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.



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Testing Covered in Line with TS 34.121-1

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 be 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.

Testing Covered in Line with TS 34.121-1

3GPP Rel-5 tra by the R&S [®] C	3GPP Rel-5 transmitter characteristics and receiver characteristics supported by the R&S [®] CMW500							
Test	Clause	Test parameter						
	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						
Transmitter characteristics	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	6.3A	Maximum input level for HS-PDSCH reception (16QAM)						
[Rel-5]	6.3B	Maximum input level for HS-PDSCH reception (64QAM)						
Receiver	6.2A	Reference sensitivity level for DC-HSDPA						
characteristics	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:

 $\begin{array}{l} WCDMA-UE \ Signaling \rightarrow PS \ Domain \rightarrow On \ [check \ mark] \\ WCDMA-UE \ Signaling \rightarrow UE \ Term. \ Connect \rightarrow RMC \\ WCDMA-UE \ Signaling \rightarrow RMC \ Data \ Rate \rightarrow DL \ RMC \ 12.2 \ UL \ 12.2 \\ WCDMA-UE \ Signaling \rightarrow HSPA \ Test \ Mode \rightarrow On \ [check \ mark] \\ WCDMA-UE \ Signaling \rightarrow Procedure \rightarrow RMC \ on \ CS \ Domain \ + \ HSPA \ 34.108 \\ WCDMA-UE \ Signaling \rightarrow Direction \ \rightarrow \ HSDPA \end{array}$

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.

WCDMA UE Signaling 1 - 1/3.0.10							10/CDM0
Connection Statue		Coll Sotup					WCDIIIA
Cell (M) HSDPA		Band	Band 1	• 0	Carrier 1	•	WCDMA 1 TX Meas
Circuit Switched Regi	istered	Channel	Downlink 10563	Ch	9613	Ch	
Packet Switched Atta	ched	Frequency	2112.6	MHz	1922.6	MHz	WCDMA 1 RX Meas
CMW Demod. Info		Output Power	-56.10	dBm			
Event Log		Total Output	-56.10	dBm			Coto
05:30:01 RRC Connection Released	-	Scrambling Code	0	hex	0	hex	60 (0
05:30:00 n RRC Connection Established		P-CPICH -	-10.0	dB C	ode	0	
05:29:15 Cell On, Dual Carrier Scenario		PS Domain	Reduced S	Signaling			Routing
05:28:50 () Signaling Unit Startup 05:28:50 () WCDMA 3.0.10.20 Base 3.0.10.2	22	Connection Setun					
05:00:31 () Signaling Unit Shutdown finishe	ed 👻	UE term. Connec	t RMC -				
		RMC					
oc measurement Report • • •		Data Rate	DL 12.2 kbns	- UL 12.	2 khns 🔻		
UTRA FDD (Current Cell)	Lower Upper	Test Mode	Loon Mode 1	RIC -			
CPICH RSCP [dBm]		HSPA Test Mode		REC -			
Log10(TCH BLER)							Cignaling
Transmitted UE Power [dBm]		Procedure R	MC on CS Dom	ain + HSPA	• 34.108		Parameter
UE RX-TX Time Difference [Chip]		Direction H	SDPA		•		
Pathioss (dB)	-	Data Pattern P	RBS9		•		WCDMA-UE
		Error Insertion	10 %				
Physical DL Settings		HSDPA			Confi	g	

Generic Call Setup for Transmitter Characteristics

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		Rel-6				
 Uplink DPCH power control info 						
 Ack-Nack repetition factor 	3	Rel-5				
Downlink HS-PDSCH Information						
 Measurement feedback info 						
– CQI feedback cycle, k	4 ms	Rel-5				
- CQI repetition factor	2	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

WCDMA Signaling Configuration					WCDMA		
Path: Scenario					WCDMA 1		
Scenario	Standard Cell	Standard Cell					
⊞-RF Settings							
Physical Downlink Settings					WCDMA 1		
Physical Uplink Settings					RX Meas		
Connection Configuration					├───		
⊕-Network					0-1-		
	T A me				Go to		
	¢ 4 ms						
CQI Repetition Factor	2						
ACK/NACK Repetition Factor	3				Routing		
UE Category	Manual: 12 Use Repor						
⊟- Channel Configuration							
Configuration Type	Fixed Reference Chan						
Fixed Reference							
H-Set	H-Set 1 QPSK	-					
⊕CQI							
⊕-Messaging (SMS)					Signaling		
					Parameter		
⊞-Message Monitoring							
					WGDMA-UE Signaling		
Dhusical DL	Ŷ	Y					
Settings TPC	HSDPA			Config			

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 1536306176 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 \rightarrow Config. \rightarrow Physical Downlink Settings \rightarrow DPCH Enhanced \rightarrow Timing Offset \rightarrow 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.

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		

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

Notes:

1. \triangle ACK, \triangle NACK and \triangle CQI = 30/15 with β_{HS} = 30/15 * β c.

2. For clauses 5.2C, 5.7A, 5.13.1A and 5.13.1AA, \triangle ACK and \triangle NACK = 30/15 with β_{HS} = 30/15 * β c, and \triangle CQI = 24/15 with β_{HS} = 24/15 * β c.

3. CM = 1 for $\beta c/\beta d$ =12/15, $\beta_{HS}/\beta c$ = 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 $\beta c/\beta d$ 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 $\beta c = 11/15$ and $\beta d = 15/15$.

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 , $\Delta NACK$ 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 $\triangle ACK$, $\triangle NACK$ and $\triangle CQI$							
Signaled value for $\triangle ACK$, $\triangle NACK$ and $\triangle CQI$	Quantized amplitude ratio (β_{HS} / β_{C})						
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 $\triangle ACK$, $\triangle NACK$ and $\triangle CQI$ on the R&S[®]CMW500.

Summary of gain factor settings on the R&S [®] CMW500									
Subtest	βc	βd	∆ACK	ANACK	∆CQI				
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 \Rightarrow Config. \Rightarrow Physical Uplink Settings \Rightarrow Gain Factors \Rightarrow HSDPA $\Rightarrow \beta c \Rightarrow 2$ (Subtest 1), 11 (Subtest 2) or 15 (Subtests 3 and 4) WCDMA-UE Signaling \Rightarrow Config. \Rightarrow Physical Uplink Settings \Rightarrow Gain Factors \Rightarrow HSDPA $\Rightarrow \beta d \Rightarrow 15$ (Subtests 1 and 2), 8 (Subtest 3) or 4 (Subtest 4) WCDMA-UE Signaling \Rightarrow Config. \Rightarrow Physical Uplink Settings \Rightarrow Gain Factors \Rightarrow HSDPA $\Rightarrow \Delta ACK \Rightarrow 8$ WCDMA-UE Signaling \Rightarrow Config. \Rightarrow Physical Uplink Settings \Rightarrow Gain Factors \Rightarrow HSDPA $\Rightarrow \Delta ACK \Rightarrow 8$ WCDMA-UE Signaling \Rightarrow Config. \Rightarrow Physical Uplink Settings \Rightarrow Gain Factors \Rightarrow HSDPA $\Rightarrow \Delta NACK \Rightarrow 8$

HSDPA → Δ CQI → 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)

WC R	WCDMA Signaling Configuration	_	_							WCDMA
Conr	ath: Connection Configuration/RMC/Test Mode	9								
Cell	Gain Factors	βC	βD	ΔΑCΚ	ANACK	ACOI		-		TX Meas
		8	15							
Circui	RMC 64	5	15						h	
Packe	RMC 144	4	15						Hz	RX Meas
CMW	RMC 384	4	15							
Fuer	RMC 768	4	15							
13:03:	Voice	11	15							Go to
13:03:	Video 64	9	15					_	ex	
13:03:	HSDPA	2	15	8	8	8			0	
13:03:	- Connection Configuration							-		Routing
13:02:		RM	С	•					———	
13:01:	SRB Data Rate	DL	13.6	kbps 🔻 UL	13.6 kbp	5 -				
UE (⊕Video									
Band	⊕-Single SRB									
Supr	⊟ RMC									
Banc	Data Rate	DL	12.2	kbps 🔻 UL	12.2 kbp	s 🕶				
Supp	Test Mode	Loc	op M	ode 1 RLC	-					Signaling
Phys	Loop Mode 1 RLC	Тга	nspa	arent	•					Parameter
	-Loop Mode 2 Sym. UL CRC							_		<u> </u>
	Keep Test Loop during Reconf									WCDMA-UE Signaling
L	-DL Resource in Use	10	0 %		•			•		
	Transat 1			-Y	Ye	han	ΥΥ			
Unregis	ter RMC				S	ena MS	Handover	Config		
				-	-			_		

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.

Generic Call Setup for	Transmitter	Characteristics
------------------------	-------------	-----------------

Fixed reference channel H-Set 1			
Parameter	Unit	Va	lue
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 \rightarrow HSDPA \rightarrow Channel Configuration Type \rightarrow 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/lor	–10 dB					
P-CCPCH	P-CCPCH_Ec/lor	-12 dB (Note 1)					
SCH	SCH_Ec/lor	-12 dB (Note 2)					
PICH	PICH_Ec/lor	–15 dB					
DPCH	DPCH_Ec/lor	Test-specific					
HS-SCCH-1	HS-SCCH_Ec/lor	Test-specific (Note 3)					
HS-SCCH-2	HS-SCCH_Ec/lor	DTX (Note 4)					
HS-SCCH-3	HS-SCCH_Ec/lor	DTX (Note 4)					
HS-SCCH-4	HS-SCCH_Ec/lor	DTX (Note 4)					
HS-PDSCH	HS-PDSCH_Ec/lor	Test-specific					
OCNS		Necessary power so that total transmit power spectral density of Node B (lor) 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.

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/lor	-9				
HS-SCCH_1	HS-SCCH_Ec/lor	-8				
HS-PDSCH	HS-PDSCH_Ec/lor	-3				

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

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

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

🚸 WCDMA Signaling Configuration					6	WCDMA
Path: Physical Downlink Settings/DPCH						(
Output Power (lor)	-86.00 dBm				-	TX Meas
AWGN Noise (loc)	□ -70.00 d	Bm				TAMEUS
Geometric Factor (lor/loc)						
Total Output Power (lor+loc)	-86.00 dBm					WCDMA 1 RX Meas
⊞-RF Power Uplink						KA MEUS
□ Physical Downlink Settings						
-Accumulated Power	0.00 dB Ad	just to OdB				Go to
- OCNS	-3.93 dB A	ito ▼ Re	lease 5			
Code Conflict	No Code Cor	flict Detected!				
Code Domain Diagram	Show					Routing
Channel Table	Level	Code	Symbol Rate	1		
P-CPICH	-10.0 dB	0	15 ksps			
S-CPICH	□ -3.3 dB	11	15 ksps			
S-CPICH Enhanced						
P-SCH	▼ -15.0 dB					
S-SCH	▼ -15.0 dB					
Р-ССРСН	▼ -12.0 dB	1	15 ksps			Olan allin a
S-CCPCH	▼ -5.3 dB	2	60 ksps			Parameter
PICH	✓ -15.0 dB	2	15 ksps			rurumeter
AICH	₹ -8.3 dB	3	15 ksps			WCDMA-LIE
AICH Enhanced			20.1			Signaling
Прсн	₩ -9.0 dB	3	30 ksps			
Unregister Connect RMC			Send SMS	Handover	Config	

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

Physical Downlink Settings/HS-PDSCH	1						
DPCH Enhanced							WCDMA 1
-2nd Scrambling Code	🗆 1 hex						TX Meas
Power Offset	0.0 dB						
Timing Offset	6 * 256 chip						WCDMA 1
Channel Table	Level	Channel Code	Symbol Rate	UE ID	UE ID Dummy		RX Meas
-HS-SCCH #1	I⊽ –8.0 dB	2	30 ksps	AAAA hex	5555 hex		Cata
-HS-SCCH #2	🗆 –10.3 dB	7	30 ksps	AAAA hex	12AA hex		GO tO
-HS-SCCH #3	□ -10.3 dB	8	30 ksps	AAAA hex	1AAA hex		<u> </u>
-HS-SCCH #4	□ -10.3 dB	9	30 ksps	AAAA hex	1FAA hex		D
HS-SCCH Enhanced							Routing
Selection	No. 1	-					<u> </u>
	4						
	Transmit Du	mmy UEID 🔻					
Channel Table	Level	Channel Code	Symbol Rate				
-HS-PDSCH	🔽 –3.0 dB	1	240 ksps				
B-HS-PDSCH Enhanced							
Meas. Power Offset Control	Auto 💌						Signaling
Meas. Power Offset	13.0 dB						Paramet
Unscheduled Subframes	Dummy Data						
Physical Uplink Settings Connection Configuration						•	WCDMA- Signaling
Ye y Y			Ye .	r	Y		
register Connect			Send	Handover	Config		

