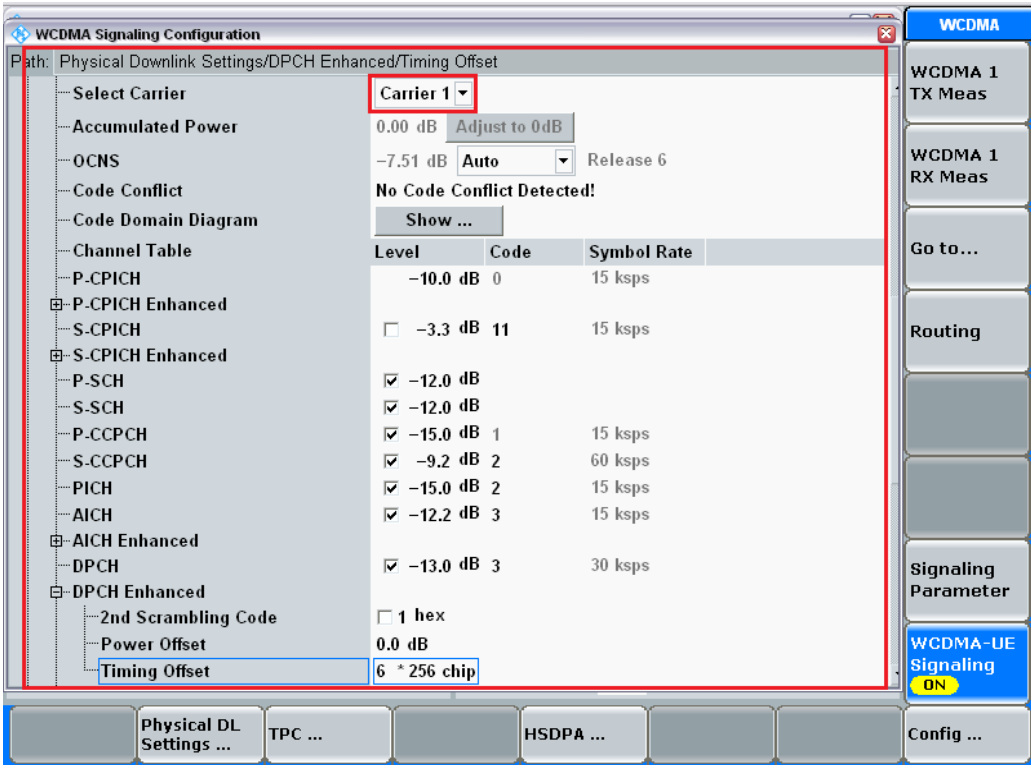

Fig. 44: Physical downlink settings for Carrier 1 (main carrier).

For Carrier 2:

WCDMA-UE Signaling → Config. → Physical Downlink Settings → Select Carrier → Carrier 2
WCDMA-UE Signaling → Config. → Physical Downlink Settings → P-CPICH → –10.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-SCCH#1 → –9.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-SCCH Enhanced → Selection → No.1
WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-SCCH Enhanced → Number of HS-SCCH → 3
WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-SCCH Enhanced → Unscheduled Subframes → DTX
WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-PDSCH → –10.3 dB

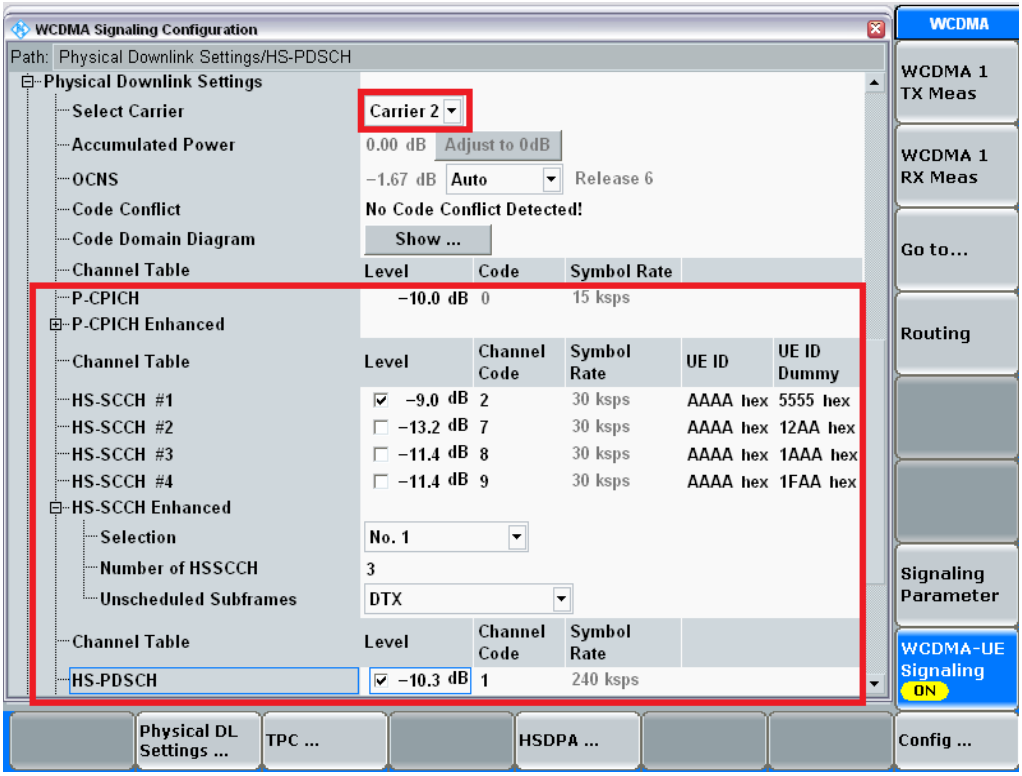

Fig. 45: Physical downlink settings for Carrier 2 (secondary carrier).

A 12.2 kbps "Loop Mode 1" RMC test connection with acknowledge mode is used for testing.

