Operation Guide for HSDPA Test Setup according to 3GPP TS 34.121

Application Note

Products:

| R&S®CMU200

Most of the tests specified in standard TS 34.121 [1] for 3GPP Rel-5 can be performed with R&S®CMU200. This document provides a step by step guide on how to perform Rel-5 measurements on transmitter characteristics, receiver characteristics and performance tests according to TS 34.121 V8.7.0 clauses 5, 6 and 9 with standalone R&S®CMU200. Test cases that require additional instruments, e.g. fading generator (R&S®SMU200A or R&S®AMU200A) will be discussed in brief in this application note with recommended reference. A set of *.sav files based on R&S®CMU200 firmware V5.22A for UE supporting operating band I with power class 3 in RMC 12.2 kbps + HSDPA is attached to this application note.

Hoi Yen Loo, Fernando Schmitt
12.2013-1CM72_2E

Application Note

ROHDE&SCHWARZ

Table of Contents

1 Introduction

Most of the tests specified in standard TS 34.121 [1] for 3GPP Rel-5 can be performed with R&S®CMU200. This document provides a step by step guide on how to perform Rel-5 measurements on transmitter characteristics, receiver characteristics and performance tests according to TS 34.121 V8.7.0 clauses 5, 6 and 9 with standalone R&S®CMU200 for UE supporting operating band I and power class 3. Test cases that require additional instruments, e.g. fading generator (R&S®SMU200A or R&S®AMU200A) will be discussed in brief in this application note with recommended reference. A set of *.sav files based on R&S®CMU200 firmware V5.22A for UE supporting operating band I and power class 3 in RMC 12.2 kbps + HSDPA is attached to this application note. Information on these *.sav files within this application note is marked with the symbol 

1.1 Covered Tests in Accordance with TS 34.121

Table 1 shows the Rel-5 transmitter characteristics, receiver characteristics and performance tests that can be performed with R&S®CMU200.

Transmitter characteristics, receiver characteristics and performance tests of 3GPP Rel-5 supported by R&S®CMU200		
Test	**Clause**	**Test Parameter**
Transmitter characteristics	5.2A	Maximum output power with HS-DPCCH (Release 5 only)
	5.2AA	Maximum output power with HS-DPCCH (Release 6 and later)
	5.2C	UE relative code domain power accuracy
	5.7A	HS-DPCCH power control
	5.9A	Spectrum emission mask with HS-DPCCH
	5.10A	Adjacent Channel Leakage Power Ratio (ACLR) with HS-DPCCH
	5.13.1A	Error Vector Magnitude (EVM) with HS-DPCCH
	5.13.1AA	Error Vector Magnitude (EVM) and phase discontinuity with HS-DPCCH
	5.13.2A	Relative code domain error with HS-DPCCH
Receiver characteristics	6.3A	Maximum input level for HS-PDSCH reception (16QAM)
Performance requirements	9.2.1A	Demodulation of HS-DSCH: Single link performance - QPSK/16QAM, Fixed Reference Channel (FRC) H-Set 1/2/3*
	9.2.1B	Demodulation of HS-DSCH: Single link performance - QPSK, Fixed Reference Channel (FRC) H-Set 4/5*
	9.2.1C	Demodulation of HS-DSCH: Single link performance - QPSK/16QAM, Fixed Reference Channel (FRC) H-Set 6/3*
	9.2.1D	Demodulation of HS-DSCH: Single link performance - Enhanced Performance Requirements Type 1 - QPSK/16QAM, Fixed Reference Channel (FRC) H-Set 1/2/3*
	9.2.1E	Demodulation of HS-DSCH: Single link performance Enhanced Performance Requirements Type 1- QPSK/16QAM, Fixed Reference Channel (FRC) H-Set 6/3*
	9.2.1F	Demodulation of HS-DSCH: Single link performance - Enhanced Performance Requirements Type 2 - QPSK/16QAM, Fixed Reference Channel (FRC) H-Set 6/3*
	9.2.1G	Demodulation of HS-DSCH: Single link performance - Enhanced Performance Requirements Type 3 - QPSK/16QAM, Fixed Reference Channel (FRC) H-Set 6/3*
	9.3.1	Reporting of Channel Quality Indicator: Single link performance - AWGN propagation conditions
	9.3.2	Reporting of Channel Quality Indicator: Single link performance - Fading propagation conditions*
	9.4.1	HS-SCCH detection performance: Single link performance*
	9.4.1A	HS-SCCH detection performance: Single link performance – Enhanced performance requirements Type 1*

* Requires additional instruments besides R&S®CMU200

Table 1: 3GPP Rel-5 measurement supported by R&S®CMU200

1.2 Information on Using *.SAV Files in R&S®CMU200

In order to recall *.sav file successfully without warning and error

- Activate WCDMA FDD-UE Signalling function group before recalling *.sav file
- Use the same WCDMA firmware version as indicated on the folder for Rel-5 *.sav files, e.g. recall *.sav files in folder R5_V522A with activated WCDMA firmware of V5.22A

2 Rel-5 Transmitter Characteristics

2.1 Generic Call Setup for Transmitter Characteristics

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

Configuration in R&S®CMU200:
Network → Packet Switched Domain → On
BS Signal → Circuit Switched → DCH (Dedicated Chn.) Type → RMC
BS Signal → Circuit Switched → RMC Settings → Reference Channel Type → 12.2 kbps + HSDPA 34.108
BS Signal → Circuit Switched → RMC Settings → RMC with HSDPA Settings → Message Versions → SRB: R99, RMC: R5 (Note)
BS Signal → Packet Switched → DCH (Dedicated Chn.) Type → HSDPA Test Mode
BS Signal → Packet Switched → HSDPA Test Mode → Radiobearer Setup → RMC 12.2 kbps + HSDPA
BS Signal → Packet Switched → HSDPA Test Mode → SRB Message Version → R99 (Note)

Note: Depending on the implementation, some UEs may not establish packet switched connection with *Message Version SRB: R99, RMC: R5* or *SRB Message Version R99*. If such case occurs, use *Message Version SRB: R5, RMC: R5* or *SRB Message Version R5*.

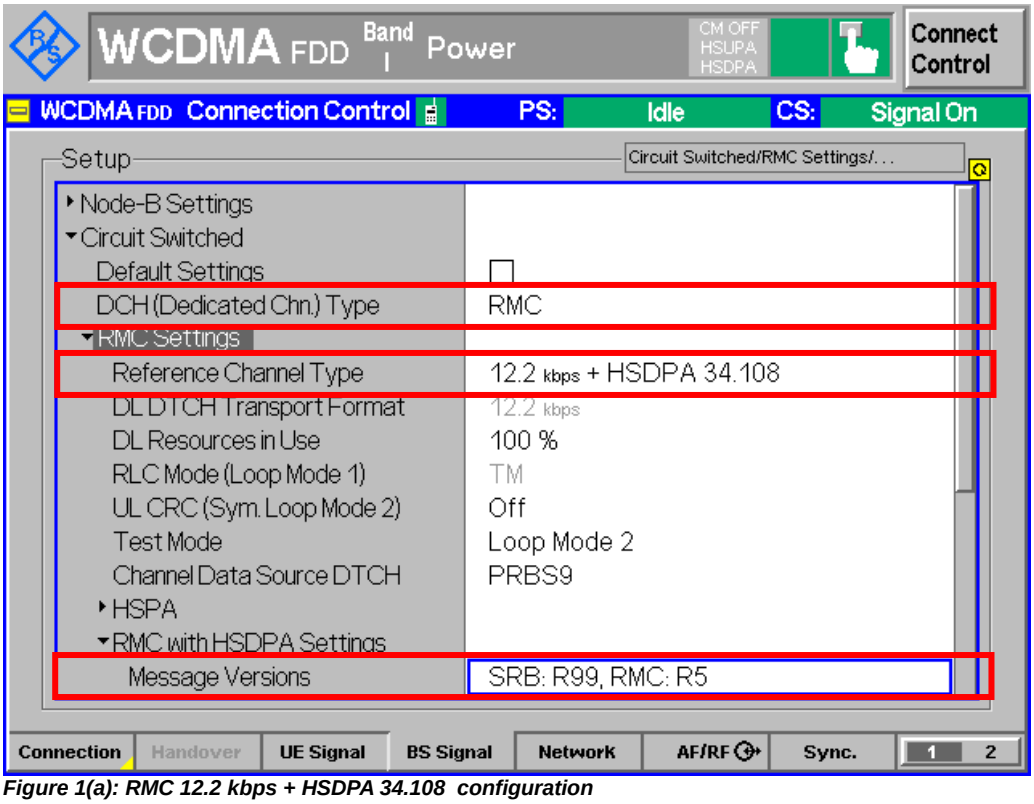


Figure 1(a): RMC 12.2 kbps + HSDPA 34.108 configuration

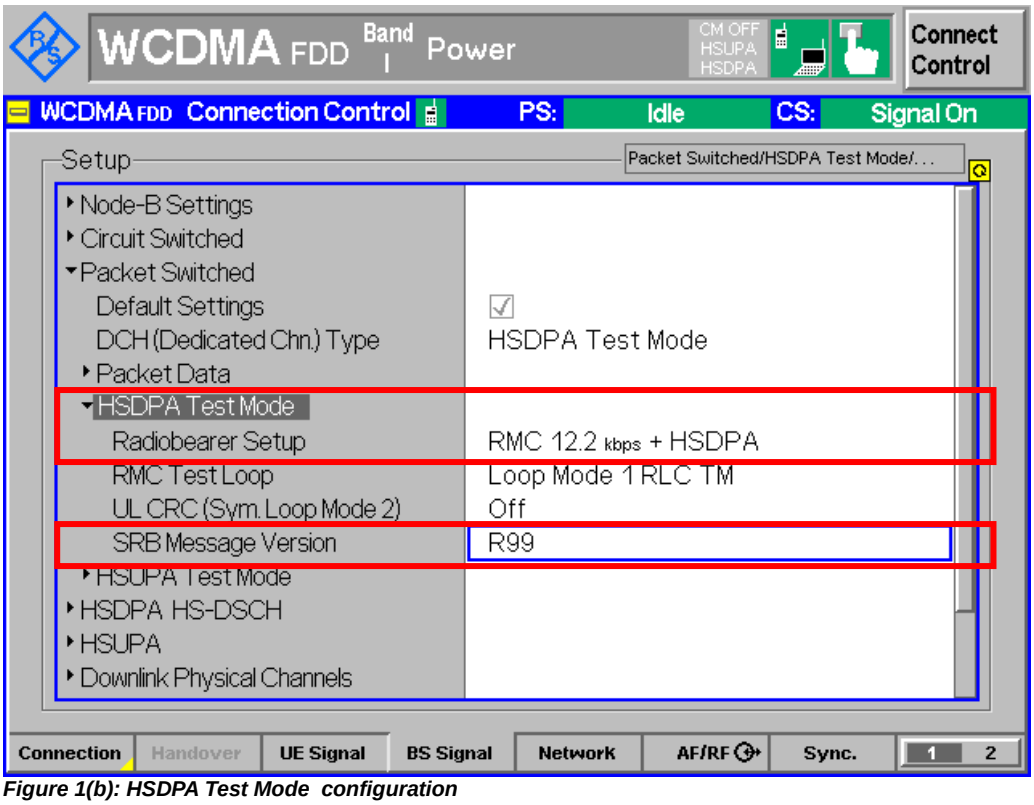


Figure 1(b): HSDPA Test Mode configuration

RADIO BEARER SETUP message in 9.2.1 of TS 34.108 [2] is used to configure HSDPA call.