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			
lor	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 dBWCDMA-UE Signaling → Config. → Network → Cell Reselection → Qrxlevmin → -115 dBm

🚸 WCDMA Signaling Configuration					8	WCDMA
Path: Network/Cell Reselection						1
⊟-HSPA Test Mode						TX Meas
Test Mode Procedure	RMC on CS	Domain + HSPA	34.108 -			
Direction	HSDPA -					WCDMA 1
Data Pattern	PRBS9	•				RX Meas
Error Insertion	□ 10 %					
-Network						Go to
-Primary Scrambling Code	0 hex					
Packet Switched Domain	V					
Network Identity Sections						Routing
B-UE Identity						
₽-Cell Reselection						
S intrasearch	−32 dB					
S intersearch	−32 dB					
S searchrat GSM	-32 dB					
Q qualmin	-24 dB					
Q rxlevmin	–115 dBm					
⊞Timer and Constants						Signaling
						Furdineter
B-Messaging (SMS)						WCDMA-UE
⊞-Shortcut Softkevs						Signaling
L						
Unregister Connect RMC			Send SMS	Handover	Config	

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 [^]

🚸 WCDMA Signaling Configuration						×	WCDMA
Path: Shortcut Softkeys/Select as fix	ed Target 1						
Scenario		Standard C	ell 🔻				WCDMA 1 TX Meas
							\succ
Physical Downlink Settings						7	WCDMA 1
Physical Uplink Settings							RX Meas
Connection Configuration							
B-UE Macouroment Depart							Go to
Mossaging (SMS)							
B- Shortcut Softkeys							
Salast Manu 1				amont 1			Routing
Select menu 1		WCDMA FD	D OC TA Medsur	ement			
Select as fixed Target 1		×					
Select Menu 2		WCDMA FD	D UE RX Measur	ement 1 🔻			
Select as fixed Target 2		v					
Select Menu 3		WCDMA FD	D UE TX Measur	ement 1 💌			
Select as fixed Target 3							
🗄 Message Monitoring							
							Signaling
							Parameter
							WCDMA-UE
Y. Y	Y			(Y I		
Unregister Connect RMC				Send	Handover	Config	
, and							

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"

🚸 WCDMA UE Signaling 1 - V3.0.10								_ 🛛	WCDMA
Connection Status			Cell Setup						
	A+		Band	Ba	nd 1	-			WCDMA 1 TX Meas
				Dov	wnlink		Uplink		
Circuit Switched	Call Establish	ed	Channel		10563	Ch	9613	Ch	WODMA 1
Packet Switched	Connection E	stablished	Frequency		2112.6	MHz	1922.6	MHz	RX Meas
CMW Demod. Info Power in Ran	ge In Sync		Output Power	-	-86.00	dBm			
Event Log			Total Output		-86.00	dBm			Cata
13:35:50 () Call Established		^	Scrambling Code		0	hex	(hex	GO to
13:35:50 Test Loop Closed			P.CPICH .		-10.0	dB	Code	0	
13:35:50 CS and PS Radiobearer E	stablished		PS Domain		Reduced S	Signaling			Routing
13:35:45 RRC Connection Establis	hed		1 C Doniali			Jighaning		-	······
13:35:43 () Establish RMC+HSPA Te	st Mode Call		Connection Set	up					
13:35:38 🔒 RRC Connection Release	d	•	UE term. Connec	t RN	1C /				
UE Measurement Report - 🔽	On		RMC						
· · · · ·			Data Rate	DL	12.2 kbps	UL 1	12.2 kbps 🗸		
UTRA FDD (Current Cell)	Lower	Upper	Test Mode	Lo	on Mode 1	RLC			
CPICH RSCP [dBm]	-76	-75	HSPA Test Mode		op mono i	TIL O			
Log10(TCH BLER)	-9	-0.5	Hor A rest mode	14					al
Transmitted UE Power [dBm]	-17	-16	Procedure R	MC o	on CS Dom	ain + HSI	PA 34.108		Parameter
UE RX-TX Time Difference [Chip]	1023	1024	Direction H	SDP/	Ą			1	- dramotor
Pathloss [dB]			Data Pattern P	RBS	9				WCDMA-UE
			Error Incortion	40	a.				Signaling
			Error insertion	10	78				
Disconnect RMC				Send SMS		Handove	er Conf	ig	

Fig. 9: Packet-switched connection established.

Trigger settings required for HSDPA measurements:

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

🚸 WCDMA UE TX Measurement 1 - V3.0.10			WCDMA		
Multi Evaluation TPC Measurer UL Frequency: 1922.6000000 MHz Ref. L	nent	Meas. Period: Full Slot	Multi Evaluation RUN		
dBmSlot	de	GUP vs Slot	RF Settings		
Phase Discontinuity	Frequency Error	Relative CDE	Trigger		
Error Vector Magnitude	EVM vs Chip	CD Monitor			
Phase Error	Phase Error vs Chip	ACLR demCh	Display		
Magnitude Error	Magnitude Error vs Chip	Emission Mask			
TX Measurement Current UE Power 19.51 dBm EVM RMS 3.85 % CF Error 4.29 Hz OBW 4.10 MHz					
Source Sed PS: Connection Established Power In Range In Sync Weight Sed S					
Trigger Trigger Trigger Source Slope Thresh	· Trigger Trigger old Delay Timeout	Minimum Trigger Gap			

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

Measurement Control Settings required for HSDPA measurements:

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 \rightarrow Measurement Control \rightarrow Modulation / CDP \rightarrow Chn. Detect Threshold $\rightarrow -1$ dB (Subtest 1), -10 dB (Subtests 2 and 3) or -20 dB (Subtest 4)

🚸 WCDMA UE TX P	Measurement 1 - V3.0.10				WCDMA
UL Frequency: 1	WCDMA Multi Evaluation Configuration ath: Measurement Control/Spectrum		×		Multi Evaluation
dBm	-Measurement Length -Preselected Slot -Synchronisation	20 Slot 0 Any Slot -	Î	Slot	RF Settings
Phase Discon	⊕-List Mode ⊕-Modulation / CDP — Measurement Period	Half Slot -		Slot	Trigger
Error Vector I	- Statistic Count - Detection Mode - Analysis Mode	Auto 3GPP Signal Vith Origin Offset		dH Code	
Phase Error	— Chn. Detect Threshold — Slot Number (Table) — CDP Spreading Factor	-1.0 dB 0.0 SF 256 ▼		Ch	Display
Magnitude Er	CDP Power Reference Rotation	UE Power / 0 °			
TX Measure UE Power	⊞-BER ⊕-Trigger ⊕-Limit			13 MHz	Signaling Parameter
	CS: Call Established	PS: Connection Estar	nisnea In Sync		Signaling
Trigger Source	Trigger Slope Trigger Threshold Del	gger Trigger ay Timeout	Minimum Trigger Gap	Config	ļ

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.

 \mathbb{I}

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."

<u>Configuring the TPC commands sent to the UE, to control the UL Tx power:</u> <u>a) To stimulate the UE to transmit at its maximum power:</u>

Signaling Parameter \rightarrow TPC \rightarrow Active TPC Setup \rightarrow All 1 Signaling Parameter \rightarrow TPC \rightarrow Alg. /Step Size \rightarrow 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 \rightarrow TPC \rightarrow Active TPC Setup \rightarrow Closed Loop Signaling Parameter \rightarrow TPC \rightarrow Alg. /Step Size \rightarrow Alg. 2, 1 dB Signaling Parameter \rightarrow TPC \rightarrow Configuration \rightarrow DPCH (reference) Signaling Parameter \rightarrow TPC \rightarrow Configuration \rightarrow 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 μ s guard period at the beginning and end of the half slot is required and is set as shown in Fig. 14 below.

🚸 WCDMA UE TX Measurement 1 - V3.0.10			WCDMA
UL Frequency: 1922.6000000 MHz Ref. Lev	el: 3.29 dBm Connector: RF1COM	Meas. Period: Half Slot	Multi Evaluation
UE Power	Power Steps	CDP vs Slot	RUN
dBmSlot	dB Slot	dB Slot	RF Settings
Phase Discontinuity	Frequency Error	Relative CDE	<u> </u>
Stot	Hz Slor	dB Slot	Trigger
Error Vector Magnitude	EVM vs Chip	CD Monitor	
1 Slot	X Managaran and Anna and Anna anna anna Chip	I-SiandLath Code I-SiandLath Code U-SiandLath Code U-SiandLath Code	
Phase Error	Phase Error vs Chip	ACLR	Display
• Slot	Chip	dBm Ch	
Magnitude Error	Magnitude Error vs Chip	Emission Mask	
X. Slot	ъ Сhip	dBkHg	
TX Measurement Current UE Power .9.82 dBm EVM RM	S 3.72 % CF Error	4.23 Hz OBW 4.10 MHz	Signaling Parameter
HSDPA+ CS: Call Establishe	d PS: 📩 Connection Est Half	eas. Period 🛛 ange	WCDMA-UE Signaling
Repetition Stop Condition Count	Measurement Preselected Me Length Slot Pe	asurement Assign riod Views Config	

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

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							
Patio of Ro to Rd for all values of R	Power C	lass 3	Power Class 4				
Ratio of pe to pu for all values of p _{Hs}	Power (dBm)	Tol. (dB)	Power (dBm)	Tol. (dB)			
βc / βd = 2/15, 12/15	+24	+1.7/-3.7	+21	+2.7/–2.7			
$\beta c / \beta d = 15/8$	+23	+2.7/-3.7	+20	+3.7/–2.7			
$\beta c / \beta d = 15/4$	+22	+3.7/–3.7	+19	+4.7/–2.7			

Note: \triangle ACK, \triangle NACK and \triangle CQI = 30/15 with β_{HS} = 30/15 * β c

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

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

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.

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* \rightarrow *Display* \rightarrow *Select View* \rightarrow *UE Power Multi-Evaluation* \rightarrow *Signaling Parameter* \rightarrow *TPC* \rightarrow *Active TPC Setup* \rightarrow *All 1 Multi-Evaluation* \rightarrow *Signaling Parameter* \rightarrow *TPC* \rightarrow *Alg. /Step Size* \rightarrow *Alg. 2, 1 dB Multi-Evaluation* \rightarrow *Signaling Parameter* \rightarrow *TPC* \rightarrow *Precondition* \rightarrow *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* \rightarrow *Measurement Period* \rightarrow *Full Slot*

WCDMA U	IE TX Measuremer	nt 1 - ¥3.0.	.10		_			_				WCDMA
UL Frequence JE Power	raluation T cy. 1922.6000000	PC Meas MHz	surement Ref. Level:	32.30 dBm	Conn	ector: RF1	сом	М	eas. Perio	d: Half Slot		Multi Evaluation RUN
• 🖗 🗠	13.00 Slot y:	21.05 dBr	n 🔶 🗘 🗠	011	Y:		•	₿×	Off	Y:		RE
dBm											 Current 	Settings
0												Trigger
20												
40	Ch TPC					6						Display
60	Active TPC S	etup	All 1	•	1	11	12	13 1	4 15	16 17	Slot 18 19	
atistic Co	TPC State		Precond.	Execute								Marker
	TPC Condition Alg. / Step Si User Defined	n ze Patt	Max Powe Alg. 2, 1 d	r B - D1111111111			Av	erage 21.36 NCAP		Max 21.42 NCAP	StdDev 0.03 NCAP	Signaling Parameter
<mark>ж)</mark> нsi	Precondition Configuration		None 11			ection	Establis	hed P	'ower in F n Sync	lange		WCDMA-UE Signaling
	Physical D Settings)L тр	с		ŀ	HSDPA			Ĩ		Config	

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

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

🚸 WCDMA UE TX Measurement 1 - V3.0.10 WCDMA Multi Evaluation TPC Measurement Multi Evaluation UL Frequency: 1922.600000 MHz Ref. Level: 32.30 dBm Meas. Period: Half Slot Connector: RF1COM **UE Power** 13.00 Slot y 🔶 🖗 🗙 21.02 dBm 🔶 🛛 🗙 Off 🔶 🛛 🗙 Off y. RF dBm Settings Current 0 Trigger -20 -40 Display -60 Slot 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 1 2 Marker Statistic Count 1st Measured Slot... 14 100 / 100 Statistics @ Slot 0 Max StdDev Current Average Signaling Power [dBm] 0.02 21.32 21.35 21.42 Paramete Power Steps [dB] NCAP NCAP NCAP NCAP WCDMA-UE Call Established Signaling CS: PS: 🔼 **Connection Estal** Physical DL Settings ... трс ... HSDPA ... Config ...