WCDMA-UE Signaling → Config. → Connection Configuration → RMC → Data Rate → 12.2 kbps (DL and UL)
WCDMA-UE Signaling → Config. → Connection Configuration → RMC → Test Mode → Loop Mode 1 RLC
WCDMA-UE Signaling → Config. → Connection Configuration → RMC → Loop Mode 1 RLC → Acknowledge

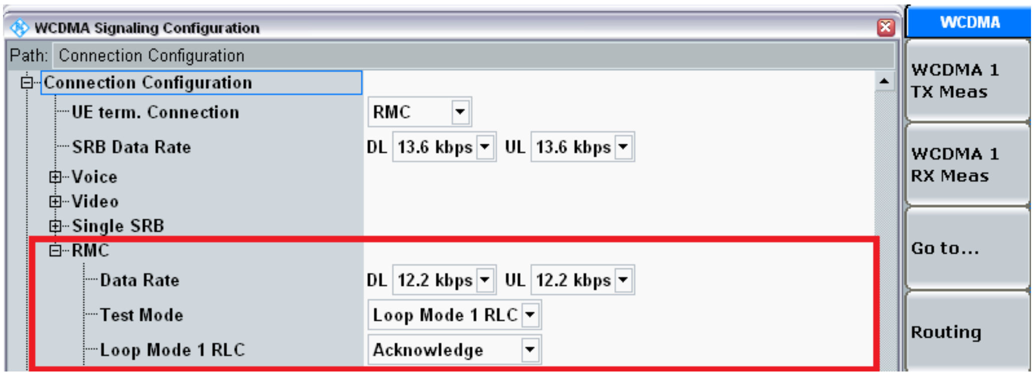

Fig. 46: "Loop Mode 1" test configuration.

Switch ON the UE and wait until it is CS registered and PS attached.

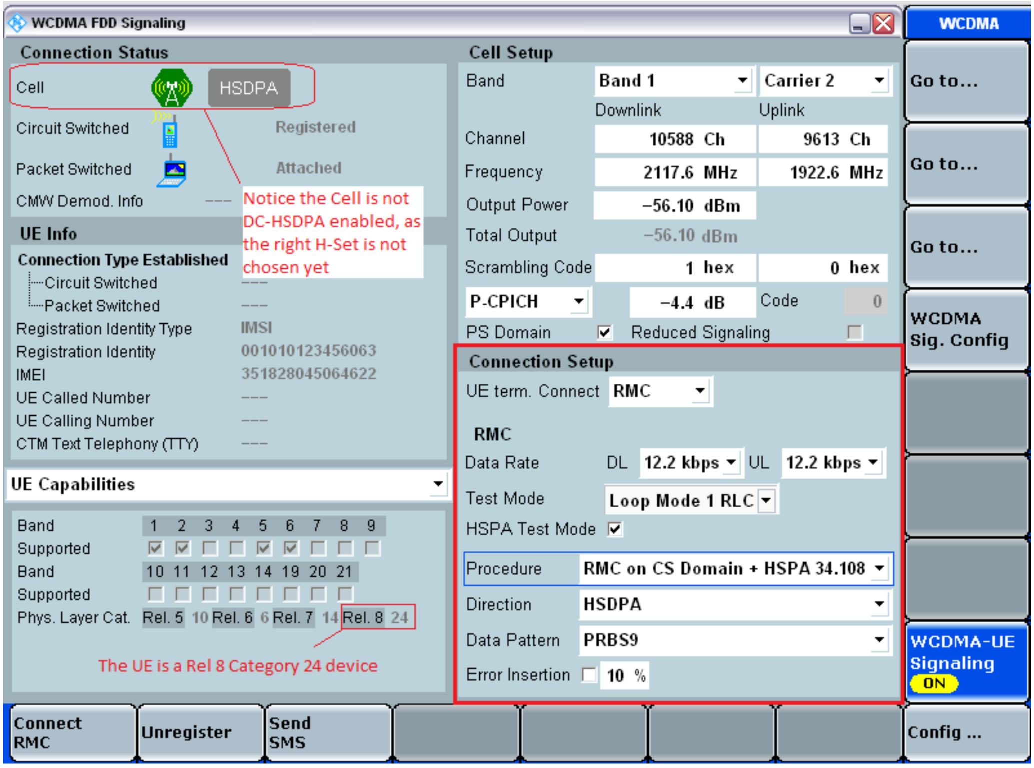

Fig. 207: Rel-8 UE category for DC-HSDPA.

WCDMA-UE Signaling → Config. → HSDPA → Channel Configuration → Configuration Type → Fixed Reference Channel
WCDMA-UE Signaling → Config. → HSDPA → Channel Configuration → H-Set → H-Set 12 QPSK

Test case	Description	Necessary H-Set	Support in the R&S®CMW500
6.2A	**Reference sensitivity level for DC-HSDPA**	**H-Set 12 QPSK**	✓
6.3C	**Maximum input level for DC-HSDPA reception (16QAM)**	**H-Set 1A (16QAM version)**	✓
6.3D	**Maximum input level for DC-HSDPA reception (16QAM)**	**H-Set 8A Max. Input**	✓

Table 30: FRC H-Set for RX test cases from chapter 6 of TS 34.121[1].

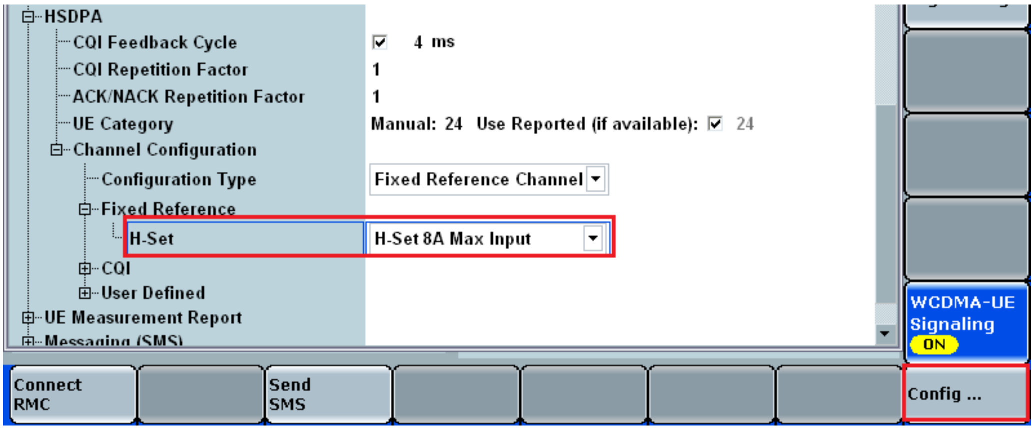

Fig. 218: H-Set configuration on the R&S®CMW500.