Contents of RADIO BEARER SETUP message: AM or UM (HSDPA)		
Information Element	**Value/remark**	**Version**
Uplink DPCH info		Rel-6
- Uplink DPCH power control info		
- Ack-Nack repetition factor	1	Rel-5
Downlink HS-PDSCH Information		
- Measurement feedback info		
- CQI feedback cycle, k	2 ms	Rel-5
- CQI repetition factor	1	Rel-5

Table 2(a): Contents of RADIO BEARER SETUP message: AM or UM (HSDPA) (Subset of 9.2.1 of TS 34.108 [2])

Configuration in R&S®CMU200:
BS Signal → HSDPA HS-DSCH → CQI Feedback Cycle → 2 ms
BS Signal → HSDPA HS-DSCH → CQI Repetition Factor → 1
BS Signal → HSDPA HS-DSCH → ACK/NACK Repetition Factor → 1

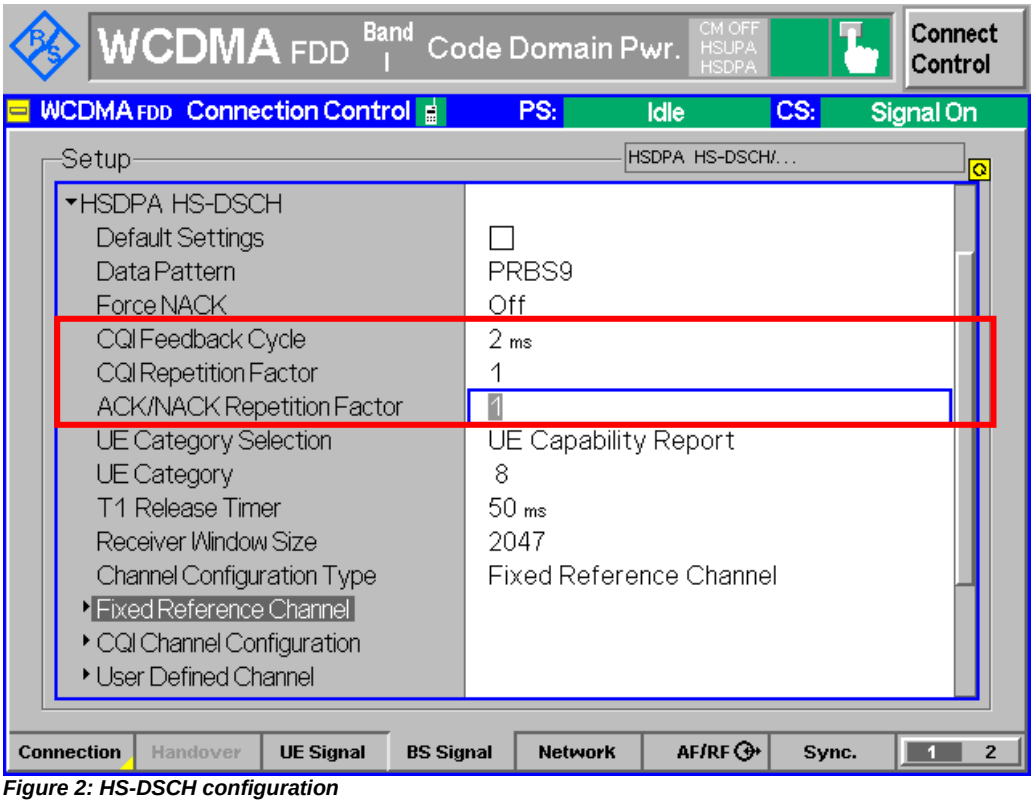


Figure 2: HS-DSCH configuration

For RRC CONNECTION SETUP, “Contents of RRC CONNECTION SETUP message: UM” message in 9.2 of TS 34.108 [2] is used to configure HSDPA call with the following exceptions.

Contents of RRC CONNECTION SETUP message: UM

Information Element	Value/remark
- Default DPCH Offset Value	Arbitrary set to value 1536…306176 by step of 2560 (this corresponds to a 0.5 slot timing offset between the DPCCH and the HS-DPCCH)

Table 2(b): Contents of RRC CONNECTION SETUP message: UM (section 7.3.6.4.3 of TS 34.121 [1]

Configuration in R&S®CMU200:
*BS Signal → Downlink Physical Channels → DL DPCH Timing Offset → 6 * 256 chip*

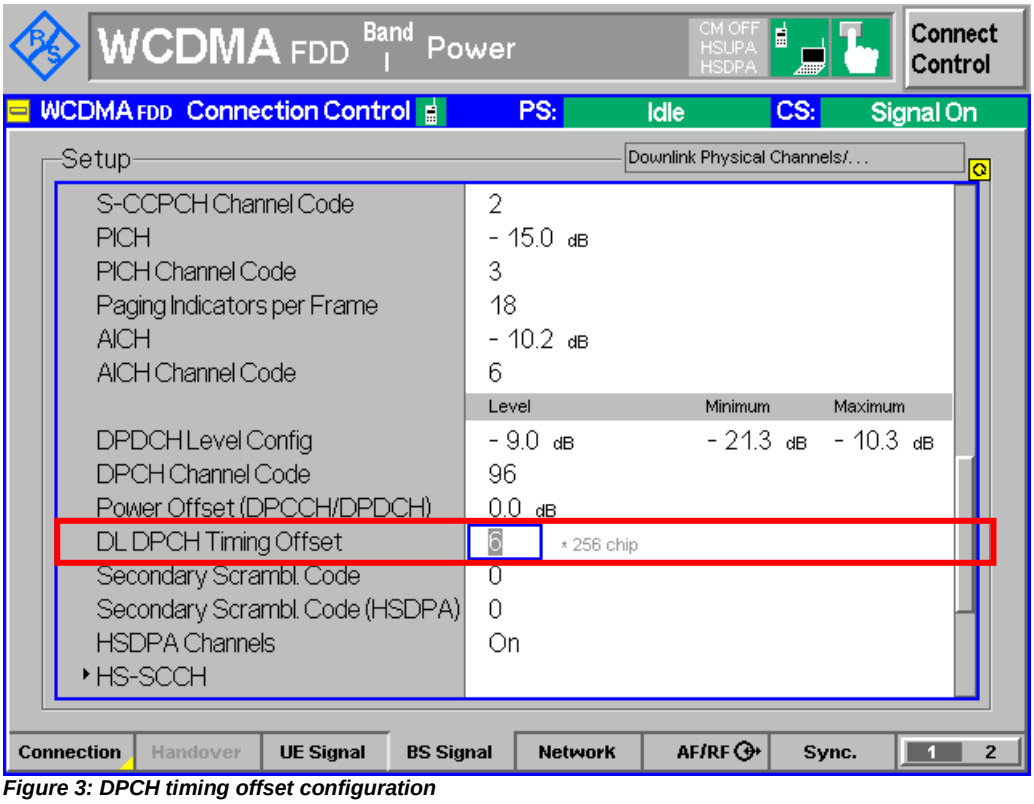


Figure 3: DPCH timing offset configuration

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

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

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

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

Table 3(b), 3(c) and 3(d) show the signalled value for gain factors βc, βd, ΔACK, ΔNACK and ΔCQI in R&S®CMU200 and summary of gain factor setting in R&S®CMU200 respectively.

Signalled value for gain factors βc and βd	
Signalled 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): Signalled value for gain factors βc and βd in R&S®CMU200

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

Table 3(c): Signalled value for gain factors ΔACK, ΔNACK and ΔCQI in R&S®CMU200

Summary of gain factor setting in R&S®CMU200					
Subtest	**βc**	**βd**	**ΔACK**	**ΔNACK**	**ΔCQI**
1	2	15	8	8	8
2	11	15	8	8	8
3	15	8	8	8	8
4	15	4	8	8	8

Table 3(d): Summary of gain factor setting in R&S®CMU200

Configuration in R&S®CMU200:
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → βc → 2 (subtest 1), 11 (subtest 2) or 15 (subtest 3 and 4)
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → βd → 15 (subtest 1 and 2), 8 (subtest 3) or 4 (subtest 4)
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → ΔACK → 8
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → ΔNACK → 8
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → ΔCQI → 8 (subtest 1, 2, 3 and 4 of all clauses except clauses 5.2C, 5.7A, 5.13.1A and 5.13.1AA) or 7 (subtest 1, 2, 3 and 4 in clauses 5.2C, 5.7A, 5.13.1A and 5.13.1AA)

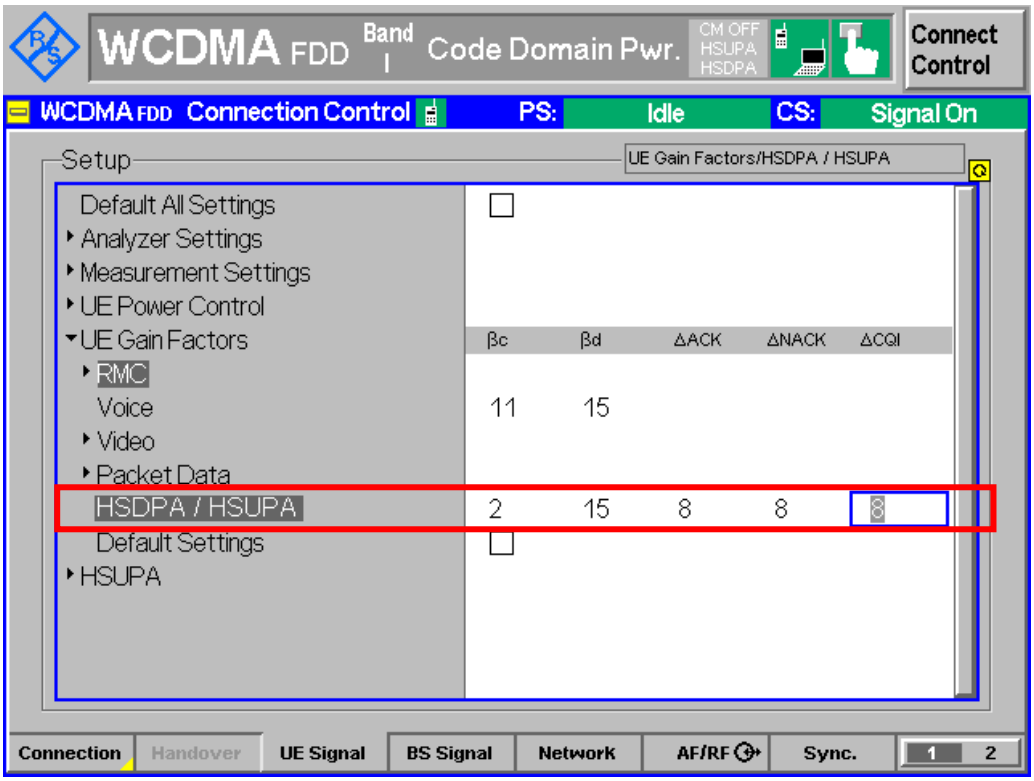


Figure 4: β values for transmitter characteristics tests with HS-DPCCH configuration

All parameters of transmitter characteristics in this application note are defined using Fixed Reference Channel (FRC H-Set 1, QPSK version or 16QAM version) as specified in Table 4 unless stated otherwise. Table 4 shows the definition for Fixed Reference Channel H-Set 1.