Fig. 16 shows the maximum output power measurement results.

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

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

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: $WCDMA TX Meas. \rightarrow Multi-Evaluation \rightarrow Display \rightarrow Select View \rightarrow UE Power$ $WCDMA TX Meas. \rightarrow Multi-Evaluation \rightarrow Measurement period \rightarrow Full Slot$

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 (Release 6 and Later; 5.2AA)

Maximum output power with HS-DPCCH							
Subtect in Table 3(a)	Power C	lass 3	Power Class 4				
Sublest III Table 3(a)	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 $\beta c/\beta d$ values.

Case (ii) -

Fixed reference channel (FRC H-Set 1, 16QAM version) and all four of the possible $\beta c/\beta d$ 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:

 $\begin{array}{l} \textit{Multi-Evaluation} \rightarrow \textit{Display} \rightarrow \textit{Select View} \rightarrow \textit{UE Power} \\ \textit{Multi-Evaluation} \rightarrow \textit{Signaling Parameter} \rightarrow \textit{TPC} \rightarrow \textit{Active TPC Setup} \rightarrow \textit{All 1} \\ \textit{Multi-Evaluation} \rightarrow \textit{Signaling Parameter} \rightarrow \textit{TPC} \rightarrow \textit{Alg. /Step Size} \rightarrow \textit{Alg. 2, 1 dB} \\ \end{array}$

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* \rightarrow *Measurement Period* \rightarrow *Full Slot*

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



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

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.

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



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:

Measured CDP ratio $= 10 * \log \left(\frac{10}{10} + \frac{10}{10}$	Measured code power			
	Measured total power of	all active codes		
Nominal CDP ratio - 10 * log	Nominal CDP			
	Sum of all nominal CDPs			

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							
Subtast in Table 3(a)	Massurament point	Expected relative code-domain power in dB					
	weasurement point	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			
	1	-4.1	-2.1	OFF			
2	2	-8.2	-6.2	-2.1			
2	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			
	1	-0.3	-11.8	OFF			
Λ	2	-7.1	-18.5	-1			
4	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 $\Delta NACK = 30/15$, where $\beta_{HS} = 30/15 * \beta c$, and $\Delta CQI = 24/15$, where $\beta_{HS} = 24/15 * \beta c$ for all subtests. Configure ΔACK , $\Delta NACK$ and ΔCQI in the R&S[®]CMW500 by referring to Fig. 4.

Configuration in the R&S[®]CMW500: *WCDMA-UE Signaling* \rightarrow *Config.* \rightarrow *Physical Uplink Settings* \rightarrow *Gain Factors* \rightarrow *HSDPA* $\rightarrow \triangle ACK \rightarrow 8$

WCDMA-UE Signaling \rightarrow Config. \rightarrow Physical Uplink Settings \rightarrow Gain Factors \rightarrow HSDPA $\rightarrow \Delta NACK \rightarrow 8$ WCDMA-UE Signaling \rightarrow Config. \rightarrow Physical Uplink Settings \rightarrow Gain Factors \rightarrow HSDPA $\rightarrow \Delta CQI \rightarrow 7$

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

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

Mi Path: Connection Configuration/RMC/Loop Mode 1 RLC ULFre Θ-Gain Factors βC βD ΔACK ΔNACK ΔCOI UE Pr	rent	Multi Evaluation RUN RF Settings
UL Fre Θ-Gain Factors βC βD ΔACK ΔNACK ΔCOI UE Pr -RMC 12.2 8 15 - </td <td>rent</td> <td>RF Settings</td>	rent	RF Settings
UE P4 • 0 • 0 • -RMC 12.2 • 8 • 15 - RMC 64 • 5 • 15 - RMC 144 • 15 - RMC 768 • 4 • 15 - RMC 768 • 4 • 15 - RMC 768 • 15 • RMC 12.2 •	rent	RF Settings
Image: Constraint of the state of	rent	RF Settings
-RMC 144 4 15 -RMC 384 4 15 0 -RMC 768 4 15	rent	Settings
- RMC 384 4 15 - RMC 768 4 15		Trisger
0 -RMC 768 4 15		Tringer
N-1		Trigger
		ingger
-20 HSDPA 2 15 8 8 8		
-40 SRB Data Rate DL 13.6 kbps / UL 13.6 kbps /		
⊕-Voice		Display
-60 E-Video	Slat	
⊕-Single SRB		
Ė-RMC		Marker
Statis Data Rate DL 12.2 kbps / UL 12.2 kbps /		
Test Mode Loop Mode 1 RLC	dDev	Signaling
Loop Mode 1 RLC Transparent	ICAP	Parameter
Loop Mode 2 Sym. UL CRC		
-Keep Test Loop during Reconf		Signaling
DL Resource in Use 100 %		ON
Disconnect RMC SMS Handover Confi	J	

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 \pm 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 \rightarrow TPC \rightarrow Alg. /Step Size \rightarrow Alg. 2, 1 dB Signaling Parameter \rightarrow TPC \rightarrow Active TPC Setup \rightarrow Closed Loop Signaling Parameter \rightarrow TPC \rightarrow Configuration \rightarrow DPCH (reference) Signaling Parameter \rightarrow TPC \rightarrow Configuration \rightarrow 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.

Configuration in the R&S[®]CMW500:

WCDMA Multi-Evaluation \rightarrow Config. \rightarrow Measurement Control \rightarrow Modulation / CDP \rightarrow Chn. Detect Threshold $\rightarrow -1$ 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 \rightarrow Display \rightarrow Select View \rightarrow CDP vs. Slot

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

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* \rightarrow *Measurement Length* \rightarrow 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 \rightarrow Display \rightarrow Slot Number Table \rightarrow 0.0 [Measurement Point 1] WCDMA Multi-Evaluation \rightarrow Display \rightarrow Slot Number Table \rightarrow 0.5 [Measurement Point

2]

WCDMA Multi-Evaluation \rightarrow Display \rightarrow Slot Number Table \rightarrow 1.5 [Measurement Point 3]

WCDMA Multi-Evaluation \rightarrow Display \rightarrow Slot Number Table \rightarrow 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 \rightarrow Display \rightarrow Select View \rightarrow CDP vs. Slot WCDMA Multi-Evaluation \rightarrow Display \rightarrow Select Trace CDP \rightarrow 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 \rightarrow X Scale CDP \rightarrow X Max. \rightarrow 18 slots Display \rightarrow Y Scale CDP \rightarrow Y Max. \rightarrow 0 dB Display \rightarrow Y Scale CDP \rightarrow Y Min. \rightarrow -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.

UE Relative Code-Domain Power Accuracy (5.2C)



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.



The power step due to HS-DPCCH transmission is the difference between the mean powers transmitted before and after an HS-DPCCH slot boundary. The mean power evaluation period excludes a 25µs period before and after any DPCCH or HS-DPCCH slot boundary.

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 μ s after a DPCCH slot boundary and ends 25 μ s before the following HS-DPCCH slot boundary. The second evaluation period starts 25 μ s after the same HS-DPCCH slot boundary and ends 25 μ s after the same HS-DPCCH slot boundary and ends 25 μ s after the same HS-DPCCH slot boundary and ends 25 μ s 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 μ s 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]).

Transmitte	r power test	requirements for	r 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]
	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
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 μ s 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]).

Transmitte	r power test	requirements for	r 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]
	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
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.

 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 $\Delta NACK = 30/15$, where $\beta_{HS} = 30/15 * \beta c$, and $\Delta CQI = 24/15$, where $\beta_{HS} = 24/15 * \beta c$. Refer to Fig. 4 to configure ΔACK , $\Delta NACK$ and ΔCQI in the R&S[®]CMW500.

Configuration in the R&S[®]CMW500:

 $\begin{array}{l} WCDMA-UE \ Signaling \rightarrow Config. \rightarrow Physical \ Uplink \ Settings \rightarrow Gain \ Factors \rightarrow \\ HSDPA \rightarrow \beta c \rightarrow 15 \\ WCDMA-UE \ Signaling \rightarrow Config. \rightarrow Physical \ Uplink \ Settings \rightarrow Gain \ Factors \rightarrow \\ HSDPA \rightarrow \beta d \rightarrow 8 \\ WCDMA-UE \ Signaling \rightarrow Config. \rightarrow Physical \ Uplink \ Settings \rightarrow Gain \ Factors \rightarrow \\ HSDPA \rightarrow \Delta ACK \rightarrow 8 \\ WCDMA-UE \ Signaling \rightarrow Config. \rightarrow Physical \ Uplink \ Settings \rightarrow Gain \ Factors \rightarrow \\ HSDPA \rightarrow \Delta ACK \rightarrow 8 \\ WCDMA-UE \ Signaling \rightarrow Config. \rightarrow Physical \ Uplink \ Settings \rightarrow Gain \ Factors \rightarrow \\ HSDPA \rightarrow \Delta ACK \rightarrow 8 \\ WCDMA-UE \ Signaling \rightarrow Config. \rightarrow Physical \ Uplink \ Settings \rightarrow Gain \ Factors \rightarrow \\ HSDPA \rightarrow \Delta ACK \rightarrow 8 \\ WCDMA-UE \ Signaling \rightarrow Config. \rightarrow Physical \ Uplink \ Settings \rightarrow Gain \ Factors \rightarrow \\ HSDPA \rightarrow \Delta ACK \rightarrow 8 \\ WCDMA-UE \ Signaling \rightarrow Config. \rightarrow Physical \ Uplink \ Settings \rightarrow Gain \ Factors \rightarrow \\ HSDPA \rightarrow \Delta CQI \rightarrow 7 \\ \end{array}$

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 \rightarrow Config. \rightarrow Connection Configuration \rightarrow RMC \rightarrow Test Mode \rightarrow Loop Mode 1 RLC WCDMA-UE Signaling \rightarrow Config. \rightarrow Connection Configuration \rightarrow RMC \rightarrow Test Mode \rightarrow Loop Mode 1 RLC \rightarrow Transparent WCDMA-UE Signaling \rightarrow Config. \rightarrow Physical Downlink Settings \rightarrow DPCH Enhanced \rightarrow Timing Offset \rightarrow 6 * 256 chip WCDMA-UE Signaling \rightarrow Config. \rightarrow HSDPA \rightarrow CQI Feedback Cycle \rightarrow [checkmark] 4 ms WCDMA-UE Signaling \rightarrow Config. \rightarrow HSDPA \rightarrow CQI Repetition Factor \rightarrow 1 WCDMA-UE Signaling \rightarrow Config. \rightarrow HSDPA \rightarrow ACK/NACK Repetition Factor \rightarrow 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 \pm 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 \rightarrow TPC \rightarrow Active TPC Setup \rightarrow Closed Loop Signaling Parameter \rightarrow TPC \rightarrow Alg. /Step Size \rightarrow Alg2_1dB Signaling Parameter \rightarrow TPC \rightarrow Configuration \rightarrow DPCH (reference) Signaling Parameter \rightarrow TPC \rightarrow Target Power \rightarrow 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 \rightarrow TPC \rightarrow Active TPC Setup \rightarrow All 1 Signaling Parameter \rightarrow TPC \rightarrow Alg. /Step size \rightarrow 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 \rightarrow Assign Views \rightarrow UE Power [\checkmark] WCDMA Multi-Evaluation \rightarrow Display \rightarrow X Scale UE Pwr. \rightarrow X Max. \rightarrow 18 Slots WCDMA Multi-Evaluation \rightarrow Display \rightarrow Y Scale UE Pwr. \rightarrow Y Max. \rightarrow 20 dB WCDMA Multi-Evaluation \rightarrow Display \rightarrow Y Scale UE Pwr. \rightarrow Y Min. \rightarrow 0 dB