After choosing the H-Set that the test case requires, establish a call using the "Connect RMC" tab that is available under the "WCDMA-UE Signaling" tab.

All the above mentioned settings for Rel-8 RX Measurements are part of Rel8Rx.dfl. Recall the Rel8Rx.dfl file, and establish the RMC call.

Change the H-Set and physical DL level to match the test case.

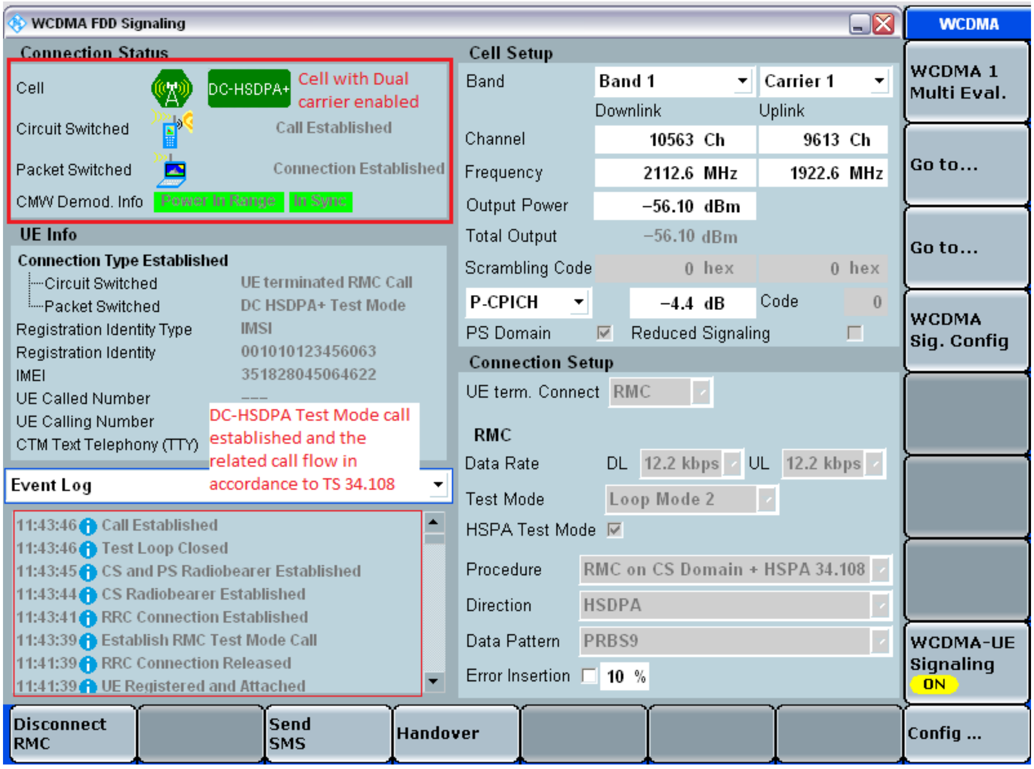

Fig. 49: Cell setup and event log for a DC-HSDPA loop-back call.

With the above settings, the setup is now prepared to carry out the necessary RX Measurements by navigating to the "HSDPA Ack" application in the "WCDMA RX Measurement" application.

4.2 Reference Sensitivity Level for DC-HSDPA (6.2A)

The reference sensitivity level <REFSENS> is the minimum mean power received at the UE antenna port, where the block error ratio (BLER) on each individual cell must not exceed a specific value. The requirements and this test apply for Rel-8 and later releases to all types of UTRA for the FDD UE that supports DC-HSDPA.
The BLER measured on each individual cell is not to exceed 0.1 for the parameters specified in Table 31. The lack of reception sensitivity decreases the HSDPA coverage area at the far side from Node B.

Test parameters for reference sensitivity, additional requirement for DC-HSDPA			
Operating Band	**Unit**	**HS-PDSCH_Ec <REFSENS>**	**<REFIor>**
I	dBm/3.84 MHz	–112.3	–102
II	dBm/3.84 MHz	–110.3	–100
III	dBm/3.84 MHz	–109.3	–99
IV	dBm/3.84 MHz	–112.3	–102
V	dBm/3.84 MHz	–110.3	–100
VI	dBm/3.84 MHz	–112.3	–102
VII	dBm/3.84 MHz	–110.3	–100
VIII	dBm/3.84 MHz	–109.3	–99
IX	dBm/3.84 MHz	–111.3	–101
X	dBm/3.84 MHz	–112.3	–102
XI	dBm/3.84 MHz	–112.3	–102
XII	dBm/3.84 MHz	–109.3	–99
XIII	dBm/3.84 MHz	–109.3	–99
XIV	dBm/3.84 MHz	–109.3	–99
XIX	dBm/3.84 MHz	–112.3	–102
XX	dBm/3.84 MHz	–109.3	–99
XXI	dBm/3.84 MHz	–112.3	–102

Note 1: For Power Class 3 and 3bis, this shall be at the maximum output power

Note 2: For Power Class 4, this shall be at the maximum output power

Note 3: For the UE which supports both Band III and Band IX operating frequencies, the reference sensitivity level of -109.8dBm HS-PDSCH_Ec <REFSENS> shall apply for Band IX. The corresponding <REFIor> is -99.5 dBm

Note 4: For a UE that supports both the Band XI and Band XXO operating frequencies, the reference sensitivity level is FFS.

Table 31: Ouput power setting for Rx sensitivity tests.

During call setup, the radio bearer setup message is required to include the specific message content specified in Table 32.

Contents of the radio bearer setup message: AM or UM (DC-HSDPA)		
Information element	**Value/Remark**	**Version**
Downlink HS-PDSCH information CHOICE mode – Downlink 64QAM configured – HS-DSCH TB size table	FDD Not Present Octet aligned (for H-Set 12)	Rel-7 Rel-7
Downlink secondary cell info FDD – CHOICE Configuration info – Downlink 64QAM configured – HS-DSCH TB size table	 New configuration Not Present Octet aligned (for H-Set 12)	Rel-8

Table 32: Contents of the radio bearer setup message.

Establish a call, and stimulate the UE to transmit at its maximum power by sending continuous UP power control commands to the UE. Refer to Figs. 3 and 15.