Fixed Reference Channel H-Set 1			
Parameter	**Unit**	**Value**	
Nominal Avg. Inf. Bit Rate	kbps	534	777
Inter-TTI Distance	TTI's	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 Code Blocks	Blocks	1	1
Binary Channel Bits Per TTI	Bits	4800	7680
Total Available SML's in UE	SML's	19200	19200
Number of SML's per HARQ Proc.	SML's	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 continuous 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 in R&S®CMU200:

BS Signal → HSDPA HS-DSCH → Channel Configuration Type → Fixed Reference Channel

BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 1 QPSK or H-Set 116QAM

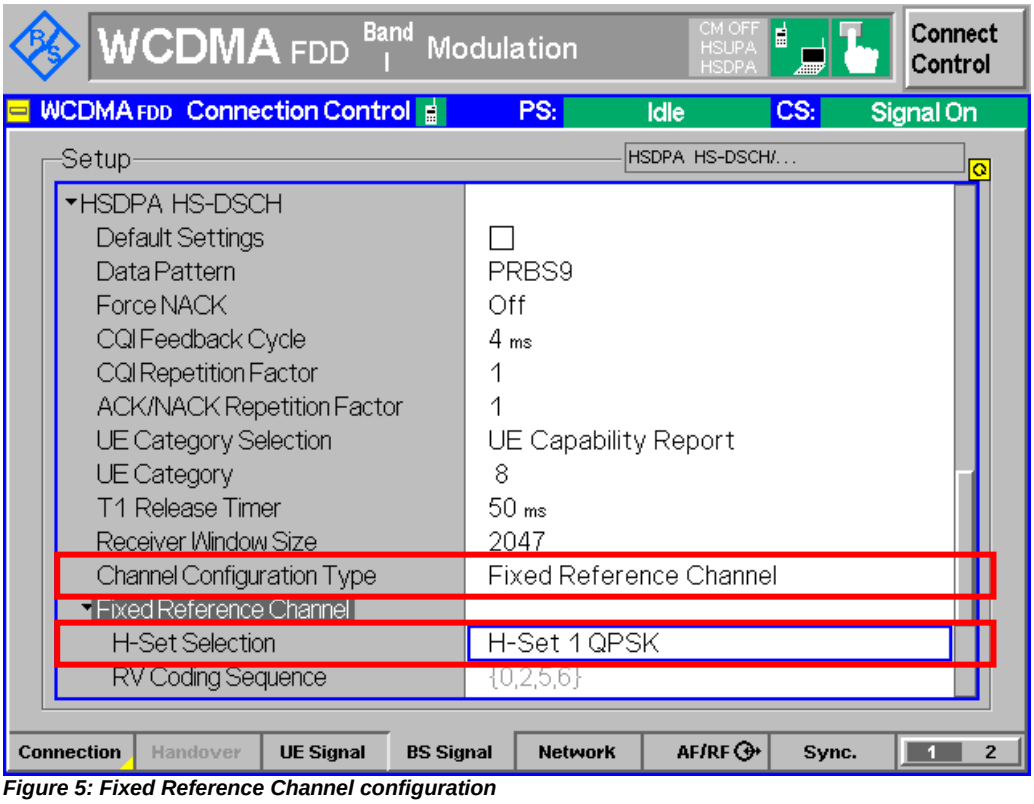


Figure 5: Fixed Reference Channel configuration

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, 9.2.1A to 9.2.1G, 9.3.1 (HSDPA categories 1-8, 11 and 12), 9.3.2, 9.5.1 and 9.5.1A as specified in Table E.5.1 of TS 34.121 [1].

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

Notes:
1. Power split between P- and S-SCH.
2. 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.
3. No signalling scheduled, or power radiated, on this HS-SCCH, but signalled 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 downlinks physical channels for transmitter characteristics with HS-DPCCH in subclauses 5.2A, 5.2AA, 5.2C, 5.7A, 5.9A, 5.10A, 5.13.1A, 5.13.1AA and 5.13.2A as specified in Table E.5.10 of TS 34.121 [1].

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

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

Configuration in R&S®CMU200:

BS Signal → Node-B Settings → Level Reference → Output Channel Power (Ior)
BS Signal → Downlink Physical Channels → P-CPICH → -10.0 dB
BS Signal → Downlink Physical Channels → P-CCPCH → -12.0 dB
BS Signal → Downlink Physical Channels → P-SCH → -15.0 dB
BS Signal → Downlink Physical Channels → S-SCH → -15.0 dB
BS Signal → Downlink Physical Channels → PICH → -15.0 dB
BS Signal → Downlink Physical Channels → DPDCH Level Config → -9.0 dB
BS Signal → Downlink Physical Channels → HSDPA Channels → On
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#1 → Level → -8.0 dB
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#2 → Level → Off
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#3 → Level → Off
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#4 → Level → Off
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH Selection → 1
BS Signal → Downlink Physical Channels → HS-SCCH → Number of HS-SCCH → 4
BS Signal → Downlink Physical Channels → HS-SCCH → Unscheduled Subframes → Transmit Dummy UEID
BS Signal → Downlink Physical Channels → HS-PDSCH → Level (All Active Codes) → -3.0 dB

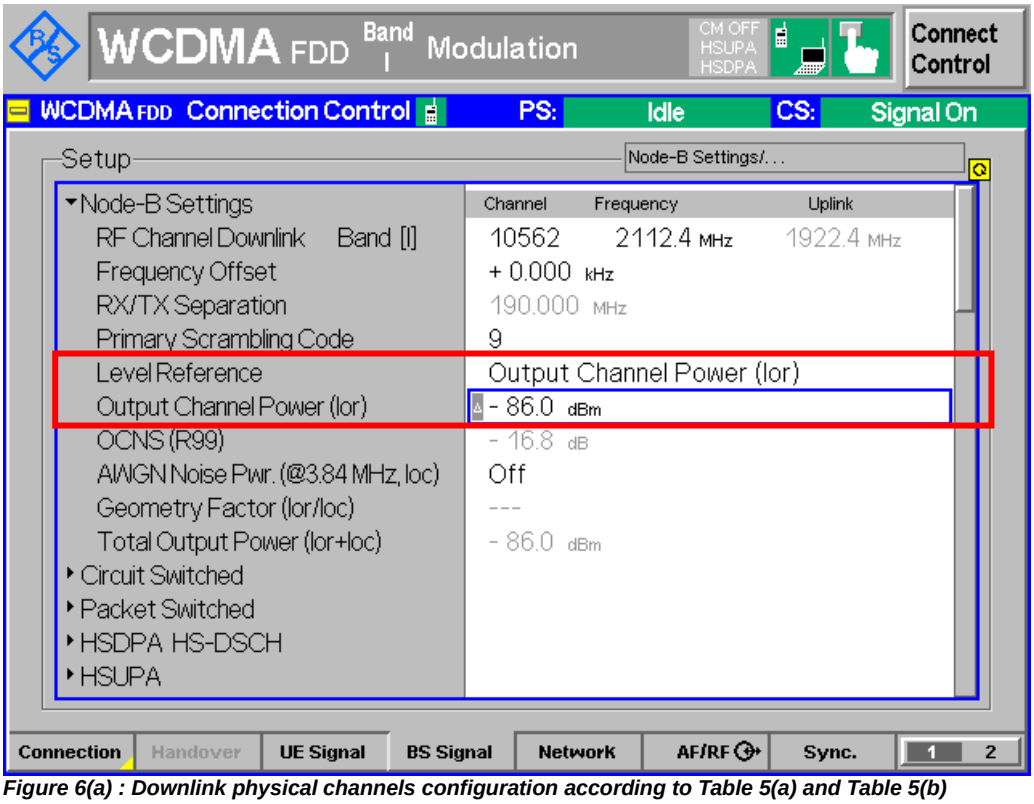


Figure 6(a) : Downlink physical channels configuration according to Table 5(a) and Table 5(b)

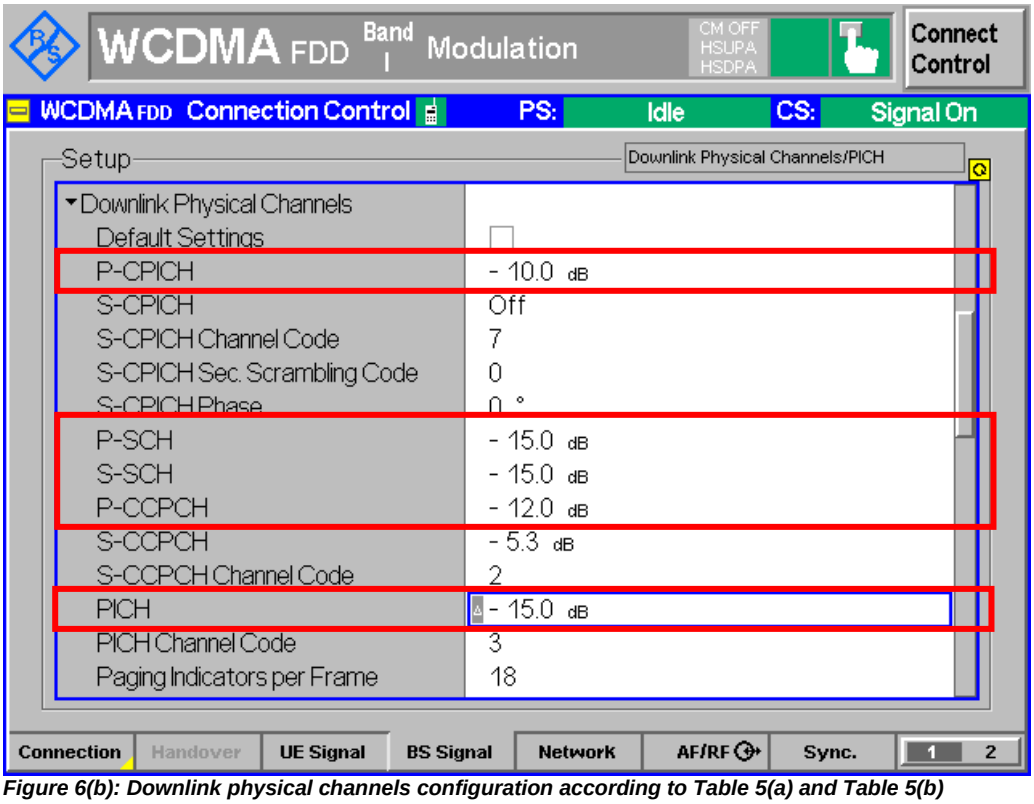


Figure 6(b): Downlink physical channels configuration according to Table 5(a) and Table 5(b)