WCDMA Multi-Evaluation \rightarrow Assign Views \rightarrow Power Steps [$\sqrt{}$] WCDMA Multi-Evaluation \rightarrow Display \rightarrow Select View \rightarrow Power Steps

WCDMA Multi-Evaluation \rightarrow Display \rightarrow Select Number Table \rightarrow 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 \rightarrow Config. \rightarrow Limit \rightarrow Power Control \rightarrow HS-DPCCH Power Steps \rightarrow Test Case \rightarrow TPC 0 dB (for TPC_cmd=0 **OR** TPC 1 dB for TPC_cmd=1)

The requirement that "the evaluation period starts 25 μ s after the DPCCH slot boundary and ends 25 μ s 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 \rightarrow Measurement Length \rightarrow 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 \rightarrow HSDPA \rightarrow CQI Feedback Cycle \rightarrow 4 ms Signaling Parameter \rightarrow HSDPA \rightarrow CQI Repetition Factor \rightarrow 1 Signaling Parameter \rightarrow HSDPA \rightarrow ACK/NACK Repetition Factor \rightarrow 1 WCDMA Signaling \rightarrow Config. \rightarrow Physical Uplink Settings \rightarrow Gain Factors \rightarrow $HSDPA \rightarrow \Delta CQI \rightarrow 7$ Signaling Parameter \rightarrow TPC \rightarrow Active TPC Setup \rightarrow Closed Loop Signaling Parameter \rightarrow TPC \rightarrow Configuration \rightarrow DPCH (reference) Signaling Parameter \rightarrow TPC \rightarrow Configuration \rightarrow Target Power 0.0 dBm Signaling Parameter \rightarrow TPC \rightarrow Alg. / Step Size \rightarrow 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 \rightarrow HSDPA \rightarrow CQI Feedback Cycle \rightarrow 4 ms Signaling Parameter \rightarrow HSDPA \rightarrow CQI Repetition Factor \rightarrow 1 Signaling Parameter \rightarrow HSDPA \rightarrow ACK/NACK Repetition Factor \rightarrow 1 WCDMA Signaling \rightarrow Config. \rightarrow Physical Uplink Settings \rightarrow Gain Factors \rightarrow $HSDPA \rightarrow \Delta CQI \rightarrow 7$ Signaling Parameter \rightarrow TPC \rightarrow Active TPC Setup \rightarrow All 1 Signaling Parameter \rightarrow TPC \rightarrow Alg. / Step Size \rightarrow Alg1 1 dB The measurement results are available here: WCDMA Multi-Evaluation \rightarrow Display \rightarrow Select View \rightarrow Power Step WCDMA Multi-Evaluation \rightarrow Config. \rightarrow Limit \rightarrow Power Control \rightarrow HS-DPCCH Power Steps \rightarrow Test Case \rightarrow TPC 0 dB (for TPC_cmd=0 **OR** TPC 1 dB for TPC_cmd=1)

Spectrum Emission Mask with HS-DPCCH (5.9A)

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							
Af in MUT	Minimum requireme	ents	Massurament 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 e	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 ≤ ∆f < 3.5 MHz	2.515 MHz ≤ f_offset < 3.485 MHz	–15 dBm	30 kHz						
$3.5 \text{ MHz} \leq \Delta f \leq 12.5 \text{ MHz}$	4.0 MHz \leq f_offset < 12.0 MHz	–13 dBm	1 MHz						
Table 1	(A/a): Additional anostrum omission lin	nite for Panda II IV/ V/Tabla	E 0 A 2 A of TO 24 424 [4]						

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

Additional spectrum e	mission 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 ≤ ∆f < 3.5 MHz	$2.515 \text{ MHz} \leq f_offset < 3.485 \text{ MHz}$	–15 dBm	30 kHz
$3.5 \text{ MHz} \leq \Delta f \leq 12.5 \text{ MHz}$	$3.55 \text{ MHz} \leq f_{offset} < 12.45 \text{ MHz}$	–13 dBm	100 kHz

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

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Spectrum Emission Mask with HS-DPCCH (5.9A)

Additional spectrum e	mission limits for Bands XII, X	III, XIV	
∆f in MHz	Frequency offset of measurement	Additional requirements	Measurement bandwidth
	filter center frequency, f_offset	Band XII, XIII, XIV	
2.5 MHz ≤ ∆f < 2.6 MHz	2.515 MHz \leq f_offset < 2.585 MHz	–13 dBm	30 kHz
$2.6 \text{ MHz} \leq \Delta f \leq 12.45 \text{ MHz}$	2.65 MHz \leq 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 \rightarrow TPC \rightarrow Active TPC Setup \rightarrow All 1 Signaling Parameter \rightarrow TPC \rightarrow Alg. / Step Size \rightarrow 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 \rightarrow Display \rightarrow Select View \rightarrow 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

Spectrum Emission Mask with HS-DPCCH (5.9A)



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.



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

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 \Rightarrow Signaling Parameter \Rightarrow TPC \Rightarrow Active TPC Setup \Rightarrow All 1 WCDMA-UE Signaling \Rightarrow Signaling Parameter \Rightarrow TPC \Rightarrow Alg. / Step Size \Rightarrow Alg. 2, 1 dB

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

βc / βd = 2/15
βc / βd = 11/15
βc / βd = 15/8
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 \rightarrow Display \rightarrow Select View \rightarrow ACLR

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

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



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 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: <u>Case(i)</u>: When the UE transmits at its maximum power <u>Case(ii)</u>: 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 μ s at each end of the slot. The EVM shall not exceed 17.5 % for the parameters specified in Table 16.

Parameters for the EVM / peak code-domain error								
Parameter		Level / Status	Unit					
Output power		≥-20	dBm					
Operating condition	ions	Normal conditions						
Power control ste	ep size	1 dB						
Measurement	PRACH	3904	Chine					
period ¹	Any DPCH	From 1280 to 2560 ²	Chips					

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 $\Delta NACK = 30/15$, where $\beta_{HS} = 30/15 * \beta c$, and $\Delta CQI = 24/15$, where $\beta_{HS} = 24/15 * \beta c$. Refer to Fig. 4 to configure ΔACK , $\Delta NACK$ 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 \Rightarrow Config. \Rightarrow Physical Uplink Settings \Rightarrow HSDPA \Rightarrow \beta c \Rightarrow 15
WCDMA-UE Signaling \Rightarrow Config. \Rightarrow Physical Uplink Settings \Rightarrow HSDPA \Rightarrow \beta d \Rightarrow 8
WCDMA-UE Signaling \Rightarrow Config. \Rightarrow Physical Uplink Settings \Rightarrow HSDPA \Rightarrow \Delta ACK \Rightarrow 8
WCDMA-UE Signaling \Rightarrow Config. \Rightarrow Physical Uplink Settings \Rightarrow HSDPA \Rightarrow \Delta ACK \Rightarrow 8
WCDMA-UE Signaling \Rightarrow Config. \Rightarrow Physical Uplink Settings \Rightarrow HSDPA \Rightarrow \Delta ACK \Rightarrow 8
WCDMA-UE Signaling \Rightarrow Config. \Rightarrow Physical Uplink Settings \Rightarrow HSDPA \Rightarrow \Delta CQI \Rightarrow 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 \rightarrow Config. \rightarrow Connection Configuration \rightarrow RMC \rightarrow Test Mode \rightarrow Loop Mode 1 RLC WCDMA-UE Signaling \rightarrow Config. \rightarrow Connection Configuration \rightarrow RMC \rightarrow Test Mode \rightarrow Loop Mode 1 RLC \rightarrow Transparent WCDMA-UE Signaling \rightarrow Config. \rightarrow Physical Downlink Settings \rightarrow DPCH Enhanced \rightarrow Timing Offset \rightarrow 6 * 256 chip Signaling Parameter \rightarrow HSDPA \rightarrow CQI Feedback Cycle \rightarrow 4 ms Signaling Parameter \rightarrow HSDPA \rightarrow CQI Repetition Factor \rightarrow 1 Signaling Parameter \rightarrow HSDPA \rightarrow ACK/NACK Repetition Factor \rightarrow 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 \rightarrow TPC \rightarrow Active TPC Setup \rightarrow All 1

Signaling Parameter \rightarrow TPC \rightarrow Alg. / Step Size \rightarrow 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:

 $\begin{array}{l} \mbox{Multi-Evaluation} \end{tabular} Trigger \end{tabular} Trigger \end{tabular} Trigger \end{tabular} Trigger \end{tabular} \end{tabu$

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 \rightarrow TPC \rightarrow Active TPC Setup \rightarrow Closed Loop Signaling Parameter \rightarrow TPC \rightarrow Alg. /Step size \rightarrow Alg2_1dB Signaling Parameter \rightarrow TPC \rightarrow Configuration \rightarrow DPCH (reference) Signaling Parameter \rightarrow Configuration \rightarrow 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.



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 \rightarrow Trigger \rightarrow Trigger Delay \rightarrow 0 µs (minimum power) or 666.7 µs (1-slot delay for maximum power)

	requency:	: 1922.6 Magni	5000000 itude vs	MHz Chin	Ref. Levi	el: 33.5	60 dBm (Connector	RF1COM	Meas. F	eriod: Hall	f Slot		Multi
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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 \pm 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 \rightarrow TPC \rightarrow Active TPC Setup \rightarrow Closed Loop Signaling Parameter \rightarrow TPC \rightarrow Alg. / Step Size \rightarrow Alg2_1dB Signaling Parameter \rightarrow TPC \rightarrow Configuration \rightarrow DPCH (reference) Signaling Parameter \rightarrow TPC \rightarrow Configuration \rightarrow 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* \rightarrow *Display* \rightarrow *Select View* \rightarrow *EVM* vs. *Chip Multi-Evaluation* \rightarrow *Display* \rightarrow X *Scale EVM Chip* \rightarrow X *Max.* \rightarrow 1280 *Multi-Evaluation* \rightarrow *Measurement Period* \rightarrow *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* \rightarrow *Display* \rightarrow *Select View* \rightarrow *TX Measurement* (*Scalar*), *Magnitude Error* vs. *Chip*, *Phase Error* vs. *Chip*.

🚯 WCDMA FDD TX Measu	rement 1 - Multi Eva	luation				WCDMA
UL Frequency: 1922.6000 TX Measurement Statistic Count 65 / 100	000 MHz Ref. Leve	el: 33.50 dBm C	connector: RF1COM	Meas, Period: Half SI	ot	Multi Evaluation RUN
1st Measured Slot Nu	mber	6			Chillion	RF Settings
Statistics @ Pre. Sid	ot U 1st H	Current	Average	Max	StaDev	
Power (dom)		24.20 NCAD	24.13 NCAD	24.30 NCAD	0.65	
FUWER Steps [db]		3.55	3.61	3 90	0.13	Trigger
EVM Reak [%]		10.52	11 53	14.93	1 36	
Magnitude Error RMS	[%]	1.58	1.63	1.67	0.02	
Magnitude Error Peak	[%]	5.10	5.14	5.97	0.35	Sig Config
Phase Error RMS (°)		2.52	2.51	2.72	0.09	loig. Coming
Phase Error Peak [°]		-8.67	8.62	-10.74	0.76	
IQ Origin Offset [dB]		-58.50	-59.19	-53.13	5.75	
IQ Imbalance [dB]		-52.47	-57.27	-51.41	6.60	
CF Error [Hz]		8.53	14.95	36.83	11.93	
Trans. Time Error [Ch	ip]	-1.83	-1.82	-1.90	0.05	Display
Phase Disc. [°]		0.03				
OBW [MHz]		4.16	4.12	4.16		}
		Min = -666.7 Max = 24000	70 µs 10.00 µs 5.70 µs			WCDMA 1 Signaling
Trigger Trigge Source Slope	r Trigger Thresh	old Trigger	. Trigger Timeout	Minimum Trigger Gap		Config

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.