*WCDMA-UE Signaling → Config. → Physical Downlink Settings → DPCH Enhanced → Timing Offset → 6 * 256 chip*
WCDMA-UE Signaling → Config. → Connection Configuration → RMC → Test Mode → Loop Mode 1 RLC
WCDMA-UE Signaling → Config. → Connection Configuration → RMC → Loop Mode 1 RLC → Acknowledge
Signaling Parameter → TPC → Active TPC Setup → All 1
Signaling Parameter → TPC → Alg. /Step Size → Alg2 1 dB

The minimum number of measurements required to obtain a statistically significant result for this test is clarified in annex F.6.3, Table F.6.3.5.0 of TS 34.121, which is reproduced here for easy reference.

Receiver sensitivity for HS-PDSCH reception						
DC-HSDPA Reception	**Absolute test requirement (kbps)**	**Relative test requirement (normalized to ideal=60 kbps) No. of events / No of samples in %**	**Test limit expressed as No. of events / min. No. of samples (Bad DUT factor)**	**Min. No. of samples (No. of events to pass) Mandatory if applicable**	**Test time in s Mandatory if fading Informative and approx. if statistical**	**BL / RT**
QPSK H-Set 12						
	54	10%	58/467 (M=1.5)	467 (≤58)	2.8 s (stat)	BL

Table 33: Statistical testing for the DC-HSDPA receiver test case 6.2A (table F.6.3.5.0 of TS 34.121[1]).

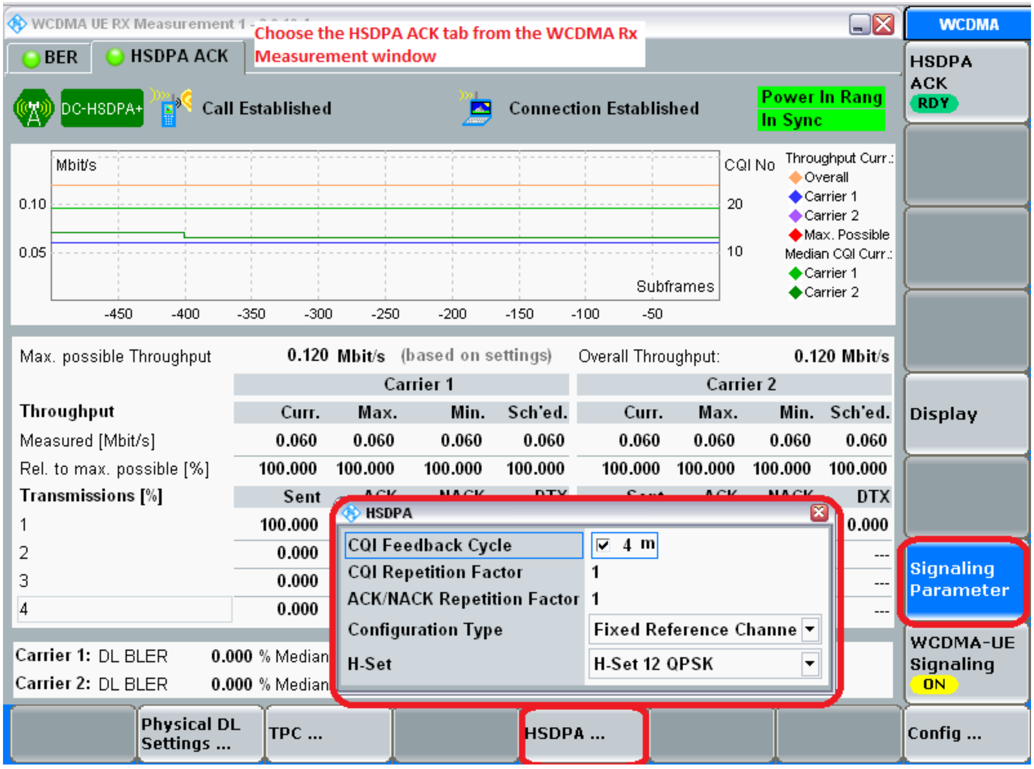

Fig. 50: Configuration for DC-HSDPA receiver sensitivity test.

From the WCDMA signaling menu, choose "WCDMA RX Measurement" and navigate to the "HSDPA ACK" tab in order to check the BLER and throughput results for both carriers.

HSDPA ACK → Measurement Control → Repetition → Single Shot
HSDPA ACK → Measurement Control → Measure Subframes → 500

Recall Rel8Rx.dfl, and establish RMC call.
Change the FRC H-SET to H-Set 12 QPSK
Signaling Parameter → HSDPA → H-Set → H-Set 12 QPSK
Change the Physical DL level according to the test case.