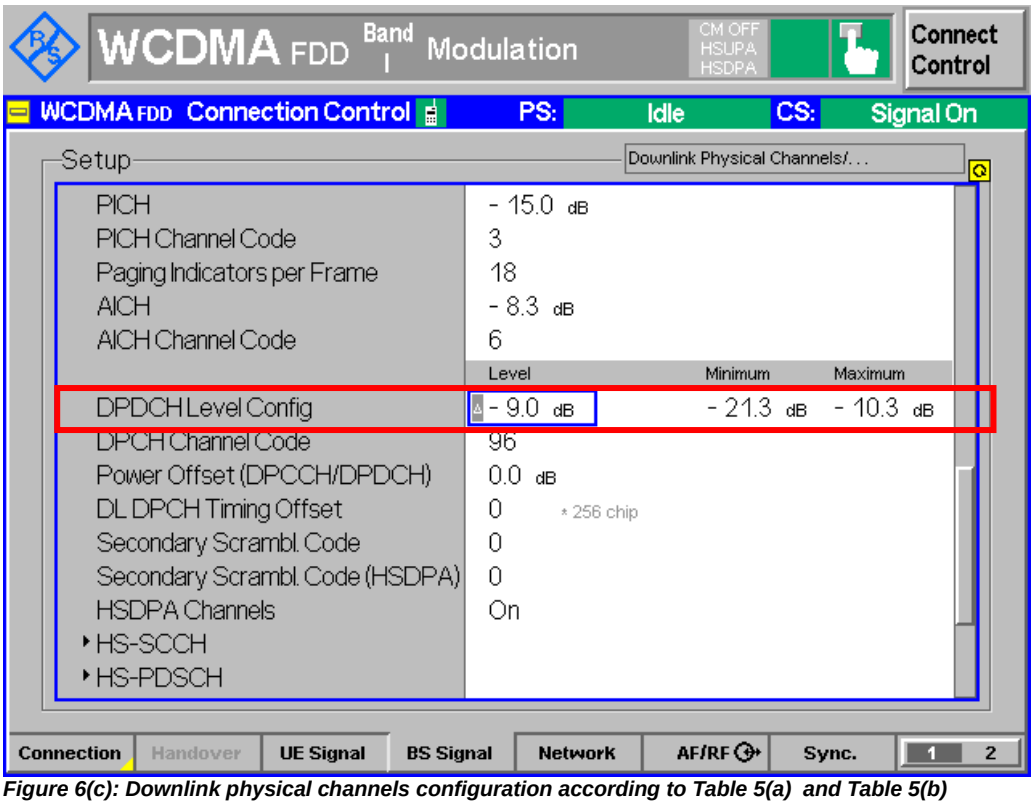


Figure 6(c): Downlink physical channels configuration according to Table 5(a) and Table 5(b)

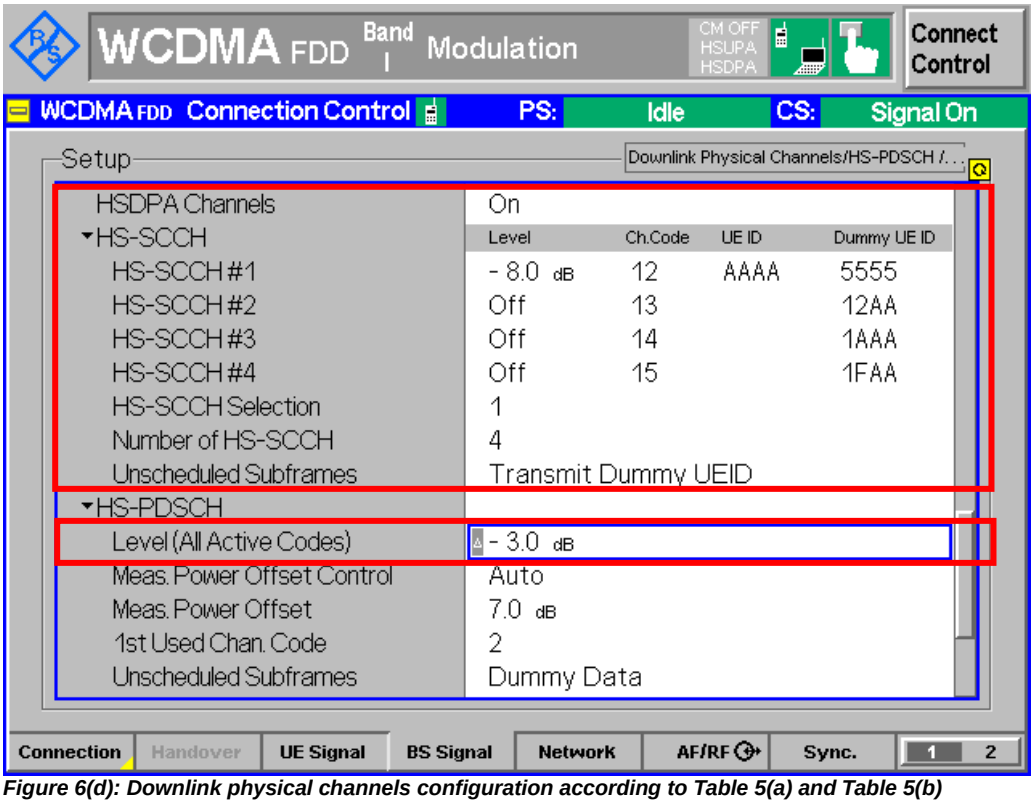


Figure 6(d): Downlink physical channels configuration according to Table 5(a) and Table 5(b)

Table 6 shows the settings for serving cell.

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

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

Configuration in R&S®CMU200:
Network → Cell Reselection Information → Qqualmin → - 24 dB
*Network → Cell Reselection Information → Qrxlevmin → - 58 dBm * 2 + 1*
UE Signal → UE Power Control → Open Loop → Max Allowed UE Power → 21.0 dBm
BS Signal → Node-B Settings → Output Channel Power (Ior) → -86 dBm

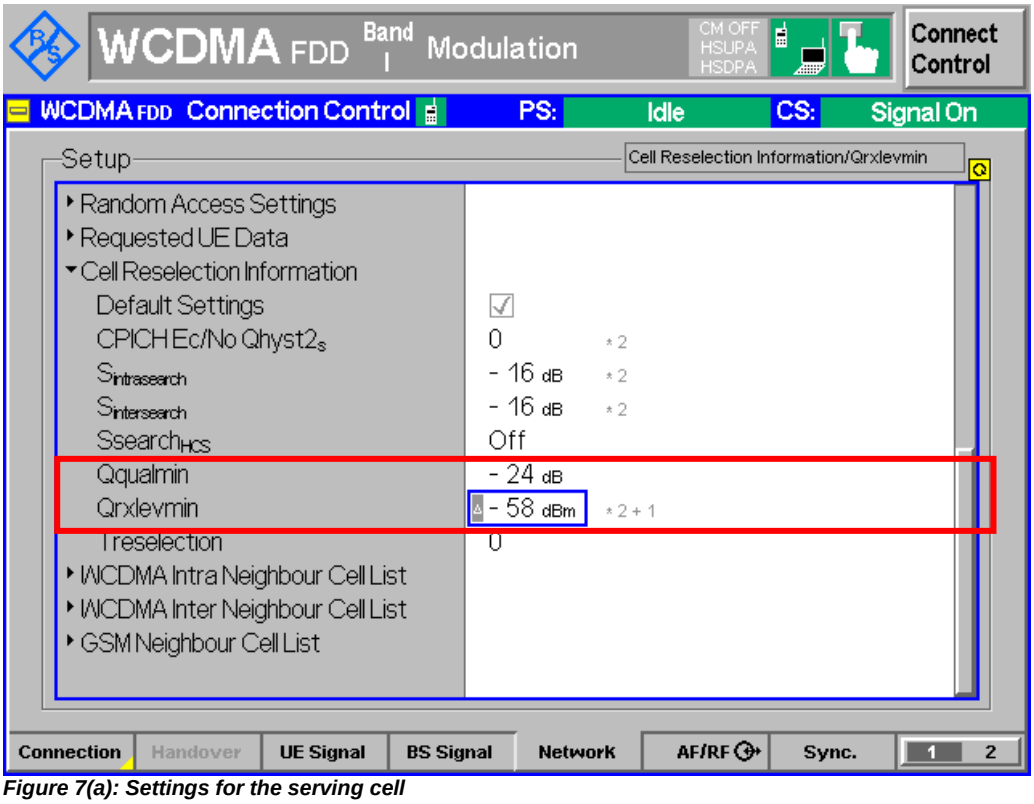


Figure 7(a): Settings for the serving cell

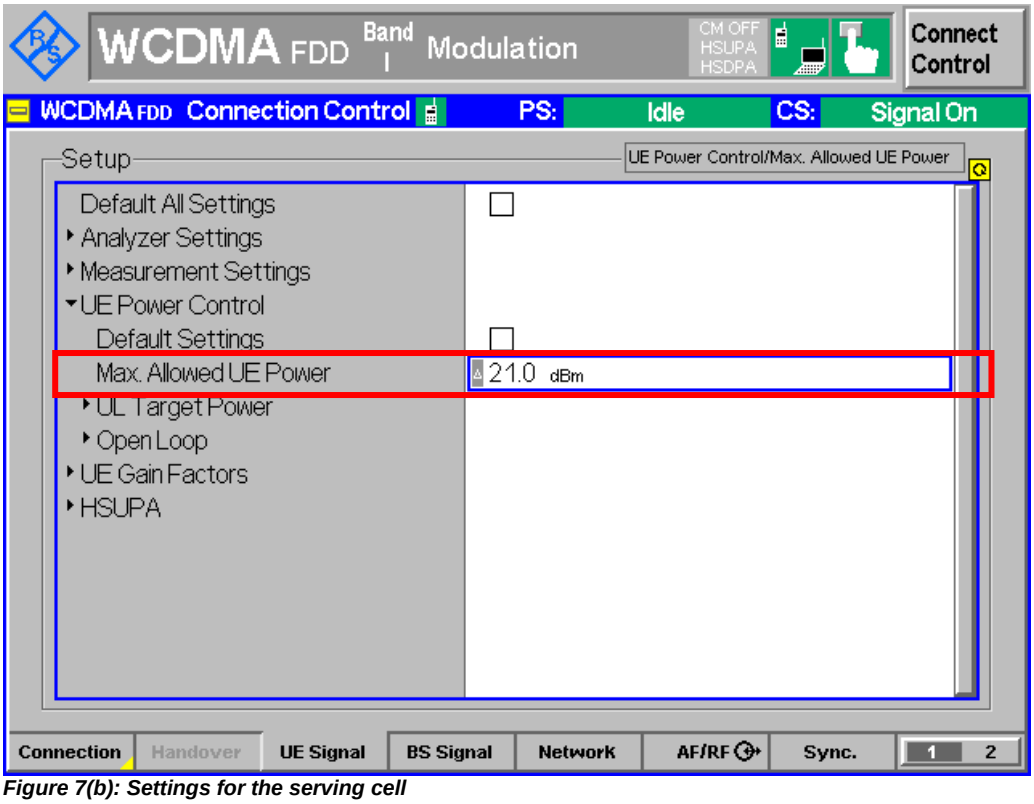


Figure 7(b): Settings for the serving cell

It is recommended to use HS-DPCCH trigger to guarantee the measurement period contains at least a partially transmitted HS-DPCCH.