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

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 α = 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: <u>Case(i)</u>: When the UE is transmitting at its maximum power <u>Case(ii)</u>: 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 μ s 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 μ s 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-DP boundary	CCH at the HS-DPCCH slot
Phase discontinuity for HS-DPCCH $\Delta \theta$ 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

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

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 β c and β d for Subtest 3. For this test, Δ ACK and Δ NACK = 30/15, where β_{HS} = 30/15 * β c, and Δ CQI = 24/15, where β_{HS} = 24/15 * β c. Refer to Fig. 4 to configure Δ ACK, Δ NACK and Δ CQI in the R&S[®]CMW500.

Configuration in the R&S[®]CMW500:

```
WCDMA-UE Signaling \Rightarrow Config. \Rightarrow Physical Uplink Settings \Rightarrow HSDPA \Rightarrow \beta c \Rightarrow 15
WCDMA-UE Signaling \Rightarrow Config. \Rightarrow Physical Uplink Settings \Rightarrow HSDPA \Rightarrow \beta d \Rightarrow 8
WCDMA-UE Signaling \Rightarrow Config. \Rightarrow Physical Uplink Settings \Rightarrow HSDPA \Rightarrow \Delta ACK \Rightarrow 8
WCDMA-UE Signaling \Rightarrow Config. \Rightarrow Physical Uplink Settings \Rightarrow HSDPA \Rightarrow \Delta ACK \Rightarrow 8
WCDMA-UE Signaling \Rightarrow Config. \Rightarrow Physical Uplink Settings \Rightarrow HSDPA \Rightarrow \Delta ACK \Rightarrow 8
WCDMA-UE Signaling \Rightarrow Config. \Rightarrow Physical Uplink Settings \Rightarrow HSDPA \Rightarrow \Delta CQI \Rightarrow 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 \rightarrow TPC \rightarrow Active TPC Setup \rightarrow All 1 Signaling Parameter \rightarrow TPC \rightarrow Alg. /Step size \rightarrow 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 \rightarrow *Trigger* \rightarrow *Trigger Delay* \rightarrow 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

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

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 \rightarrow TPC \rightarrow Active TPC Setup \rightarrow Closed Loop Signaling Parameter \rightarrow TPC \rightarrow Alg. /Step size \rightarrow Alg2_1dB Signaling Parameter \rightarrow TPC \rightarrow Configuration \rightarrow DPCH (reference) Signaling Parameter \rightarrow Configuration \rightarrow 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:

```
\begin{array}{l} \mbox{Multi-Evaluation} \rightarrow \mbox{Display} \rightarrow \mbox{Select View} \rightarrow \mbox{Phase Discontinuity} \\ \mbox{Multi-Evaluation} \rightarrow \mbox{Measurement Period} \rightarrow \mbox{Half Slot} \\ \mbox{Multi-Evaluation} \rightarrow \mbox{Measurement Length} \rightarrow \mbox{45} \\ \mbox{Multi-Evaluation} \rightarrow \mbox{Display} \rightarrow \mbox{Scale PhDisc} \rightarrow \mbox{X Max.} \rightarrow \mbox{45 Slots} \\ \mbox{Multi-Evaluation} \rightarrow \mbox{Display} \rightarrow \mbox{Select View} \rightarrow \mbox{Phase Discontinuity} \\ \mbox{Multi-Evaluation} \rightarrow \mbox{Display} \rightarrow \mbox{Select View} \rightarrow \mbox{Phase Discontinuity} \\ \mbox{Multi-Evaluation} \rightarrow \mbox{Display} \rightarrow \mbox{Slot Number Table} \rightarrow \mbox{0 [Measurement Point 1]} \\ \mbox{Multi-Evaluation} \rightarrow \mbox{Display} \rightarrow \mbox{Slot Number Table} \rightarrow \mbox{0 [Measurement Point 2]} \\ \mbox{Multi-Evaluation} \rightarrow \mbox{Display} \rightarrow \mbox{Slot Number Table} \rightarrow \mbox{10 [Measurement Point 3]} \\ \mbox{Multi-Evaluation} \rightarrow \mbox{Display} \rightarrow \mbox{Slot Number Table} \rightarrow \mbox{10.5 [Measurement Point 3]} \\ \mbox{Multi-Evaluation} \rightarrow \mbox{Display} \rightarrow \mbox{Slot Number Table} \rightarrow \mbox{10.5 [Measurement Point 4]} \\ \end{tabular}
```

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

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-40																						WCDMA Sig. Confi	
		6		10	12	1.4	16	10	20	22	24	26	20	20	22	24	26	20	40	12	44	ſ	
tatistic Cou 2 Phase Disco	nt 3 / 1 ontin	00 iuity	HS-	DPC	CH			1	st Me	asu	ired S	lot N	٩r			0						Display	
Overall Max.	PhD	2		0.0) °			S	tatist	ics	@ SI	ot 3,	.5	1	Curre	ent A	Avera	nge	Ma	x S	StdDev	<u>}</u>	
Measure Po	ints				46			F	ower	[dB	m]				-18.	08	-21	.02	-17.1	8	2.48	Markon	
Count > 36 °	•				0	- 9	0.00	% E	EVM F	RMS	6 [%]				4.	45	3	.80	4.4	7	0.34	Marker	
PhD (HS-DF	CCH	1)	(Curre	ent	Max	imur	n E	VM F	Peak	([%]			100	10.	32	10	.81	13.2	2	1.25	<u>}</u>	
A @ Slot 0.5 B @ Slot 10	5 .5	1		0.0 0.0) °) °		0.0 0.0	° C	F Err hase	or (I Dis	Hz] c. [°]				13. 0.	88 03	18	.16	35.4	1	8.72	WCDMA 1 Signaling	
	Ì	Phy: Setti	sical ings	DL	T	РС		ή				Тн	ISDPA		Ĩ							Config	



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 \rightarrow HSDPA \rightarrow CQI Feedback Cycle \rightarrow 4 ms Signaling Parameter \rightarrow HSDPA \rightarrow CQI Repetition Factor \rightarrow 1 Signaling Parameter \rightarrow HSDPA \rightarrow ACK/NACK Repetition Factor \rightarrow 1 WCDMA Signaling \rightarrow Config \rightarrow Physical Uplink Settings \rightarrow Gain Factors \rightarrow HSDPA $\rightarrow \triangle CQI \rightarrow 7$ Signaling Parameter \rightarrow TPC \rightarrow Active TPC Setup \rightarrow All 1 Signaling Parameter \rightarrow TPC \rightarrow Alg. /Step Size \rightarrow 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 \rightarrow HSDPA \rightarrow CQI Feedback Cycle \rightarrow 4 ms Signaling Parameter \rightarrow HSDPA \rightarrow CQI Repetition Factor \rightarrow 1 Signaling Parameter \rightarrow HSDPA \rightarrow ACK/NACK Repetition Factor \rightarrow 1 WCDMA Signaling \rightarrow Config \rightarrow Physical Uplink Settings \rightarrow Gain Factors \rightarrow HSDPA $\rightarrow \triangle CQI \rightarrow 7$ Signaling Parameter \rightarrow TPC \rightarrow Active TPC Setup \rightarrow Closed Loop Signaling Parameter \rightarrow TPC \rightarrow Alg. /Step Size \rightarrow Alg2 1 dB Signaling Parameter \rightarrow TPC \rightarrow Configuration \rightarrow DPCH (reference) Signaling Parameter \rightarrow TPC \rightarrow Configuration \rightarrow Target Power \rightarrow -18.0 dBm The measurement results are available here: *Multi-Evaluation* \rightarrow *Display* \rightarrow *Select View* \rightarrow *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 μ s 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]:

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

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					
	DPCCH	-17.9	256	-17.9					
1	DPDCH	-0.4	64	-6.4					
	HS-DPCCH	-11.8	256	-11.8					
	DPCCH	-7.2	256	-7.2					
3	DPDCH	-12.7	64	-18.7					
	HS-DPCCH	-1.2	256	-1.2					
	DPCCH	-7.1	256	-7.1					
4	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 $\text{R\&S}^{\circledast}\text{CMW500}$ 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 \rightarrow TPC \rightarrow Active TPC Setup \rightarrow All 1 Signaling Parameter \rightarrow TPC \rightarrow Alg. / Step Size \rightarrow Alg2_1dB

Repeat the relative code-domain error measurement at the UE power level of -18 dBm with a tolerance of $\pm 2 \text{ dB}$. 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 \rightarrow TPC \rightarrow Active TPC Setup \rightarrow Closed Loop Signaling Parameter \rightarrow TPC \rightarrow Alg. / Step Size \rightarrow Alg2_1dB Signaling Parameter \rightarrow TPC \rightarrow Configuration \rightarrow DPCH (reference) Signaling Parameter \rightarrow TPC \rightarrow Configuration \rightarrow 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):

- $\beta c / \beta d = 2/15 UE$ transmitting at its maximum power
- $\beta c / \beta d = 2/15 UE$ transmitting at -18.0 dBm

Case (ii):

- $\beta c / \beta d = 15/8 UE$ transmitting at its maximum power
- $\beta c / \beta d = 15/8 UE$ transmitting at -18.0 dBm

Case (iii):

- $\beta c / \beta d = 15/4 UE$ transmitting at its maximum power
- $\beta c / \beta d = 15/4 UE$ 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 \rightarrow Config. \rightarrow Measurement Control \rightarrow Modulation/CDP \rightarrow Chn. Detect Threshold $\rightarrow -1$ 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: $WCDMA Multi-Evaluation \rightarrow Display \rightarrow Select View \rightarrow Relative CDE$ $WCDMA Multi-Evaluation \rightarrow Measurement Period \rightarrow Half Slot$

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.

🚸 WCDMA Multi Evaluation Configuration 🛛 🛛 🕅								
Path: Limit/Code Domain/Relative CDE/Expected EC	DP/E-DPDCH	3				Multi		
id⊢Limit id⊢Modulation					1	Evaluation RDY		
E-Code Domain						PE		
E-Expected ECDP	Beta Factor	Spreading Factor	Nominal CDP [dB]	Effective CDP [dE	e 3]	Settings		
DPCCH	15 / 15	256	-7.2	-7.2				
DPDCH	8 / 15	64	-12.7	-18.7 -1.2		Trigger		
-HS-DPCCH	450 / 225	256	-1.2					
E-DPCCH	/ 225							
E-DPDCH 1	/ 225							
E-DPDCH 2	/ 225					. <u> </u>		
E-DPDCH 3	/ 225	/ 225				Display		
E-DPDCH 4	/ 225							
Used HS-DPCCH Config	АСК 🔻							
⊟ -BPSK	ECDP [dB] Lin	nit					
Requirement 1	> -2	1.0 -15.5				Marker		
Requirement 2	-21.0 to ≥ -3	0.0 -36.5 - ECD	P					
⊟4PAM	ECDP [dB] Lin	nit			0		
Requirement 1	> -2	5.5 -17.5				Signaling		
Requirement 2	-25.5 to ≥ -3	d.o –43.0 - ecd	P			, didinecter		
⊕-Power Control ⊕-Spectrum ACLR ⊕-Spectrum Emission Mask					-	WCDMA-UE Signaling ON		
Repetition Stop Condition Statistic Count	leasurement ength	Preselected Slot	Measurement Period	Assign Views	Config			

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.



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

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/lor (dB)	T-put <i>R</i> (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					
lor	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/lor	dB	-13					
HS-SCCH_1_Ec/lor	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 \rightarrow HSDPA \rightarrow Configuration Type \rightarrow Fixed Reference Channel Signaling Parameter \rightarrow HSDPA \rightarrow H-Set \rightarrow 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

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

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

Signaling Parameter \rightarrow Physical DL Settings \rightarrow Output Power (lor) \rightarrow -25.7 dBm Signaling Parameter \rightarrow Physical DL Settings \rightarrow DPCH \rightarrow –13.0 dB Signaling Parameter \rightarrow Physical DL Settings \rightarrow HS-SCCH#1 \rightarrow Level \rightarrow –13.0 dB Signaling Parameter \rightarrow Physical DL Settings \rightarrow HS-PDSCH \rightarrow –3.0 dB WCDMA-UE Signaling \rightarrow Config. \rightarrow Physical Downlink Settings \rightarrow P-CPICH \rightarrow -10.0 dB WCDMA-UE Signaling \rightarrow Config. \rightarrow Physical Downlink Settings \rightarrow P-CCPCH \rightarrow -12.0 dB WCDMA-UE Signaling \rightarrow Config. \rightarrow Physical Downlink Settings \rightarrow P-SCH \rightarrow -15.0 dB WCDMA-UE Signaling \rightarrow Config. \rightarrow Physical Downlink Settings \rightarrow S-SCH \rightarrow -15.0 dB WCDMA-UE Signaling \rightarrow Config. \rightarrow Physical Downlink Settings \rightarrow PICH \rightarrow -15.0 dB WCDMA-UE Signaling \rightarrow Config. \rightarrow Connection Configuration \rightarrow Test Mode \rightarrow Loop Mode1 WCDMA-UE Signaling \rightarrow Config. \rightarrow Connection Configuration \rightarrow Loop Mode1 RLC → Acknowledge WCDMA-UE Signaling \rightarrow Config. \rightarrow Physical Downlink Settings \rightarrow HS-SCCH 1 \rightarrow ON WCDMA-UE Signaling \rightarrow Config. \rightarrow Physical Downlink Settings \rightarrow HS-SCCH 2 \rightarrow OFF WCDMA-UE Signaling \rightarrow Config. \rightarrow Physical Downlink Settings \rightarrow HS-SCCH 3 \rightarrow OFF WCDMA-UE Signaling \rightarrow Config. \rightarrow Physical Downlink Settings \rightarrow HS-SCCH 4 \rightarrow OFF WCDMA-UE Signaling \rightarrow Config. \rightarrow Physical Downlink Settings \rightarrow HS-SCCH Enhanced \rightarrow Selection \rightarrow No.1 WCDMA-UE Signaling \rightarrow Config. \rightarrow Physical Downlink Settings \rightarrow HS-SCCH Enhanced \rightarrow Number of HS-SCCH \rightarrow 4 WCDMA-UE Signaling \rightarrow Config. \rightarrow Physical Downlink Settings \rightarrow HS-SCCH Enhanced \rightarrow Unscheduled Subframes \rightarrow 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 \rightarrow TPC \rightarrow Alg. / Step Size \rightarrow Alg. 2, 1 dB Signaling Parameter \rightarrow TPC \rightarrow Active TPC Setup \rightarrow Closed Loop Signaling Parameter \rightarrow TPC \rightarrow Configuration \rightarrow Total Signaling Parameter \rightarrow TPC \rightarrow Configuration \rightarrow Target Power \rightarrow 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; 6.3A)

Maximum input level for HS-PDSCH reception (16QAM)								
Maximum input level for HS- PDSCH reception (16QAM)	Absolute test requirement (kbps)	Relative test requirement (normalized to ideal = 777 kbps) No. of events /	Test limit expressed as No. of events / min. No. of samples (Bad DUT	Min. No. of samples (No. of events to pass) Mandatory if	Test time in s Mandatory if fading Informative and approx. if	BL / RT		
16QAM H-Set 1		No. of samples	factor)	applicable	statistical			
	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+ statul X is summarized as No. of erro

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 \rightarrow (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 $R\&S^{\ensuremath{\$}CMW500}$.

🚸 Measurement Controller		
	Taskbar entry	State
⊕ WCDMA FDD UE		
TX Measurement 1	\checkmark	
TX Measurement 2		
RX Measurement 1		
RX Measurement 2		

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 \rightarrow RX Measurement \rightarrow ON [check mark] WCDMA RX Meas. \rightarrow HSDPA ACK WCDMA RX Meas. \rightarrow HSDPA ACK \rightarrow Measure Subframes \rightarrow 500 WCDMA RX Meas. \rightarrow HSDPA ACK \rightarrow Repetition \rightarrow Single Shot

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

🚸 WCDMA UE RX Measureme	😵 WCDMA UE RX Measurement 1 - V3.0.10							WCDMA		
🕒 BER [HSDPA ACI	BER BER BSDPA ACK							HSDPA		
Mbit/s 0.8 0.6 0.4 0.2 0.2 0.2 0.2 0.5 0.4 0.2 0.2 0.2 0.5 0.4 0.2 0.2 0.5 0.4 0.5 0.4 0.5 0.4 0.5 0.5 0.4 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5 0.5		×	25000	-20000	-15000	-10000	Subframes -5000	CQI No 25 20 15 10 5	Throughput: Current Max. Possible Median CGI: Current	RUN
Output Power (lor)	-25.70 dBm		lhit/e		íhas	ed on se	ettings)		_	
AWGN Noise (loc)	□ -70.00 dBm		in the second	Maxin	num		Minimum		Scheduled	
Accumulated Power	0.00 dB Adjust to	0dB		0.	777		0.777		0.777	Display
OCNS	-6.88 dB Auto			100.	000		100.000		100.000	
Code Conflict	No Code Conflict	Detected			ACK		NACK		DTX	
Channel Table	Lovel	Codo		100.	.000		0.000		0.000	
		2	<u> </u>							
	I = 13.0 dB	2	L							
HS SCCH #2	□ -10 3 dB	7								Signaling
HS-SCCH #3	□ -10 3 dB	8	es	483	4					Parameter
HS-SCCH #4	□ -10.3 dB	q							_	WCDMA-UE
HS-PDSCH	IZ -3.0 dB	1) Co	nnection	Establisł	ned <mark>Pov</mark> In S	wer In Rang Sync	e		Signaling ON