The measurement result is available at:
WCDMA Rx Measurement → HSDPA ACK → ON

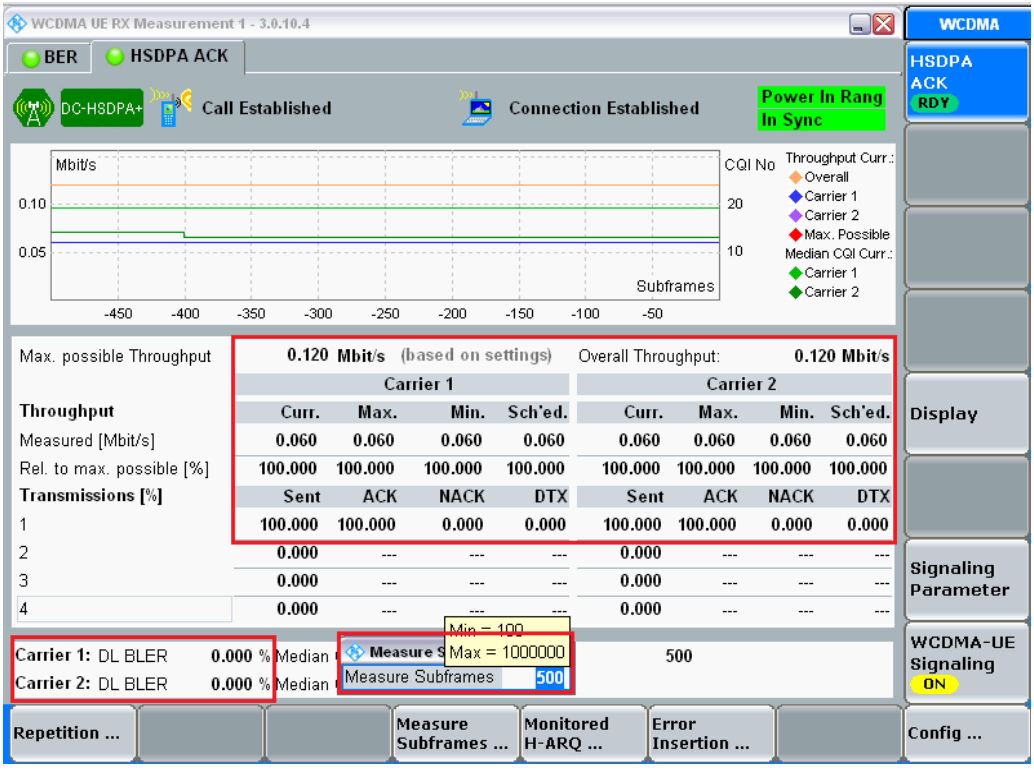

Fig. 51: Receiver sensitivity measurement results for a DC-HSDPA receiver.

The measured BLER is not to exceed 0.1 % on each individual cell for the downlink REF Ior power level as specified in Table 31.

4.3 Maximum Input Level for DC-HSDPA Reception (6.3C)

The maximum input level for DC-HSDPA reception measures the maximum power received at the UE antenna port that will not degrade the specified DC-HSDPA throughput performance. This test applies for Release 8 and later releases to all types of UTRA FDD UE that support DC-HSDPA (16QAM). An inadequate maximum input level causes a loss of DC-HSDPA coverage near the Node B.

The additional DC-HSDPA requirements are specified in terms of a minimum information throughput per cell R with the DL reference channel H-Set 1 (16QAM version) specified in Annex C.8.1.1 – with the addition of the parameters in Table 6.3C.2 – and the downlink physical channel setup in line with Table 29, applied to both cells simultaneously.
Using this configuration, the throughput must meet or exceed the minimum requirements specified in Table 34.

Minimum throughput requirement	
HS-PDSCH Ec/Ior (dB)	**T-put *R* (kbps)**
–3	700

Table 34: Minimum throughput requirement (Table 6.3C.2 of TS 34.121 [1]).

Test requirement parameters for the 16QAM maximum input level		
Parameter	**Unit**	**Value**
Phase reference		P-CPICH
Ior	dBm/3.84 MHz	–25.7
UE transmitted mean power	dBm	20 (for Power Class 3 and 3bis) 18 (for Power Class 4)
DPCH_Ec/Ior	dB	–13
HS-SCCH_1_Ec/Ior	dB	–13
Redundancy and constellation version		6
Maximum number of HARQ transmissions		1

Note:

The HS-SCCH and corresponding HS-DSCH shall be transmitted continuously with constant power, but the HS-SCCH shall only use the identity of the UE under test every third TTI.

Table 35: Test requirement parameters for 16QAM maximum input level DC-HSDPA (Table 6.3C.4 of TS 34.121 [1]).

Configuration in R&S®CMW500:
Signaling Parameter → HSDPA → Configuration Type → Fixed Reference Channel
Signaling Parameter → HSDPA → H-Set → H-Set 1A Max. Input

*WCDMA-UE Signaling → Config. → Physical Downlink Settings → DPCH Enhanced → Timing Offset → 6 * 256 chip*
WCDMA-UE Signaling → Config. → Connection Configuration → RMC → Test mode → Loop Mode 1 RLC
WCDMA-UE Signaling → Config. → Connection Configuration → RMC → Loop Mode 1 RLC → Acknowledge

Configure an HSDPA call in the R&S®CMW500 as shown in Figure 1. Configure the "Max. Input" version of the FRC H-Set 1A in the R&S®CMW500 by referring to Figure 2. Configure the downlink physical channels specified in Table 5(a) and Table 25 in the R&S®CMW500 by referring to Figure 5.

WCDMA-UE Signaling → RF Settings → RF Power Downlink → Output Power (Ior) → –25.7 dB (for Carrier 1 and Carrier 2)

For Carrier 1:
WCDMA-UE Signaling → Config. → Physical Downlink Settings → Select Carrier → Carrier 1

WCDMA-UE Signaling → Config. → Physical Downlink Settings → DPCH → –13.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → P-CPICH → –10.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → P-CCPCH → –12.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → P-SCH → –15.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → S-SCH → –15.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → PICH → –15.0 dB

WCDMA-UE Signaling → Physical Downlink Settings → HS-SCCH#1 → –13.0 dB
Signaling Parameter → Physical Downlink Settings → HS-PDSCH → –3.0 dB

For Carrier 2:
WCDMA-UE Signaling → Config. → Physical Downlink Settings → Select Carrier → Carrier 2
WCDMA-UE Signaling → Config. → Physical Downlink Settings → P-CPICH → –10.0 dB
WCDMA-UE Signaling → Physical DL Settings → HS-SCCH#1 → –13.0 dB
Signaling Parameter → Physical DL Settings → HS-PDSCH → –3.0 dB

Table 26 shows the contents of the radio bearer setup message for this test. Apart from this, there is additional specific message content as specified in table 6.3B.3 of 3GPP specification 34.121[1] to be maintained while performing the 64QAM maximum input level measurement. These settings have been incorporated into the H-Set as "H-Set 8 Max. Input."
The measured UE output power is to be kept at the specified power level with a tolerance of ±1 dB. These settings can be configured by referring to Figs. 15 and 13.

Contents of the radio bearer setup message: AM or UM (Test Loopmode 1)	
Information Element	**Value/Remark**
Uplink DPCH info – Uplink DPCH power control info – CHOICE mode	FDD
– Power Control Algorithm	Algorithm2

Table 36: Contents of the radio bearer setup message: AM or UM (Table 6.3C.3 of TS 34.121 [1]).

Configuration in the R&S®CMW500:
Signaling Parameter → TPC → Active TPC Setup → Closed Loop
Signaling Parameter → TPC → Alg. /Step Size → Alg2 1 dB
Signaling Parameter → TPC → Configuration → Total → 20 (for Power Class 3 and 3bis) or 18 (for Power Class 4)

Table 27 shows the statistical test requirements for the maximum input level for HS-PDSCH reception (64QAM).