Configuration in R&S®CMU200:
Trigger → Meas. Trigger → Source → HSDPCCH

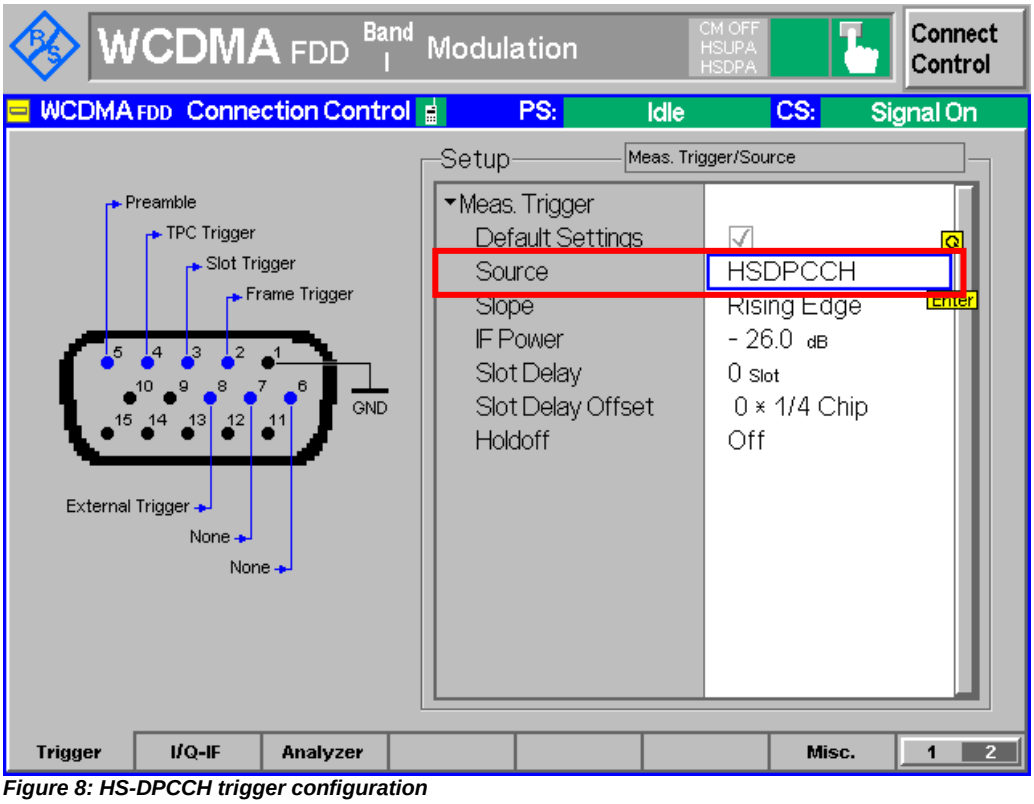


Figure 8: HS-DPCCH trigger configuration

A HSDPA call is setup according to TS 34.108 [2] subclause 7.3.6. To establish a HSDPA connection, press 'Connect UE (CS)' on R&S®CMU200 once UE has registered and attached with R&S®CMU200.

For subtest 1, recall HSDPATx1.sav and establish CS call.

For subtest 2, recall HSDPATx2.sav and establish CS call.

For subtest 3, recall HSDPATx3.sav and establish CS call.

For subtest 4, recall HSDPATx4.sav and establish CS call.

Note: With 12.2 kbps + HSDPA 34.108 reference channel, packet switched connection is setup automatically after the circuit switched connection so that the R&S®CMU200 reaches the signaling state PS: Established, CS: Connected.

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

The maximum output power with HS-DPCCH measures the maximum power the UE can transmit when HS-DPCCH is fully or partially transmitted during a DPCCH timeslot. The measurement period shall be at least one timeslot. An excess maximum output power may interfere other channels or other systems. A small maximum output power decreases the coverage area. Table 7 shows the test requirements for maximum output power with HS-DPCCH. The maximum output power, where HS-DPCCH is not transmitted, shall not exceed the tolerance prescribed in Rel-99 maximum output power. This test applies to all FDD UE of Release 5 that support HSDPA.

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

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

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

Downlink physical channels, subtest 1, serving cell and HS-DPCCH trigger are configured in R&S®CMU200 as specifed in section 2.1. Fixed Reference Channel (FRC H-Set 1, QPSK version) as shown in Figure 5 is configured in R&S®CMU200.

A HSDPA call is established. Continuous UP power control command is sent to the UE and the mean power of the UE is measured. The mean power shall be averaged over at least one timeslot. In R&S®CMU200, continuous UP power control command is automatically configured when user select *Maximum Power* measurement in R&S®CMU200.

The maximum output power with HS-DPCCH is repeated with different combinations of β values as shown in Table 3(a).

Measurement result for maximum output power with HS-DPCCH is available in *Maximum Power* in R&S®CMU200.

Configuration in R&S®CMU200:
Menus → Power → Application → Maximum Power

Figure 9 shows the maximum output power measurement result.

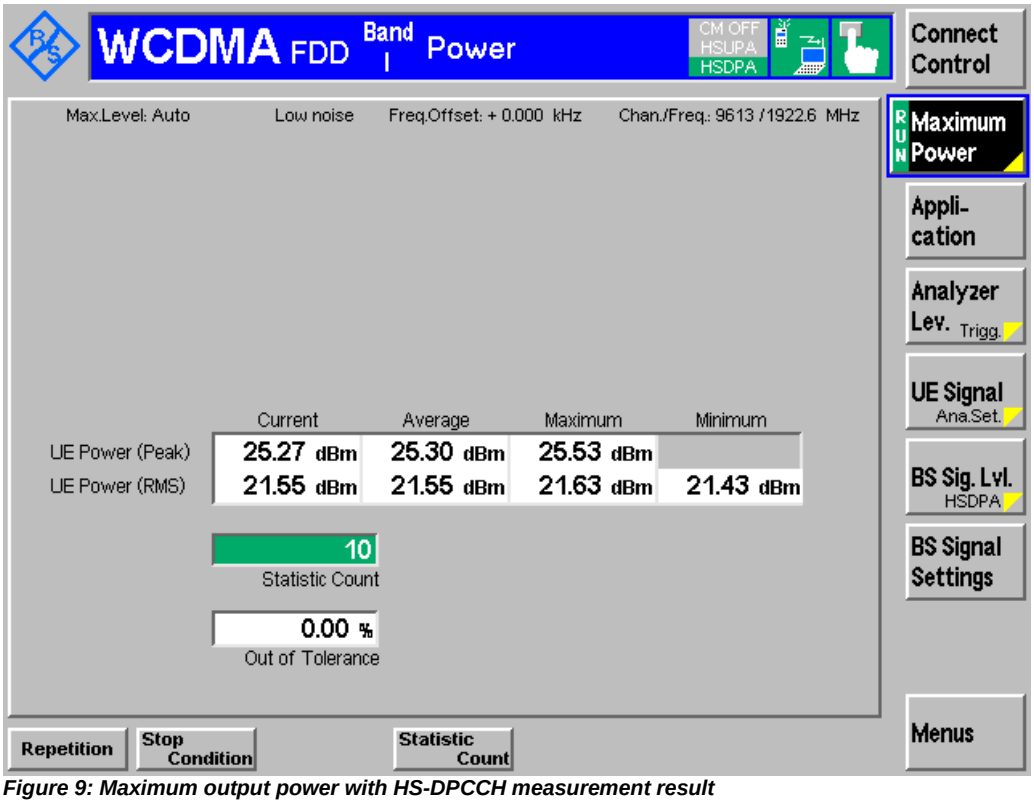


Figure 9: Maximum output power with HS-DPCCH measurement result

For subtest 1, recall HSDPATx1.sav and establish CS call.

For subtest 2, recall HSDPATx2.sav and establish CS call.

For subtest 3, recall HSDPATx3.sav and establish CS call.

For subtest 4, recall HSDPATx4.sav and establish CS call.

The measurement result is available at:
Menus → Power → Application → Maximum Power

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

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

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

Downlink physical channels, subtest 1, serving cell and HS-DPCCH trigger are configured in R&S®CMU200 as specified in section 2.1. Fixed Reference Channel (FRC H-Set 1, QPSK version) as shown in Figure 5 is configured in R&S®CMU200.

A HSDPA call is established. Continuously UP power control commands is sent to the UE. In R&S®CMU200, continuously UP power control commands is automatically configured when user select *Maximum Power* measurement in R&S®CMU200.

The maximum output power with HS-DPCCH is repeated with different combination of β values as shown in Table 3(a) and Fixed Reference Channels (FRC H-Set 1, 16QAM version). Different β values and Fixed Reference Channels can be configured in R&S®CMU200 by referring to Figure 4 and 5 respectively.

Measurement result for maximum output power with HS-DPCCH is available in *Maximum Power* in R&S®CMU200.

Configuration in R&S®CMU200:
Menus → Power → Application → Maximum Power

Figure 9 shows the maximum output power measurement result.

For subtest 1 with FRC H-Set 1, QPSK version, recall HSDPATx1.sav and establish CS call.
Repeat the test with FRC H-Set 1, 16QAM version by modifying the following configuration:
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 1 16QAM

For subtest 2 with FRC H-Set 1, QPSK version, recall HSDPATx2.sav and establish CS call.
Repeat the test with FRC H-Set 1, 16QAM version by modifying the following configuration:
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 1 16QAM

For subtest 3 with FRC H-Set 1, QPSK version, recall HSDPATx3.sav and establish CS call.
Repeat the test with FRC H-Set 1, 16QAM version by modifying the following configuration:
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 1 16QAM

For subtest 4 with FRC H-Set 1, QPSK version, recall HSDPATx4.sav and establish CS call.
Repeat the test with FRC H-Set 1, 16QAM version by modifying the following configuration:
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 1 16QAM

The measurement result is available at:
Menus → Power → Application → Maximum Power

2.4 UE Relative Code Domain Power Accuracy (5.2C)

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

UE Relative CDP accuracy = (Measured CDP ratio) – (Nominal CDP ratio)
where

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

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

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

Figure 10 shows the 12 ms transmit power profile. The relative code domain power of each active code is measured at the measurement points specified in Figure 10. Each measurement is 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 shall not be included.

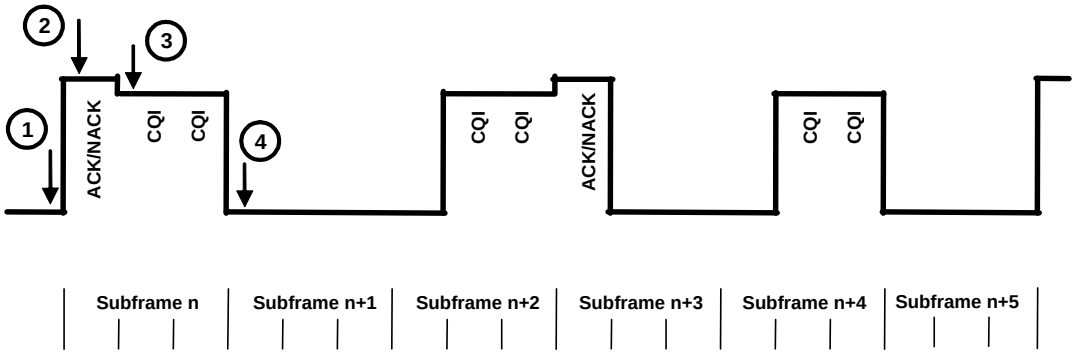


Figure 10: Transmit power profile showing measurement points (Figure 5.2C.1 of TS 34.121 [1])

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.

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

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

UE relative code domain power accuracy test requirements	
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: UE relative code domain power accuracy test requirements (Table 5.2C.4 of TS 34.121 [1])

Downlink physical channels, serving cell and HS-DPCCH trigger are configured in R&S®CMU200 as specified in section 2.1. Fixed Reference Channel (FRC H-Set 1, QPSK version) as shown in Figure 5 is configured in R&S®CMU200.

βc and βd for subtest 1 are configured as shown in Figure 4. ΔACK and ΔNACK = 30/15 with β_{HS} = 30/15 *βc, and ΔCQI = 24/15 with β_{HS} = 24/15 * βc for all subtests. ΔACK, ΔNACK and ΔCQI are configured in R&S®CMU200 by referring to Figure 4.

Configuration in R&S®CMU200:
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → ΔACK → 8
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → ΔNACK → 8
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → ΔCQI → 7

UE is configued into loopback test mode 1 in the presence of HSDPA. The DPCH frame offset is configured according to the HS-DPCCH half slot offset to create a signal with a repeat pattern of 12 ms. Table 11 shows the TRANSPORT CHANNEL RECONFIGURATION message specific content for this test.