Physical DL Settings TPC HSDPA Config										

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 \rightarrow WCDMA UE FDD HSDPA ACK \rightarrow 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/lor (dB)	T-put <i>R</i> (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			
lor	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/lor	dB	-13			
HS-SCCH_1_Ec/lor	dB	-13			
Redundancy and constellation version		6			
Maximum number of HARQ transmissions		1			

Note:

n

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.

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

Table 25: Test requirement parameters for the 64QAM maximum input level (Table 6.3B.4 of TS34.121 [1]).

Configuration in the R&S[®]CMW500: Signaling Parameter \rightarrow HSDPA \rightarrow Configuration Type \rightarrow Fixed Reference Channel Signaling Parameter \rightarrow HSDPA \rightarrow H-Set \rightarrow 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 \rightarrow Physical DL Settings \rightarrow Output Power (Ior) \rightarrow –25.7 Signaling Parameter \rightarrow Physical DL Settings \rightarrow DPCH \rightarrow –13.0 dB Signaling Parameter \rightarrow Physical DL Settings \rightarrow DPCH \rightarrow Code \rightarrow 7 Signaling Parameter \rightarrow Physical DL Settings \rightarrow HS-SCCH#1 \rightarrow –13.0 dB Signaling Parameter \rightarrow Physical DL Settings \rightarrow HS-SCCH Enhanced \rightarrow Number of HS-SCCH → 2 Signaling Parameter \rightarrow Physical DL Settings \rightarrow HS-PDSCH \rightarrow -2.0 dB WCDMA-UE Signaling \rightarrow Config. \rightarrow Physical Downlink Settings \rightarrow P-CPICH \rightarrow -10.0 dB WCDMA-UE Signaling \rightarrow Config. \rightarrow Physical Downlink Settings \rightarrow P-CCPCH \rightarrow -12.0 dB WCDMA-UE Signaling \rightarrow Config. \rightarrow Physical Downlink Settings \rightarrow P-SCH \rightarrow -15.0 dB WCDMA-UE Signaling \rightarrow Config. \rightarrow Physical Downlink Settings \rightarrow S-SCH \rightarrow -15.0 dB WCDMA-UE Signaling \rightarrow Config. \rightarrow Physical Downlink Settings \rightarrow PICH \rightarrow -15.0 dB WCDMA-UE Signaling \rightarrow Config. \rightarrow Connection Configuration \rightarrow Test Mode \rightarrow Loop Mode1 WCDMA-UE Signaling \rightarrow Config. \rightarrow Connection Configuration \rightarrow 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 \rightarrow TPC \rightarrow Active TPC Setup \rightarrow Closed Loop Signaling Parameter \rightarrow TPC \rightarrow Alg. /Step Size \rightarrow Alg2 1 dB Signaling Parameter \rightarrow TPC \rightarrow Configuration \rightarrow Total Signaling Parameter \rightarrow TPC \rightarrow Configuration \rightarrow Target Power \rightarrow 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)	Absolute test requirement (kbps)	Relative test requirement (normalized to ideal=13252 kbps) No. of events /	Test limit expressed as No. of events / min. No. of samples (Bad DUT	Min. No. of samples (No. of events to pass) Mandatory if	Test time in s Mandatory if fading Informative and approx. if	BL / RT		
64QAM H-Set 1		No. of samples	factor)	applicable	statistical			
	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": $BLER\% \rightarrow (1-BLER\%)$.

- 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 \rightarrow Select Menu \rightarrow WCDMA FDD UE HSDPA ACK WCDMA HSDPA ACK \rightarrow Measure Subframes $\rightarrow \geq$ 422 (when "Repetition" is set to "Single Shot")

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

Measured [MBit/s] Rel. to max. possible [%]	0.768	0.770	0.746	0.777	Display
Transmissions [%]	🚸 HSDPA			DTX	
1	CQI Feedback Cycle	✓ 2 ms		0.000	
2	CQI Repetition Factor	1			Signaling
3	ACK/NACK Repetition	Mo 1			Parameter
4	Configuration Type	Fixed Reference Ch	annel 🔻		
DL BLER 1.200 % Median	CQI H-Set	H-Set 8 Max Input	•		WCDMA 1 Signaling
Physical DL	ТРС	HSDPA	Ţ	Config	

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 \rightarrow HSDPA \rightarrow H-Set \rightarrow H-Set 8 Max. Input Signaling Parameter \rightarrow Physical DL Settings \rightarrow HS-PDSCH \rightarrow –2 dB

The measurement results are available here: WCDMA UE FDD HSDPA ACK \rightarrow 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 (NINF)	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.

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.
 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.

WCDMA Signaling Configuration		WCDMA				
Path: Scenario						
B-RF Output (TX)	Carrier 1	WCDMA 1				
Routing	Connector: RF1COM 🔻 Converter: RFTX1 💌	RX Meas				
External Attenuation	0.0 dB					
p RF Output (TX 2)	Carrier 2	Go to				
Routing	Connector: RF3COM 🔻 Converter: RFTX2 💌					
External Attenuation	0.0 dB					
p⊷RF Input (RX)		Routing				
Routing	Connector: RF1COM 🔻 Converter: RFRX1 💌					
External Attenuation	0.0 dB					
⊟RF Frequency	Carrier 1 Carrier 2					
Operating Band	Band 1 🔹 Band 1					
Downlink Channel	10563 Ch 2112.6 MHz 10588 Ch 2117.6 MHz					
	9613 Ch 1922.6 MHz					
	190.0 MHz					
⊟ -RF Power Downlink	Carrier 1 Carrier 2 Combined	Signaling				
Output Power (lor)	-56.10 dBm -56.10 dBm -53.09 dBm	Parameter				
AWGN Noise (loc)	□ -70.00 dBm □ -70.00 dBm					
Geometric Factor (lor/loc)		WCDMA-UE				
Total Output Power (lor+loc)	-56.10 dBm -53.09 dBm	Signaling				
Y Y	Y Y Y					
Connect RMC Unregister SMS		Config				

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/lor	–10 dB				
P-CCPCH	P-CCPCH_Ec/lor	–12 dB	Mean power level is shared with SCH			
SCH	SCH_Ec/lor	–12 dB	Mean power level is shared with P-CCPCH – SCH (includes P-SCH and S-SCH)			
PICH	PICH_Ec/lor	–15 dB				
DPCH	DPCH_Ec/lor	Test-specific only for serving the HS-DSCH cell, otherwise omitted	12.2 kbps DL reference measurement channel			
HS-SCCH-1	HS-SCCH_Ec/lor	-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/lor	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/lor	DTX'd	As HS-SCCH-2			
HS-PDSCH	HS-PDSCH_Ec/lor	Test-specific				
OCNS		Necessary power so that total transmit power spectral density of Node B (lor) 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 \rightarrow Config. \rightarrow RF Settings \rightarrow RF Power Downlink \rightarrow Output Power (Ior) \rightarrow -75 dBm (for both 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 → P-CCPCH → -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 → DPCH → -5.0 dB WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-SCCH#1 → -9.0 dB

WCDMA-UE Signaling \Rightarrow Config. \Rightarrow Physical Downlink Settings \Rightarrow HS-SCCH Enhanced \Rightarrow Selection \Rightarrow No.1 WCDMA-UE Signaling \Rightarrow Config. \Rightarrow Physical Downlink Settings \Rightarrow HS-SCCH Enhanced \Rightarrow Number of HS-SCCH \Rightarrow 3 WCDMA-UE Signaling \Rightarrow Config. \Rightarrow Physical Downlink Settings \Rightarrow HS-SCCH Enhanced \Rightarrow Unscheduled Subframes \Rightarrow DTX WCDMA-UE Signaling \Rightarrow Config. \Rightarrow Physical Downlink Settings \Rightarrow HS-PDSCH \Rightarrow -10.3 dB WCDMA-UE Signaling \Rightarrow Config. \Rightarrow Physical Downlink Settings \Rightarrow DPCH Enhanced

 \rightarrow Timing Offset \rightarrow 6 * 256 chip

*	WCDMA Signaling Configuration					WCDMA
Pat	h: Physical Downlink Settings/DPCH Enhan	ced/Timing Offs	et			
	Select Carrier	Carrier 1			ŀ	TX Meas
	Assumulated Bawar		uot to 0.dP	1		
	Accumulated Fower	0.00 dB Adj	ust to oub			WODMA 1
	OCNS	-7.51 dB Au	to 🔻	Release 6		RX Meas
	Code Conflict	No Code Con	flict Detect	ed!		
	Code Domain Diagram	Show				
	Channel Table	Level	Code	Symbol Rate		Go to
	-P-CPICH	-10.0 dB	0	15 ksps		
	⊞ P-CPICH Enhanced					
	-S-CPICH	□ -3.3 dB	11	15 ksps		Routing
	⊞-S-CPICH Enhanced					
	-P-SCH	✓ -12.0 dB				
	S-SCH	✓ -12.0 dB		45.1		
	-Р-ССРСН	IV -15.0 dB	1	15 Ksps		
	S-CCPCH	IV -9.2 dB	2	60 KSps		
		✓ -15.0 dB	2	15 kono		
		I♥ -12.2 UD	3	15 Ksps		
		☑ –13.0 dB	3	30 ksns		Gianalina
	⊡-DPCH Enhanced	,. 15.0	0			Parameter
	-2nd Scrambling Code	□1 hex				
	Power Offset	0.0 dB				WCDMA-UE
	Timing Offset	6 * 256 chip				Signaling
	Physical DL Settings		HSDP	A		Config

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 = Physical Downlink Settings → HS-SCCH = Physical → Selection → No.1 WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-SCCH = Physical Downlink Settings → HS-SCCH = Physical → Number of HS-SCCH → 3 WCDMA-UE Signaling → Config. → Physical Downlink Settings → HS-SCCH = Physical Downlink Settings → HS-PDSCH → -10.3 dB

•	WCDMA Signaling Configuration							WCDMA
Pa	th: Physical Downlink Settings/HS-PDSCH						Ī	(manual d
Ė	Physical Downlink Settings							TX Meas
	Select Carrier	Carrier 2 🔻						TA MOUS
	Accumulated Power	0.00 dB Adj	ust to 0dB					WCDMA 1
	OCNS	-1.67 dB Au	to 🔻	Release 6				RX Meas
	Code Conflict	No Code Con	flict Detecte	ed!				├ ────
	Code Domain Diagram	Show						Goto
	Channel Table	Level	Code	Symbol Rate				
	-P-CPICH	-10.0 dB	0	15 ksps				
	⊞P-CPICH Enhanced							Routina
	- Channel Table	Level	Channel Code	Symbol Rate	UE ID	UE ID Dummy		
	-HS-SCCH #1	▼ -9.0 dB	2	30 ksps	AAAA hex	5555 hex		
	-HS-SCCH #2	□ -13.2 dB	7	30 ksps	AAAA hex	12AA hex		
	-HS-SCCH #3	🗆 -11.4 dB	8	30 ksps	AAAA hex	1AAA hex		<u> </u>
	-HS-SCCH #4	🗆 -11.4 dB	9	30 ksps	AAAA hex	1FAA hex		
	🖻 HS-SCCH Enhanced							
	Selection	No. 1	-					
	Number of HSSCCH	3						Signaling
	Unscheduled Subframes	DTX	-	•				Parameter
	Channel Table	Level	Channel Code	Symbol Rate				WCDMA-UE
	HS-PDSCH	☑ -10.3 dB	1	240 ksps			•	Signaling ON
	Physical DL Settings TPC		HSDR	PA				Config

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.

🚯 WCDMA FDD Signaling				WCDMA
Connection Status	Cell Setup			
Cell (W) HSDPA	Band	Band 1 🛛 👻	Carrier 2 🛛 🔻	Go to
		Downlink U	Jplink	
Circuit Switched	Channel	10588 Ch	9613 Ch	
Packet Switched 📩 Attached	Frequency	2117.6 MHz	1922.6 MHz	Go to
CMW Demod. Info Notice the Cell is not	Output Power	-56.10 dBm		<u>├</u>
UE Info DC-HSDPA enabled, as the right H-Set is not	Total Output	-56.10 dBm		Coto
Connection Type Established chosen yet	Scrambling Code	e 1 hex	0 hex	do to
	Р-СРІСН 🔻	-4.4 dB	Code 0	}
Registration Identity Type IMSI	PS Domain	Reduced Signalin	q 🗖	WCDMA Sig. Config.
Registration Identity 001010123456063	Connection Se	tup		aig. coning
IMEI 351828045004622 UE Called Number	UE term. Conne	ct RMC 🔻		
UE Calling Number	DMC			
CTM Text Telephony (TTY)	RMC Data Bata	DI 12.2 khne - 11	12.2 khne 💌	<u> </u>
UE Capabilities 🔹				
	lest Mode	Loop Mode 1 RLC		
	HSPA Test Mod	e 🔽		
Band 10 11 12 13 14 19 20 21	Procedure	RMC on CS Domain +	HSPA 34.108 🔻	
	Direction I	ISDPA	•	
Phys. Layer Cal. Rel. 5 10 Rel. 6 6 Rel. 7 14 Rel. 8 24	Data Pattern	PRBS9	•	WCDMA-LIE
The UE is a Rel 8 Category 24 device	Error Insertion	10 %		Signaling
	End moenton 1	10 /0		
Connect RMC Unregister Send SMS				Config

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	1
6.3C	Maximum input level for DC- HSDPA reception (16QAM)	H-Set 1A (16QAM version)	1
6.3D	Maximum input level for DC- HSDPA reception (16QAM)	H-Set 8A Max. Input	1

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

⊟-HSDPA		
	☑ 4 ms	
	1	
-ACK/NACK Repetition Factor	1	
	Manual: 24 Use Reported (if available): 🗹 24	
⊡Channel Configuration		
Configuration Type	Fixed Reference Channel 🔻	
⊨ Fix <u>ed Reference</u>		
H-Set	H-Set 8A Max Input 🔹	
⊡⊂CQI		
⊞User Defined		WCDMA-UE
E Measurement Report		Signaling
Connect Send		Config
SM3		

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

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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.

Reference	Sensitivity	/ Level for		(6 24)
Nelelelice	Sensitivity		DC-HODFA	(0.2A)

🚸 WCDMA FDD Signaling									WCDMA
Connection Status		_	Cell Setup						
Cell 🧰	DC-HSDPA+ Cell with Dual		Band	Ba	nd 1	-	Carrier 1	-	WCDMA 1 Multi Eval
	carrier enabled			Dov	vnlink		Uplink		
Circuit Switched	Call Established		Channel		10563	Ch	9613	Ch	[
Packet Switched 🛛 🔁	Connection Establis	hed	Frequency		2112.6	MHz	1922.6	MHz	Go to
CMW Demod. Info Powe	r In Range In Sync.		Output Power		-56.10	dBm			<u> </u>
UE Info			Total Output		-56.10	dBm			Coto
Connection Type Establis	hed		Scrambling Cod	le	0	hex	0	hex	GU (U
Circuit Switched	UE terminated RMC Call DC HSDDA+ Test Mode		P-CPICH •	-	-4.4	dB	Code	0	├───
Registration Identity Type	IMSI		PS Domain		Reduced	I Signali	na		WCDMA
Registration Identity	001010123456063		Connection S	etup					Sig. Config
IMEI	351828045064622		UE term. Conn	ect R	RMC				
UE Called Number	DC-HSDPA Test Mode call								
CTM Text Telephony (TTY)	established and the		RMC						L
Eventlea	related call flow in	-	Data Rate	DI	12.2 kl	ops 🗹 U	JL 12.2 kb	ps	