Maximum input level for HS-PDSCH reception (16QAM)						
Maximum input level for HS-PDSCH reception (16QAM) **16QAM H-Set 1**	**Absolute test requirement (kbps)**	**Relative test requirement (normalized to ideal=777 kbps)** **No. of events / No. of samples in in %**	**Test limit expressed as No. of events / min. No. of samples** **(Bad DUT factor)**	**Min. No. of samples** **(No. of events to pass)** **Mandatory if applicable**	**Test time in s** **Mandatory if fading** **Informative and approx. if statistical**	**BL / RT**
	700	10 %	58/467 (M=1.5)	467 (≤58)	2.8 s (stat)	BL

Table 37: Maximum input level for HS-PDSCH reception (16QAM) (Table F.6.3.5.1 of TS 34.121 [1]).

From the WCDMA signaling menu, choose "WCDMA RX Measurement" and navigate to the "HSDPA ACK" tab, in order to check the BLER and throughput results for both carriers.

HSDPA ACK → Measurement Control → Repetition → Single Shot
HSDPA ACK → Measurement Control → Measure Subframes → 500

Figure 48 shows the maximum input level for the HS-PDSCH reception (16QAM) measurement results.

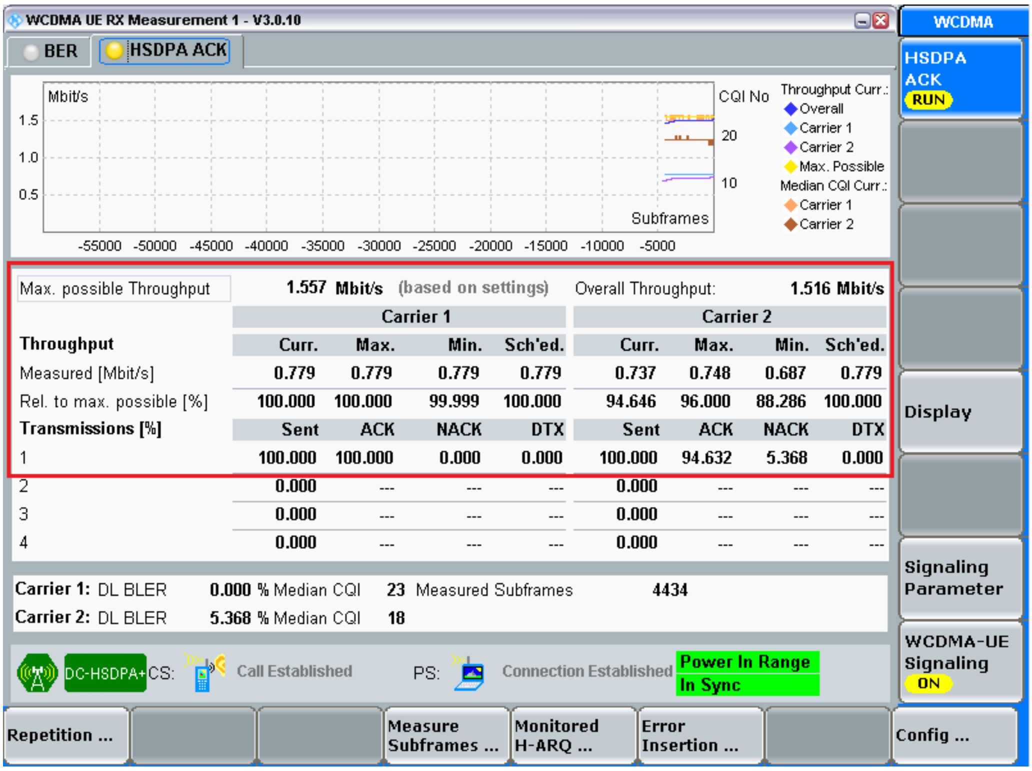

Fig. 52: Maximum input level measurement results for 16QAM DC-HSDPA.

The measured throughput must reach or exceed 700 kbps when measured over more than 467 subframes or more.

Recall Rel8Rx.dfl, and establish an RMC call:
Signaling Parameter → HSDPA → H-Set → H-Set 1A 16QAM
Signaling Parameter → Physical DL Settings → Output Power →–25.7 dBm
Signaling Parameter → Physical DL Settings → HS-PDSCH →–2.0 dB
Signaling Parameter → TPC → Configuration → Total → 20 (for Power Class 3 and 3bis) or 18 (for Power Class 4)
Signaling Parameter→ Physical DL Settings → HS-SCCH#1 →–13.0 dB

The measurement results are available at:
WCDMA RX Measurement → HSDPA ACK → ON

4.4 Maximum Input Level for DC-HSDPA Reception (6.3D)

The maximum input level for DC-HSDPA reception measures the maximum power received at the UE antenna port that will not degrade the specified DC-HSDPA throughput performance. This test applies for Release 8 and later releases for all types of UTRA FDD UE that supports DC-HSDPA with 64QAM. An inadequate maximum input level causes a loss of DC-HSDPA coverage near the Node B.

The additional DC-HSDPA requirements are specified in terms of a minimum information throughput per cell R with the DL reference channel H-Set 8A specified in Annex C.8.1.8 of TS 34.121-1 with the addition of the parameters from Table 38, and the downlink physical channel setup in line with Table 29, applied to both cells simultaneously.
Using this configuration, the throughput must meet or exceed the minimum requirements specified in Table 37.

Minimum throughput requirement	
HS-PDSCH Ec/Ior (dB)	**T-put *R* (kbps)**
–2	11800

Table 37: Minimum throughput requirement (Table 6.3D.2 of TS 34.121 [1]).

Test requirement parameters for the 16QAM maximum input level		
Parameter	**Unit**	**Value**
Phase reference		P-CPICH
Ior	dBm/3.84 MHz	–25.7
UE transmitted mean power	dBm	0
DPCH_Ec/Ior	dB	–13
HS-SCCH_1_Ec/Ior	dB	–13
Redundancy and constellation version		6
Maximum number of HARQ transmissions		1

Note:

The HS-SCCH and corresponding HS-DSCH shall be transmitted continuously with constant power, but the HS-SCCH shall only use the identity of the UE under test every third TTI.

Table 38: Test requirement parameters for the 64QAM maximum input level (Table 6.3D.4 of TS 34.121 [1]).