Specific message contents

Information Element	Value/remark
- Ack-Nack repetition factor	1
- CQI repetition factor	1

Table 11: Specific message contents (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 R&S®CMU200:
BS Signal → Packet Switched → HSDPA Test Mode → RMC Test Loop → Loop Mode 1 RLC TM
*BS Signal → Downlink Physical Channels → DL DPCH Timing Offset → 6 * 256 chip*
BS Signal → HSDPA HS-DSCH → CQI Feedback Cycle → 4 ms
BS Signal → HSDPA HS-DSCH → CQI Repetition Factor → 1
BS Signal → HSDPA HS-DSCH → ACK/NACK Repetition Factor → 1

DL DPCH timing offset and TRANSPORT CHANNEL RECONFIGURATION can be configured as shown in Figure 3 and by referring to Figure 2.

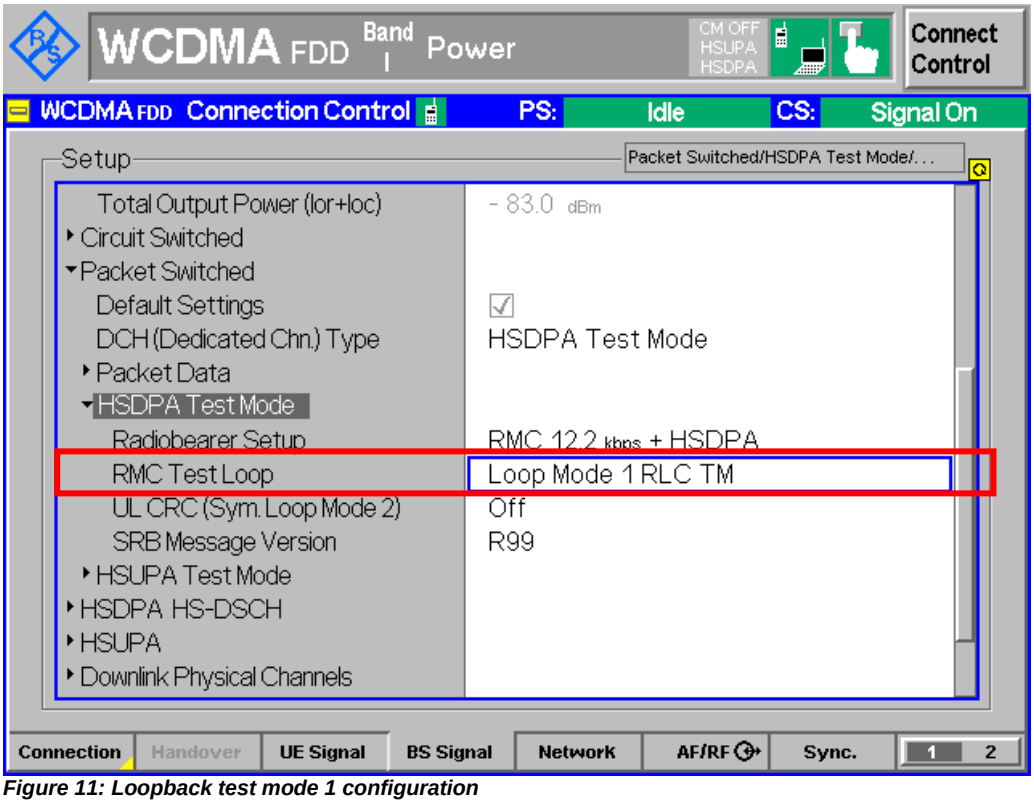


Figure 11: Loopback test mode 1 configuration

A HSDPA call is established. Algorithm 2 is configured to interpret TPC commands. Output power of the UE, measured at the UE antenna connector, when the HS-DPCCH is not transmitted, is configured to be in the range 0 dBm ± 2 dB. This is a nominal setting and not part of the test requirements. Alternating “0” and “1” TPC commands are configured in the downlink to satisfy TPC_cmd = 0.

Configuration in R&S®CMU200 for TPC_cmd = 0:
BS Signal Settings → TPC Pattern Config. → TPC Algorithm → Algorithm 2

BS Signal Settings → TPC Pattern Config. → TPC Pattern Set → Set 1
BS Signal Settings → Set 1 → Pattern Type → Closed Loop
BS Signal Settings → Set 1 → UL Target Power → 0 dBm
BS Signal Settings → Set 1 → Pattern Type → Alternating 0, 1

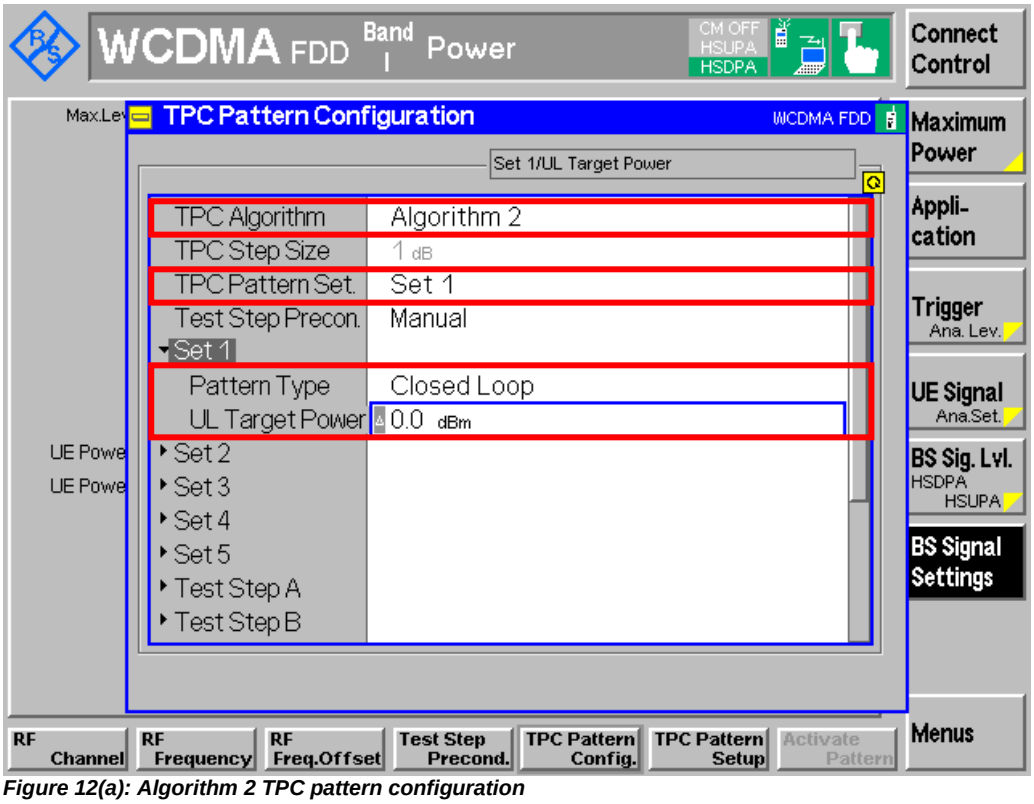


Figure 12(a): Algorithm 2 TPC pattern configuration

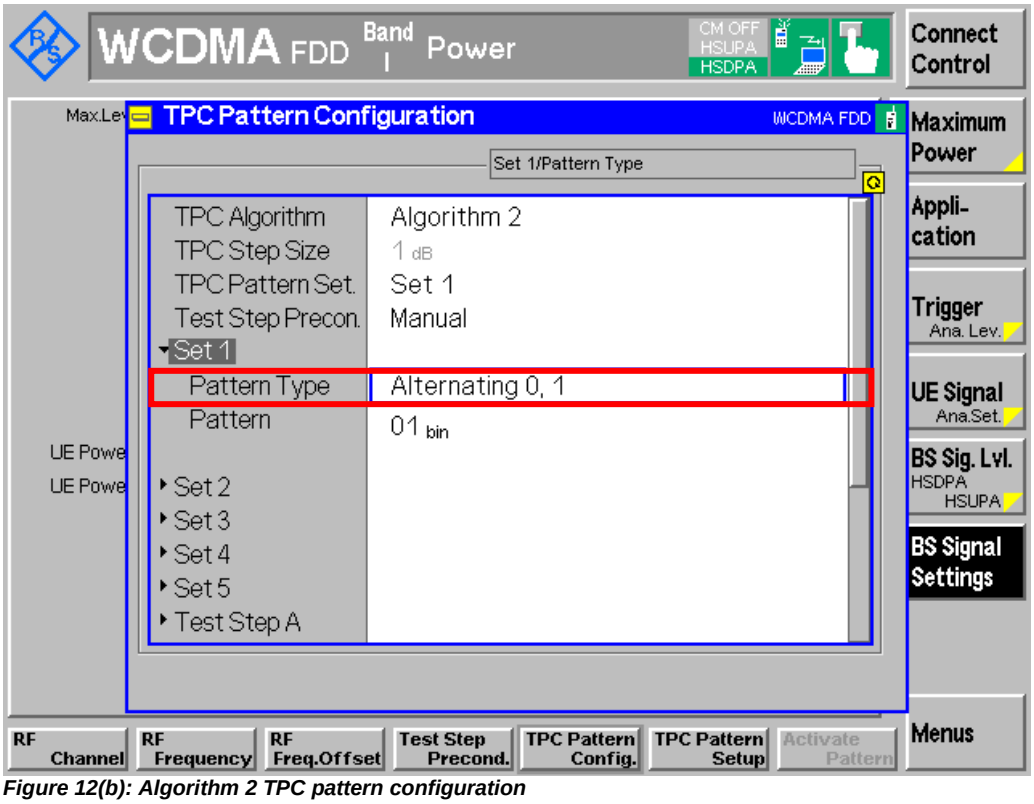


Figure 12(b): Algorithm 2 TPC pattern configuration

Transmission of HSDPA data is started. The UE relative code domain power accuracy is repeated with different combination of βc and βd values as shown in Table 3(a). Depending on the values of gain factors, measurement threshold may require adjustment. Measurement threshold of -1 dB and -20 dB is recommended for subtest 1 and 4 respectively.

Configuration in R&S®CMU200:
UE Signal → Measurement Settings → Threshold → -1 dB (subtest 1), -10 dB (subtest 2 and 3) or -20 dB (subtest 4)

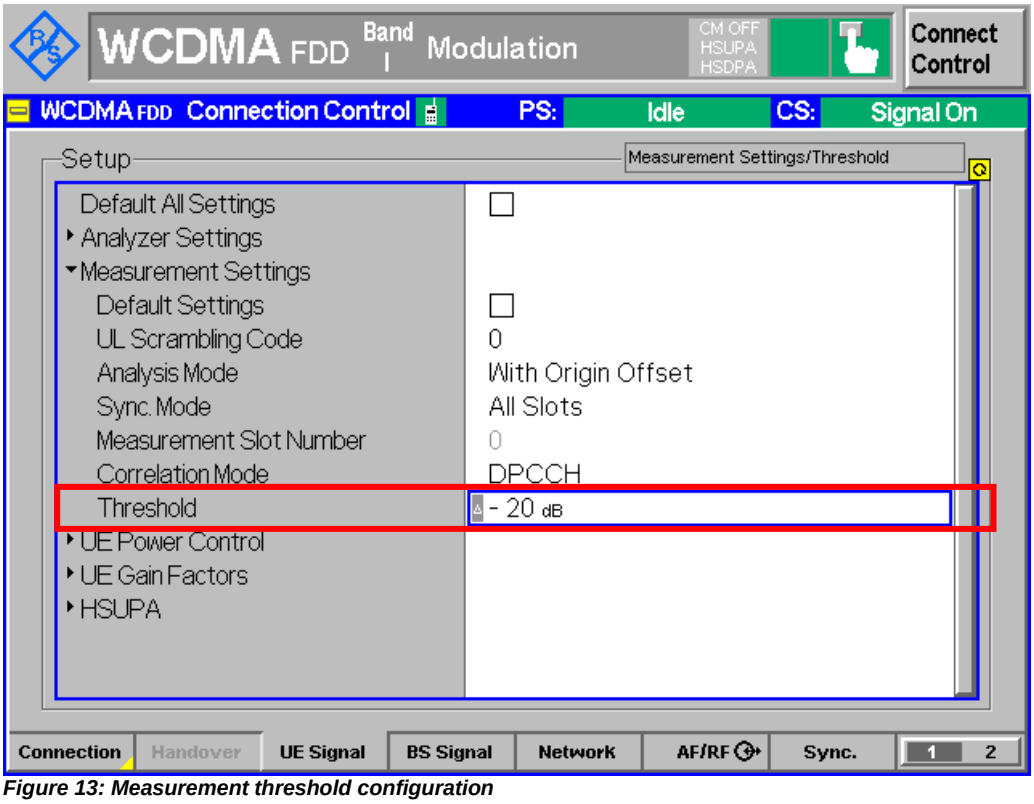


Figure 13: Measurement threshold configuration

Measurement result for UE relative code domain power accuracy is available in *CDP/Relative* in R&S®CMU200.