Event Log	accordance to 13 34.100		Test Mode	L	oop Mode	e 2			
11:43:46 🔒 Call Establish	ed .		HSPA Test Mo	de 🔽					<u> </u>
11:43:46 Test Loop Close	sed diohearer Established		Procedure	RMC	on CS D	omain 4	HSPA 34.1	108	
11:43:44 CS Radiobear	er Established		Discotion	HEDI					
11:43:41 🔂 RRC Connecti	on Established		Direction	HSDI	PA				├───
11:43:39 🔒 Establish RMC	CTest Mode Call		Data Pattern	PRB	\$9				WCDMA-UE
11:41:39 UE Registered	l and Attached	•	Error Insertion	□ 10) %				ON ON
Disconnect	Send	nde	un Ì		Υ		Ŷ		Canfin
RMC	SMS	ndo	ver						Config

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></refsens>	<reflor></reflor>					
I	dBm/3.84 MHz	-112.3	-102					
II	dBm/3.84 MHz	-110.3	-100					
	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					

Reference Sensitivity Level for DC-HSDPA (6.2A)

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	FDD	Rel-7					
 Downlink 64QAM configured 	Not Present						
– HS-DSCH TB size table	Octet aligned (for H-Set 12)	Rel-7					
Downlink secondary cell info FDD		Rel-8					
 CHOICE Configuration info 	New configuration						
 Downlink 64QAM configured 	Not Present						
– HS-DSCH TB size table	Octet aligned (for H-Set 12)						

Reference Sensitivity Level for DC-HSDPA (6.2A)

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 QPSK H-Set 12	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			
	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]).



🚸 wc	DMA UE RX Mea	asurement	Choose th	ne HSDPA	ACK tab fro	m the WC	DMA Rx				WCDMA
<u>о</u> в	ER OHSI	DPA ACK	Measurer Established	ment win	dow	Connect	tion Establi	shed	Power In Syno	In Rang	
0.10	Mbit/s	-400	-350 -300) -250	-200	-150	Suk 100 -50	20 20 10 frames	QINO Throu	ighput Curr.: verall arrier 1 arrier 2 ax. Possible an CQI Curr.: arrier 1 arrier 2	·
Max.	possible Thro	oughput	0.120	Mbit/s	based on s	ettings)	Overall Thro	ughput:	0.1	20 Mbit/s	ļ
Thro	uabout		Curr	Ca May	rrier 1 Min	Sch'od	Curr	Carr	ier Z Min	Sch'ad	Diculau
Meas	sured (Mhit/s)		0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	Dispidy
Rel. 1	to max. possil	ble [%]	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	
Tran	smissions [%	1	Sent	ACV	NACK	DTV	e	ACK	NACK	DTX	
1			100.000	S HSDP	A				Ŀ	0.000	l
2			0.000	CQIFe	edback Cyc	le	₩ 4 m				Diamating
3			0.000	CQIRe	petition Fac	ctor See Elected	1				Parameter
4			0.000		ACK Repetit	ion Facto	r i	(• • • • • • •		
Carri Carri	er 1: DL BLEI er 2: DL BLEI	R 0.0 R 0.0	000 % Median 000 % Median	H-Set	urauon type	e	H-Set 12	QPSK	.nanne ▼ ▼		WCDMA-UE Signaling ON
	Pt Se	nysical Di ettings	L ТРС			HSDP	A				Config

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 \rightarrow HSDPA \rightarrow H-Set \rightarrow H-Set 12 QPSK Change the Physical DL level according to the test case.

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

🚸 WCDMA UE RX Measurement	1 - 3.0.10.4								WCDMA
😑 BER 🛛 😑 HSDPA ACK									HSDPA
Call	Established	I)) 	Connect	ion Establis	hed	Power In Syno	In Rang :	
0.10 0.05 	-350 -300) -250	-200	-150 -	Subf 100 -50	20 	QINO Throu	ughput Curr.: verall arrier 1 arrier 2 ax. Possible an CQI Curr.: arrier 1 arrier 2	
Max. possible Throughput	0.120	Mbit/s (based on s	ettings)	Overall Throu	ughput:	0.1	20 Mbit/s	
		Ca	rrier 1			Carr	ier 2		
Throughput	Curr.	Max.	Min.	Sch'ed.	Curr.	Max.	Min.	Sch'ed.	Display
Measured [Mbit/s]	0.060	0.060	0.060	0.060	0.060	0.060	0.060	0.060	Ļ
Rel. to max. possible [%]	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	
Transmissions [%]	Sent	ACK	NACK	DTX	Sent	ACK	NACK	DTX	
1	100.000	100.000	0.000	0.000	100.000	100.000	0.000	0.000	L
2	0.000				0.000				Cianalina
3	0.000				0.000				Parameter
4	0.000				0.000				
Carrier 1: DL BLER 0.0 Carrier 2: DL BLER 0.0	00 % Median 00 % Median	🚸 Meas Measure	eure S <mark>Max =</mark> Subframes	100 • 1000000 <mark>500</mark>	ť	500			WCDMA-UE Signaling ON
Repetition		N	leasure Subframes	Monito H-ARC	ored Er 2 In	ror sertion .			Config

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 lor 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/lor (dB)	T-put <i>R</i> (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					
lor	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/lor	dB	-13					
HS-SCCH_1_Ec/lor	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 \rightarrow HSDPA \rightarrow Configuration Type \rightarrow Fixed Reference Channel Signaling Parameter \rightarrow HSDPA \rightarrow H-Set \rightarrow 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 \rightarrow RF Settings \rightarrow RF Power Downlink \rightarrow Output Power (Ior) \rightarrow -25.7 dB (for Carrier 1 and Carrier 2)

For Carrier 1:

WCDMA-UE Signaling \rightarrow Config. \rightarrow Physical Downlink Settings \rightarrow Select Carrier \rightarrow Carrier 1

 $\begin{array}{l} WCDMA-UE \ Signaling \
earrow Config. \
earrow Physical Downlink \ Settings \
earrow P-CPICH \
earrow -10.0 \ dB \\ WCDMA-UE \ Signaling \
earrow Config. \
earrow Physical Downlink \ Settings \
earrow P-CCPCH \
earrow -12.0 \ dB \\ WCDMA-UE \ Signaling \
earrow Config. \
earrow Physical Downlink \ Settings \
earrow P-SCH \
earrow -15.0 \ dB \\ WCDMA-UE \ Signaling \
earrow Config. \
earrow Physical Downlink \ Settings \
earrow S-SCH \
earrow -15.0 \ dB \\ WCDMA-UE \ Signaling \
earrow Config. \
earrow Physical Downlink \ Settings \
earrow S-SCH \
earrow -15.0 \ dB \\ WCDMA-UE \ Signaling \
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WCDMA-UE Signaling \rightarrow Physical Downlink Settings \rightarrow HS-SCCH#1 \rightarrow -13.0 dB Signaling Parameter \rightarrow Physical Downlink Settings \rightarrow HS-PDSCH \rightarrow -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 dBWCDMA-UE Signaling → Physical DL Settings → HS-SCCH#1 → -13.0 dBSignaling 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 \rightarrow TPC \rightarrow Active TPC Setup \rightarrow Closed Loop Signaling Parameter \rightarrow TPC \rightarrow Alg. /Step Size \rightarrow Alg2 1 dB Signaling Parameter \rightarrow TPC \rightarrow Configuration \rightarrow Total \rightarrow 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.

🗞 WCDMA UE RX Measurement 1	- V3.0.10							-2	WCDMA
BER HSDPA ACK]								HSDPA
Mbit/s					1 1	CQI	No Throu	ighput Curr.: /erall	
1.0						20	● Ca ● Ca ● Ma	arrier 2 arrier 2 ax. Possible	
0.5						10	Media	an CQI Curr.: arrier 1	Ļ
-55000 -50000 -45000	-40000 -350	00 -30000	-25000 -20	000 -15000	-10000 -500	ames O	◆Ca	arrier 2	
Max. possible Throughput	1.557	Mbit/s (k	ased on s	ettings)	Overall Throu	ighput:	1.5	16 Mbit/s	<u>}</u>
		Саг	rier 1			Carri	er 2		
Throughput	Curr.	Max.	Min.	Sch'ed.	Curr.	Max.	Min.	Sch'ed.	
Measured [Mbit/s]	0.779	0.779	0.779	0.779	0.737	0.748	0.687	0.779	<u>}</u>
Rel. to max. possible [%]	100.000	100.000	99.999	100.000	94.646	96.000	88.286	100.000	Display
Transmissions [%]	Sent	ACK	NACK	DTX	Sent	ACK	NACK	DTX	
1	100.000	100.000	0.000	0.000	100.000	94.632	5.368	0.000	<u>}</u>
2	0.000				0.000				
3	0.000				0.000				
4	0.000				0.000				
									Signaling
Carrier 1: DL BLER U.UU	IU % Median	CQI 23	Measured	Subframe	5 44	34			Parameter
Carrier 2: DL BLER 5.36	i8 % Median	CQI 18							
Connection Established PS: Connection Established Power In Range Signaling In Sync In Sync									
Repetition	Ť	Me	asure bframes	Monito	ored Err) Ins	or ertion			Config

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 \rightarrow HSDPA \rightarrow H-Set \rightarrow H-Set 1A 16QAM Signaling Parameter \rightarrow Physical DL Settings \rightarrow Output Power \rightarrow -25.7 dBm Signaling Parameter \rightarrow Physical DL Settings \rightarrow HS-PDSCH \rightarrow -2.0 dB Signaling Parameter \rightarrow TPC \rightarrow Configuration \rightarrow Total \rightarrow 20 (for Power Class 3 and 3bis) or 18 (for Power Class 4) Signaling Parameter \rightarrow Physical DL Settings \rightarrow HS-SCCH#1 \rightarrow -13.0 dB The measurement results are available at:

WCDMA RX Measurement \rightarrow HSDPA ACK \rightarrow 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/lor (dB)	T-put <i>R</i> (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					
lor	dBm/3.84 MHz	-25.7					
UE transmitted mean power	dBm	0					
DPCH_Ec/lor	dB	-13					
HS-SCCH_1_Ec/lor	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 \rightarrow HSDPA \rightarrow Configuration Type \rightarrow Fixed Reference Channel Signaling Parameter \rightarrow HSDPA \rightarrow H-Set \rightarrow 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 \rightarrow TPC \rightarrow Active TPC Setup \rightarrow Closed Loop Signaling Parameter \rightarrow TPC \rightarrow Alg. /Step Size \rightarrow Alg2 1 dB Signaling Parameter \rightarrow TPC \rightarrow Configuration \rightarrow Total \rightarrow 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.

Tron to max, become [16]									
Transmissions [%]	Sent	NCK	MACK	ntv	Cont.	ACK	MACK	DTX	
1	100.000	🚸 HSDPA					×	0.000	
2	0.000	CQI Fee	dback Cyc	le	☑ 4 m				
3	0.000	CQI Rep	etition Fa	tor	1				Signaling Parameter
4	0.000	ACK/NA	CK Repetit	ion Factor	1				i di di liotori
	0.000	Configu	ation Type	e	Fixed Ref	erence C	hanne 🔻		WCDMA-UE
Carrier 1: DL BLER 0.0	00 % Median	H Sat			H Sot 8A I	May Innu			Signaling
Carrier 2: DL BLER 0.0	00 % Median	n-set			II-Set oA I	мах три	· ·		ON ON
Physical DI Settings	трс			HSDPA					Config

Fig. 53: FRC H-Set configuration.

Configure the downlink physical channels defined in Table 5(a) and Table 25 in the $R\&S^{\textcircled{0}}CMW500$ by referring to Fig. 5.

WCDMA-UE Signaling \rightarrow RF Settings \rightarrow RF Power Downlink \rightarrow Output Power (lor) \rightarrow -25.7 dB (for Carrier 1 and Carrier 2)

For Carrier 1:

WCDMA-UE Signaling \rightarrow Config. \rightarrow Physical Downlink Settings \rightarrow Select Carrier \rightarrow Carrier 1

WCDMA-UE Signaling \rightarrow Physical Downlink Settings \rightarrow HS-SCCH#1 \rightarrow -13.0 dB Signaling Parameter \rightarrow Physical Downlink Settings \rightarrow HS-PDSCH \rightarrow -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 dBWCDMA-UE Signaling → Physical DL Settings → HS-SCCH#1 → -13.0 dBSignaling 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)	Absolute test requirement (kbps)	Relative test requirement (normalized to ideal=13252 kbps)	Test limit expressed as No. of events / min. No. of samples	Min. No. of samples (No. of events to pass)	Test time in s Mandatory if fading Informative and	BL / RT			
64QAM H-Set 8		No. of samples in %	(Bad DUT factor)	Mandatory if applicable	approx. if statistical				
	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.

$\begin{array}{l} \textit{HSDPA ACK} \rightarrow \textit{Measurement Control} \rightarrow \textit{Repetition} \rightarrow \textit{Single Shot} \\ \textit{HSDPA ACK} \rightarrow \textit{Measurement Control} \rightarrow \textit{Measure Subframes} \rightarrow 500 \end{array}$

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

🚸 WCDMA UE RX Measuremen	t 1 - 3.0.10.4								WCDMA
BER HSDPA ACK						In Pong	HSDPA ACK		
Cal	Established	I	9	Connect	ion Establis	hed	In Sync	iii Kang :	RDY
30 Mbit/s			·			co	No Throu	ighput Curr.: /erall	
20						20	◆ Ca ◆ Ca	arrier 1 arrier 2 av Dossible	
10						10	Media Ca	an CQI Curr.: arrier 1	
-450 -400	-350 -300	-250	-200	-150 -	Sub1 100 -50	rames	♦ Ca	arrier 2	·
Max. possible Throughput	26.504	Mbit/s (based on s	ettings)	Overall Thro	ughput:	26.5	04 Mbit/s	
		Ca	rrier 1			Carr	ier 2		
Throughput	Curr.	Max.	Min.	Sch'ed.	Curr.	Max.	Min.	Sch'ed.	Display
Measured [Mbit/s]	13.252	13.252	13.252	13.252	13.252	13.252	13.252	13.252	ļ
Rel. to max. possible [%]	100.000	100.000	100.000	100.000	100.000	100.000	100.000	100.000	
Transmissions [%]	Sent	ACK	NACK	DTX	Sent	ACK	NACK	DTX	
1	100.000	100.000	0.000	0.000	100.000	100.000	0.000	0.000	Ļ
2	0.000				0.000				Signaling
3	0.000				0.000				Parameter
4	0.000				0.000				ļ
Carrier 1: DL BLER 0.000 % Median CQI 28 Measured Subframes 500 Signali						WCDMA-UE Signaling			
Physical D Settings	L ТРС			HSDP	A				Config

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.



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)					
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	HSDPATx1.dfl				
5.9A	Spectrum emission mask with HS-DPCCH	HSDPATx2.dfl HSDPATx3.dfl				
5.10A	Adjacent channel leakage power ratio (ACLR) with HS-DPCCH	HSDPATx4.dfl				
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							
Туре	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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Certified Environmental System ISO 14001 DQS REG_NO 1954 UM

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