Configuration in the R&S®CMW500:
Signaling Parameter → HSDPA → Configuration Type → Fixed Reference Channel
Signaling Parameter → HSDPA → H-Set → H-Set 8A Max. Input

*WCDMA-UE Signaling → Config. → Physical Downlink Settings → DPCH Enhanced → Timing Offset → 6 * 256 chip*
WCDMA-UE Signaling → Config. → Connection Configuration → RMC → Test Mode → Loop Mode 1 RLC
WCDMA-UE Signaling → Config. → Connection Configuration → RMC → Loop Mode 1 RLC → Acknowledge

The measured UE output power is to be kept at the specified power level with a ±1 dB tolerance.

Signaling Parameter → TPC → Active TPC Setup → Closed Loop
Signaling Parameter → TPC → Alg. /Step Size → Alg2 1 dB
Signaling Parameter → TPC → Configuration → Total → 0 dBm

Configure an HSDPA call in the R&S®CMW500 as shown in Figure 1. Configure the FRC H-Set 8A, "Max. Input" version, in the R&S®CMW500 by referring to Figure 2. Choosing the "H-Set 8A Max. Input" also ensures that all other specific message content is used for the 64QAM maximum input level as specified in Table 6.3B.3 of TS 34.121.

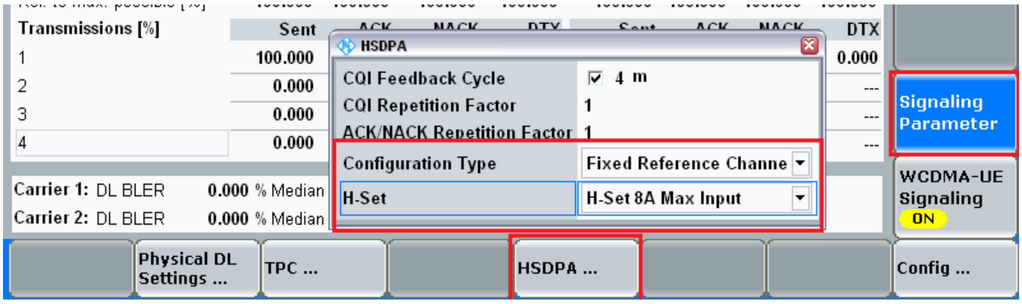

Fig. 53: FRC H-Set configuration.

Configure the downlink physical channels defined in Table 5(a) and Table 25 in the R&S®CMW500 by referring to Fig. 5.

WCDMA-UE Signaling → RF Settings → RF Power Downlink → Output Power (Ior) → –25.7 dB (for Carrier 1 and Carrier 2)

For Carrier 1:
WCDMA-UE Signaling → Config. → Physical Downlink Settings → Select Carrier → Carrier 1

WCDMA-UE Signaling → Config. → Physical Downlink Settings → P-CPICH → –10.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → P-CCPCH → –12.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → P-SCH → –15.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → S-SCH → –15.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → PICH → –15.0 dB
WCDMA-UE Signaling → Config. → Physical Downlink Settings → DPCH → –13.0 dB

WCDMA-UE Signaling → Physical Downlink Settings → HS-SCCH#1 → –13.0 dB
Signaling Parameter → Physical Downlink Settings → HS-PDSCH → –2.0 dB

For Carrier 2:
WCDMA-UE Signaling → Config. → Physical Downlink Settings → Select Carrier → Carrier 2
WCDMA-UE Signaling → Config. → Physical Downlink Settings → P-CPICH → –10.0 dB
WCDMA-UE Signaling → Physical DL Settings → HS-SCCH#1 → –13.0 dB
Signaling Parameter → Physical DL Settings → HS-PDSCH → –2.0 dB

Table 39 shows the statistical test requirements for the maximum input level for HS-PDSCH reception (64QAM).

Maximum input level for HS-PDSCH reception (64QAM)						
Maximum input level for HS-PDSCH reception (64QAM) 64QAM H-Set 8	Absolute test requirement (kbps)	Relative test requirement (normalized to ideal=13252 kbps) No. of events / No. of samples in %	Test limit expressed as No. of events / min. No. of samples (Bad DUT factor)	Min. No. of samples (No. of events to pass) Mandatory if applicable	Test time in s Mandatory if fading Informative and approx. if statistical	BL / RT
	11800	10.96 %	57/422 (M=1.499)	422 (≤57)	0.844 s (stat)	BL

Table 39: Maximum input level for HS-PDSCH reception (64QAM; Table F.6.3.5.1A of TS 34.121 [1]).

From the WCDMA signaling menu, choose "WCDMA RX Measurement" and navigate to the "HSDPA ACK" tab, in order to check the BLER and throughput results for both carriers.

HSDPA ACK → Measurement Control → Repetition → Single Shot
HSDPA ACK → Measurement Control → Measure Subframes → 500

Figure 50 shows the maximum input level for the HS-PDSCH reception (64QAM) measurement results.