Configuration in R&S®CMU200:
Menus → Code Dom. Power → Applic. 1 → CDP/Relative

Figure 14(a) shows the UE relative code domain power accuracy measurement result.

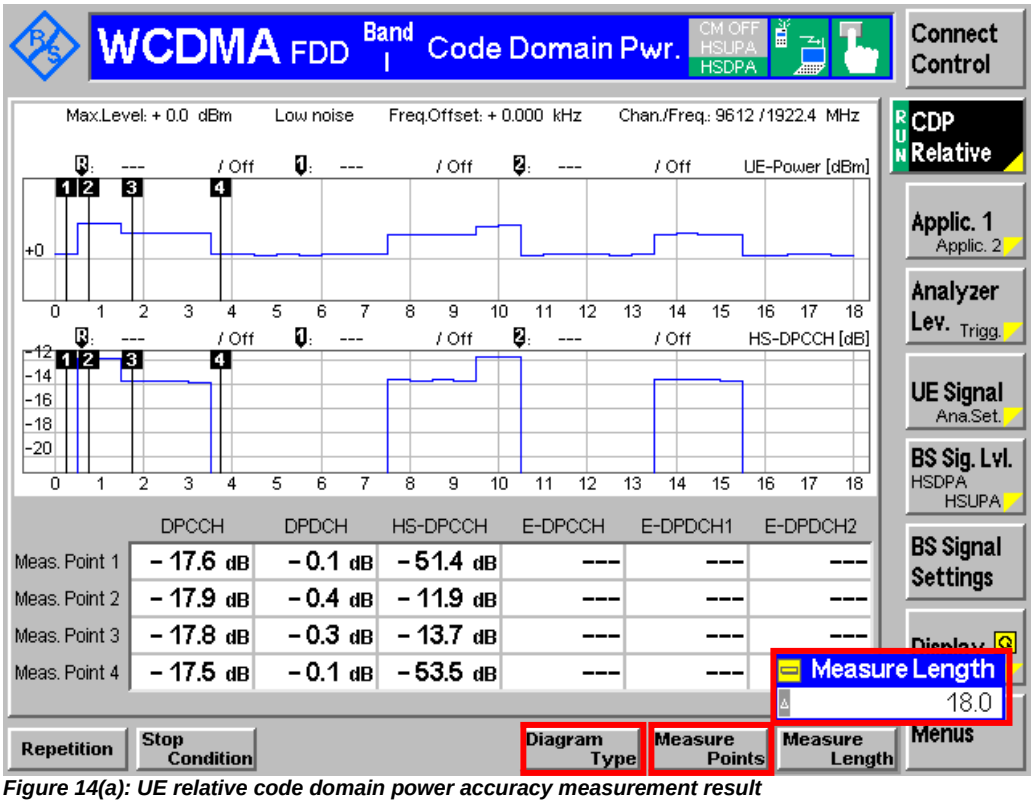


Figure 14(a): UE relative code domain power accuracy measurement result

The number of symbols displayed in the graph can be configured by changing the *Measure Length* in R&S®CMU200 as shown in Figure 14(a).

Configuration in R&S®CMU200:
Menus → Code Dom. Power → Applic. 1 → CDP/Relative
CDP Relative → 18.0

Position of the measurement points can be configured by changing the *Measure Points* in R&S®CMU200.

Configuration in R&S®CMU200:
Menus → Code Dom. Power → Applic. 1 → CDP/Relative
CDP/Relative → Measure Points → Measure Point 1 → 0.0
CDP/Relative → Measure Points → Measure Point 2 → 0.5
CDP/Relative → Measure Points → Measure Point 3 → 1.5
CDP/Relative → Measure Points → Measure Point 4 → 3.5

The upper diagram of the measurement result shows the UE-Power, which matches transmit power profile in Figure 10. The lower diagram can display either DPCCH, DPDCH1 or HS-DPCCH by changing *Diagram Type*.

Configuration in R&S®CMU200:
Menus → Code Dom. Power → Applic. 1 → CDP/Relative
Diagram Type → DPCCH, DPDCH1 or HS-DPCCH

The span of X and Y scale of both diagrams can be configured by changing the Scale X and Scale Y in R&S®CMU200 as shown in Figure 14(b).

Configuration in R&S®CMU200:
Display → UE-Power Scale Y → 1 dBm (subtest 1) or 10 dBm (subtest 2, 3 and 4)
Display → HS-DPCCH Scale Y → 10 dB
Display → UE-Power Scale X → Start → 0
Display → UE-Power Scale X → Span → 18
Display → HS-DPCCH Scale X → Start → 0
Display → HS-DPCCH Scale X → Span → 18

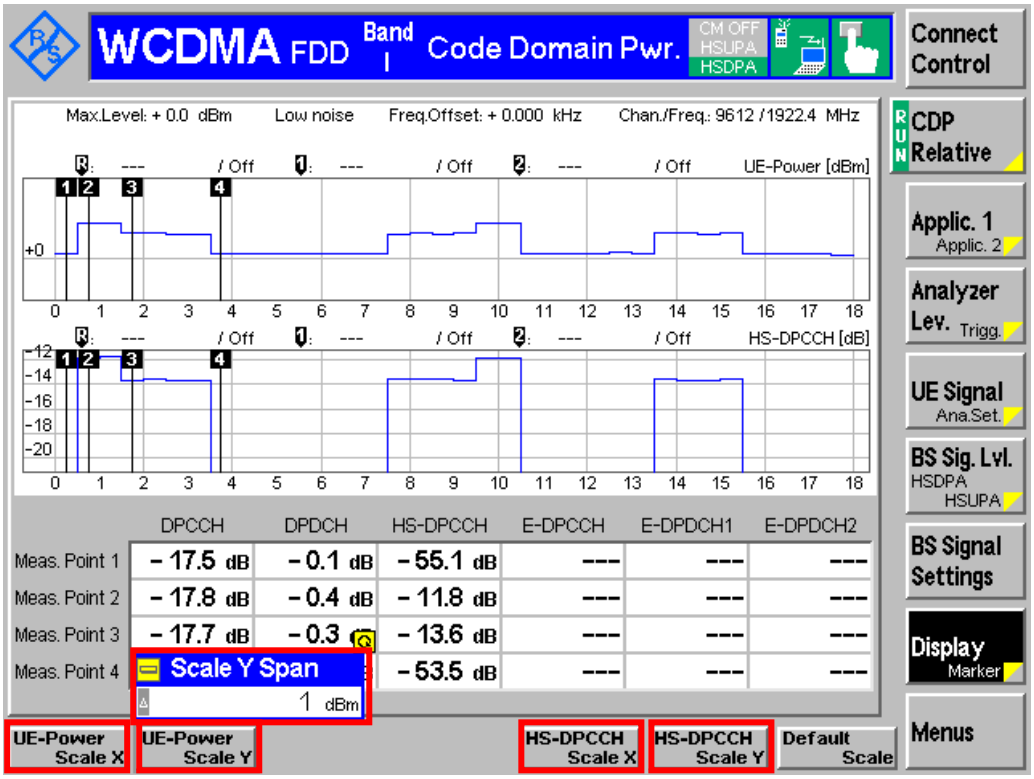
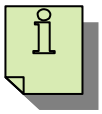


Figure 14(b): Span of X and Y scale configuration



For subtest 1 with FRC H-Set 1, QPSK version, recall HSDPATx1.sav, modify the following configurations and establish CS call.
BS Signal → Downlink Physical Channels → DL DPCH Timing Offset → 6 * 256 chip
BS Signal → HSDPA HS-DSCH → CQI Feedback Cycle → 4 ms
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → ΔCQI → 7
UE Signal → Measurement Settings → Threshold → -1 dB

For subtest 2 with FRC H-Set 1, QPSK version, recall HSDPATx2.sav, modify the following configurations and establish CS call.
BS Signal → Downlink Physical Channels → DL DPCH Timing Offset → 6 * 256 chip
BS Signal → HSDPA HS-DSCH → CQI Feedback Cycle → 4 ms
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → ΔCQI → 7

For subtest 3 with FRC H-Set 1, QPSK version, recall HSDPATx3.sav, modify the following configurations and establish CS call.
BS Signal → Downlink Physical Channels → DL DPCH Timing Offset → 6 * 256 chip
BS Signal → HSDPA HS-DSCH → CQI Feedback Cycle → 4 ms
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → ΔCQI → 7

For subtest 4 with FRC H-Set 1, QPSK version, recall HSDPATx4.sav, modify the following configurations and establish CS call.
BS Signal → Downlink Physical Channels → DL DPCH Timing Offset → 6 * 256 chip
BS Signal → HSDPA HS-DSCH → CQI Feedback Cycle → 4 ms
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → ΔCQI → 7
UE Signal → Measurement Settings → Threshold → -20 dB

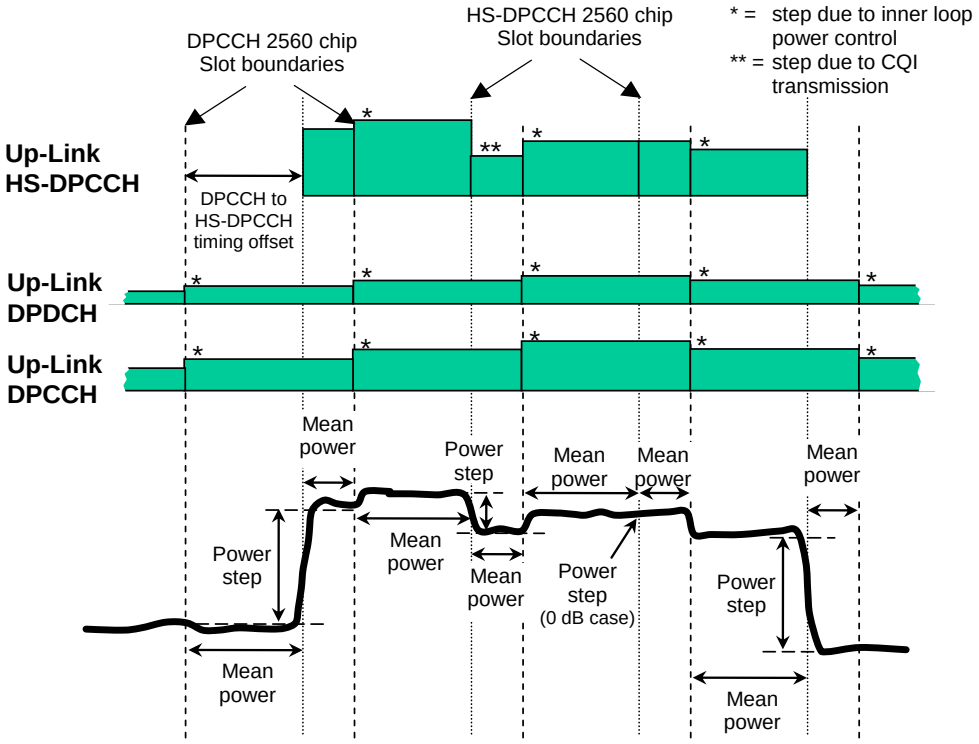
The TPC setting is available at:
BS Signal Settings → TPC Pattern Setup → Set 2 (closed loop), Set 3 (Alternating 0, 1)

The measurement result is available at:
Menus → Code Dom. Power → Applic. 1 → CDP/Relative Diagram Type → DPCCH, DPDCH1 or HS-DPCCH

2.5 HS-DPCCH Power Control (5.7A)

The transmission of ACK/NACK or CQI over the HS-DPCCH may cause the UE output power varies 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]. 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 FDD UE of Release 5 and 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 integer values 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.