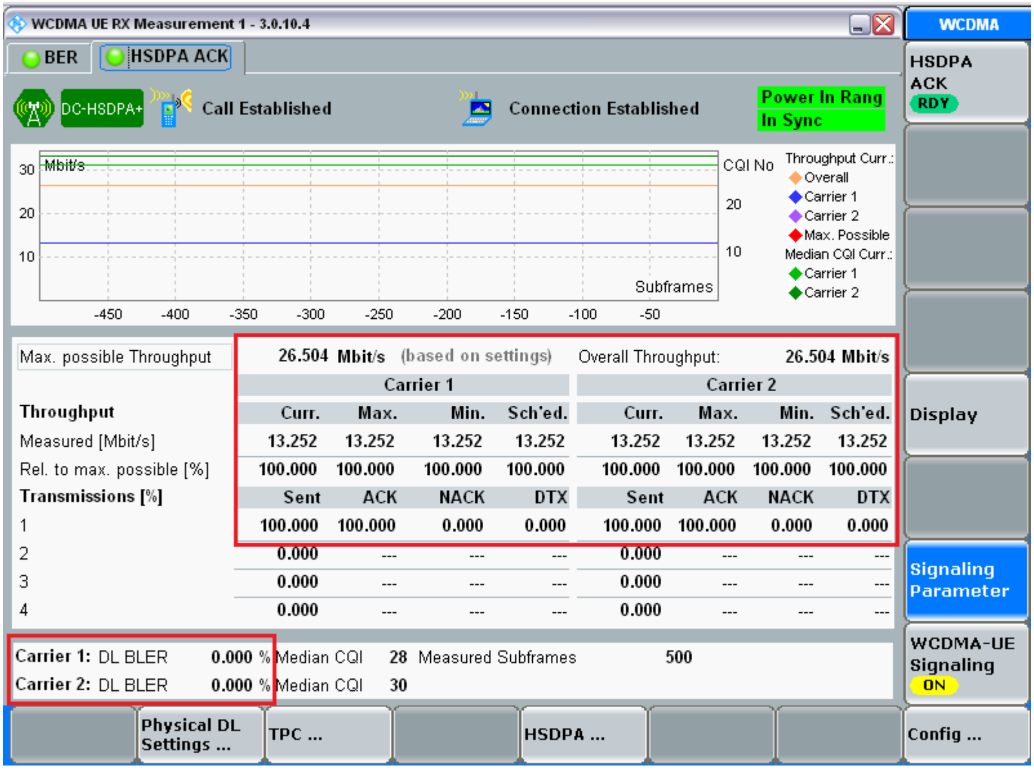

Fig. 54: Maximum input level measurement results for 64QAM DC-HSDPA.

The measured throughput must reach or exceed 11 800 kbps when measured over 422 subframes or more.

Recall Rel8Rx.dfl, and establish an RMC call:
Change the FRC H-SET to "H-Set 8A Max. Input":
Signaling Parameter → HSDPA → H-Set → H-Set 8A Max. Input

Change the Physical DL level to match the test case:
Signaling Parameter → Physical DL Settings → Output Power → –25.7 dBm
Signaling Parameter → Physical DL Settings → HS-PDSCH → –2.0 dB
Signaling Parameter → TPC → Configuration → Total → 0 dBm
Signaling Parameter → Physical DL Settings → HS-SCCH#1 → –13.0 dB

The measurement results are available at:
WCDMA UE WCDMA Rx Measurement → HSDPA ACK → ON

5 Summary of R&S®CMW500 *.dfl Files

The table below summarizes the available *.dfl files based on R&S®CMW500 firmware V2.1.30 for UE that supports Operating Band I with Power Class 3 in RMC 12.2 kbps + HSPA 34.108.

Summary of *.dfl files (firmware V5.03, UE Operating Band I and Power Class 3)		
Clause	**Test parameter**	***.dfl filename**
5.2A	Maximum output power with HS-DPCCH (Release 5 only)	HSDPATx1.dfl HSDPATx2.dfl HSDPATx3.dfl HSDPATx4.dfl
5.2AA	Maximum output power with HS-DPCCH (Release 6 and later)	
5.2C	UE elative code-domain power accuracy	
5.7A	HS-DPCCH power control	
5.9A	Spectrum emission mask with HS-DPCCH	
5.10A	Adjacent channel leakage power ratio (ACLR) with HS-DPCCH	
5.13.1A	Error vector magnitude (EVM) with HS-DPCCH	
5.13.1AA	Error vector magnitude (EVM) and phase discontinuity with HS-DPCCH	
5.13.2A	Relative code-domain error with HS-DPCCH	
6.3A	Maximum input level for HS-PDSCH reception (16QAM)	MaxInput.dfl
6.3B	Maximum input level for HS-PDSCH reception (64QAM)	MaxInput.dfl
6.2A	Receiver sensitivity level for DC-HSDPA	Rel8Rx.dfl
6.3C	Maximum input level for DC-HSDPA reception (16QAM)	Rel8Rx.dfl
6.3D	Maximum input level for DC-HSDPA reception (64QAM)	Rel8Rx.dfl

6 References

[1] Technical Specification Group Radio Access Network; User Equipment (UE) Conformance Specification; 3GPP TS 34.121-1 V9.5.0

[2] Technical Specification Group Radio Access Network; Common test environments for User Equipment (UE); 3GPP TS 34.108 V9.3.0

[3] Technical Specification Group Radio Access Network; Physical layer procedures (FDD); 3GPP TS 25.214 V9.5.0, May 2009

[4] Technical Specification Group Radio Access Network; User Equipment (UE) radio transmission and reception (FDD); 3GPP TS 25.101 V9.5.0, May 2009

[5] Rohde & Schwarz; Reiner Stuhlfauth; High Speed Downlink Packet Access, HSDPA – RF measurements with CMW500 radio communication tester

[6] 1CM72 – Operation guide for HSDPA Test Setup according to 3GPP TS 34.121

7 Ordering Information

Ordering information		
Type	**Description**	**Order no.**
R&S®CMW500	Wideband Radio Communication Tester	1201.0002K50
R&S®CMW-PS502	CMW500 Basic Assembly (mainframe), including one RF Converter Module and one Baseband Measurement Unit	1202.5408.02
R&S®CMW-S550B	Baseband Interconnection Flexible Link	1202.4801.03
R&S®CMW-S590D	RF Frontend, advanced functionality, not installable post factory, CMW module H590A (selection)	1202.5108.03
R&S®CMW-S600B	CMW500 Front Panel with Display/Keypad	1201.0102.03
R&S®CMW-B300A	Signaling Unit Wideband (SUW), for WCDMA / LTE, CMW module H300A (hardware option)	1202.6304.02
R&S®CMW-KM400	WCDMA Release 99, TX measurement, uplink (software license)	1203.0700.02
R&S®CMW-KM401	WCDMA Release 5/6 HSPA , TX measurement, uplink (software license)	1203.2954.02
R&S®CMW-KM403	WCDMA Release 7 HSPA+, TX measurement, uplink (software license)	1203.9007.02
R&S®CMW-KS400	WCDMA Release 99, signaling/network emulation, basic functionality (software license)	1203.0751.02
R&S®CMW-KS410	WCDMA Release 99, signaling/network emulation, advanced functionality (software license)	1203.9807.02
R&S®CMW-KS401	WCDMA Release 5/6 HSPA, signaling/network emulation, basic functionality (software license)	1203.9907.02
R&S®CMW-KS411	WCDMA Release 5/6 HSPA, signaling/network emulation, advanced functionality (software license)	1207.3503.02
R&S®CMW-KS403	WCDMA Release 7 HSPA+, SISO, signaling/network emulation, basic functionality (software license)	1203.9959.02
R&S®CMW-KS404	WCDMA Release 8, signaling/network emulation, basic functionality (software license)	1207.6154.02

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