Figure 15: Transmit power template during HS-DPCCH transmission (Figure 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 either side of an HS-DPCCH boundary. The first evaluation period starts 25 µs after a DPCCH slot boundary and ends 25 µs before the following HS-DPCCH slot boundary. The second evaluation period starts 25 µs after the same HS-DPCCH slot boundary and ends 25 µs before the following DPCCH slot boundary.

This test verifies the changes in uplink transmit power when transmitting the HS-DPCCH (ACK/NACK and CQI) and the power between HS-DPCCH transmissions are within the allowed power step tolerances as shown in Table 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).

Figure 16 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 Figure 16. The 25 µs transient periods at the end of each half slot period shall not 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 Figure 16. The power steps shall meet the test requirements in Table 12.

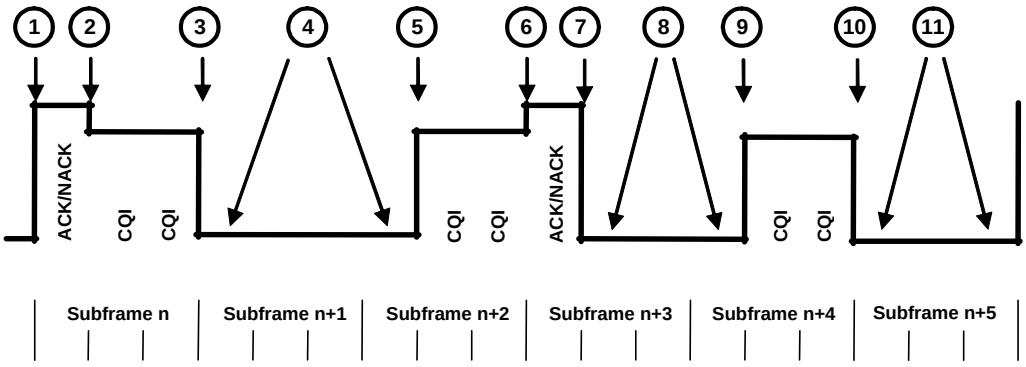


Figure 16: Transmit power template below max power with TPC_cmd = 0 (Figure 5.7A.2 of TS 34.121 [1])

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

* Two test points

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

Figure 17 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 Figure 17. The 25 µs transient periods at the end of each half slot period shall not 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 making the test requirement very wide. The difference in mean power is evaluated to

determine the power steps around the measurement points as shown in Figure 17. The transmitter power steps shall meet the test requirements in Table 13.

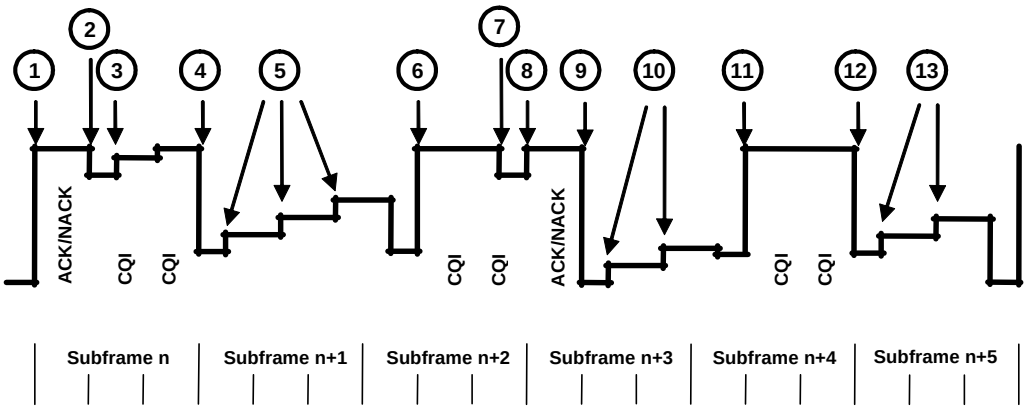


Figure 17: Transmit power template at max power with TPC_cmd = 1 (Figure 5.7A.3 of TS 34.121 [1])

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

Notes:
1. Three test points.
2. Two test points.
3. In these test points, Rel-6 UE performs additional power scaling due to changes in allowed MPR, and 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])

Downlink physical channels, subtest 3, serving cell and HS-DPCCH trigger are configured in R&S®CMU200 as specified in section 2.1. Fixed Reference Channel (FRC H-Set 1, QPSK version) as shown in Figure 5 is configured in R&S®CMU200.

βc and βd for subtest 3 are configured by referring to Figure 4. ΔACK and ΔNACK = 30/15 with β_{HS} = 30/15 *βc, and ΔCQI = 24/15 with β_{HS} = 24/15 * βc for this test. ΔACK, ΔNACK and ΔCQI are configured in R&S®CMU200 by referring to Figure 4.

Configuration in R&S®CMU200:
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → βc → 15
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → βd → 8
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → ΔACK → 8
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → ΔNACK → 8
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → ΔCQI → 7

UE is configued into loopback test mode 1 in the presence of HSDPA. The DPCH frame offset is configured according to the HS-DPCCH half slot offset to create a signal with a repeat pattern of 12 ms. Table 11 shows the TRANSPORT CHANNEL RECONFIGURATION message specific content for this test. These settings can be configured as shown in Figure 11 and 3 and by referring to Figure 2.

Configuration in R&S®CMU200:
BS Signal → Packet Switched → HSDPA Test Mode → RMC Test Loop → Loop Mode 1 RLC TM
*BS Signal → Downlink Physical Channels → DL DPCH Timing Offset → 6 * 256 chip*
BS Signal → HSDPA HS-DSCH → CQI Feedback Cycle → 4 ms
BS Signal → HSDPA HS-DSCH → CQI Repetition Factor → 1
BS Signal → HSDPA HS-DSCH → ACK/NACK Repetition Factor → 1

A HSDPA call is established. Algorithm 2 is configured to interpret TPC commands. Output power of the UE, measured at the UE antenna connector, when the HS-DPCCH is not transmitted, is configured to be in the range 0 dBm ± 2 dB. This is a nominal setting and not part of the test requirements. These configurations are as shown in Figure 12(a). The transmitter power step is measured as shown in Figure 16 at TPC_cmd = 0.

Configuration in R&S®CMU200 for TPC_cmd = 0:
BS Signal Settings → TPC Pattern Config. → TPC Algorithm → Algorithm 2
BS Signal Settings → TPC Pattern Config. → TPC Pattern Set → Set 1
BS Signal Settings → Set 1 → Pattern Type → Closed Loop
BS Signal Settings → Set 1 → UL Target Power → 0 dBm

The HS-DPCCH power control measurement is repeated with maximum power. Algorithm 1 with 1 dB step size is configured to interpret TPC commands. Continuous UP power control commands are sent to the UE until the UE output power during HS-DPCCH ACK / NACK transmission reaches the maximum output power as specified in section 2.2. The transmitter power step is measured as shown in Figure 17 at TPC_cmd = 1.

Configuration in R&S®CMU200 for TPC_cmd = 1:
BS Signal Settings → TPC Pattern Config. → TPC Algorithm → Algorithm 1
BS Signal Settings → TPC Pattern Config. → TPC Step Size → 1 dB
BS Signal Settings → TPC Pattern Config. → TPC Pattern Set → Set 1
BS Signal Settings → Set 1 → Pattern Type → All 1

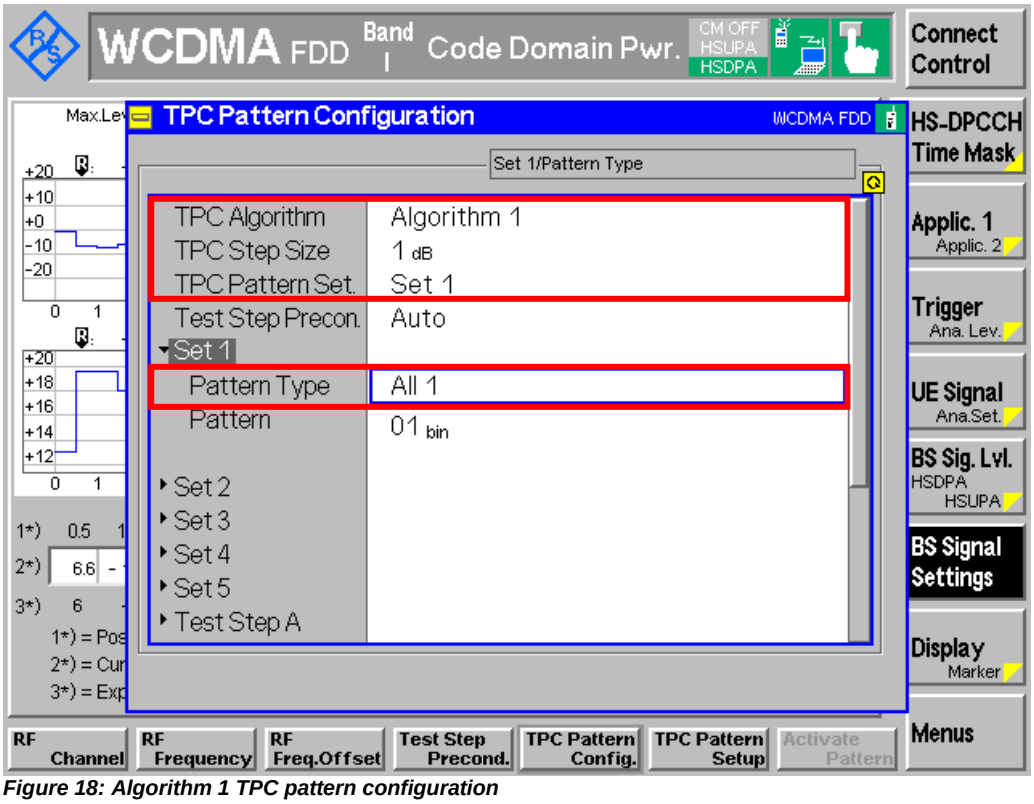


Figure 18: Algorithm 1 TPC pattern configuration

Measurement result for HS-DPCCH power control is available in *HS-DPCCH Time Mask* in R&S®CMU200.

Configuration in R&S®CMU200:
Menus → Code Dom. Power → Applic. 1 → HS-DPCCH Time Mask
HS-DPCCH Time Mask → Mode → Variant 2 (TPC_cmd = 0, constant power) or Variant 1 (TPC_cmd = 1, TPC bits "All 1")

Figure 19 shows the HS-DPCCH power control measurement result.

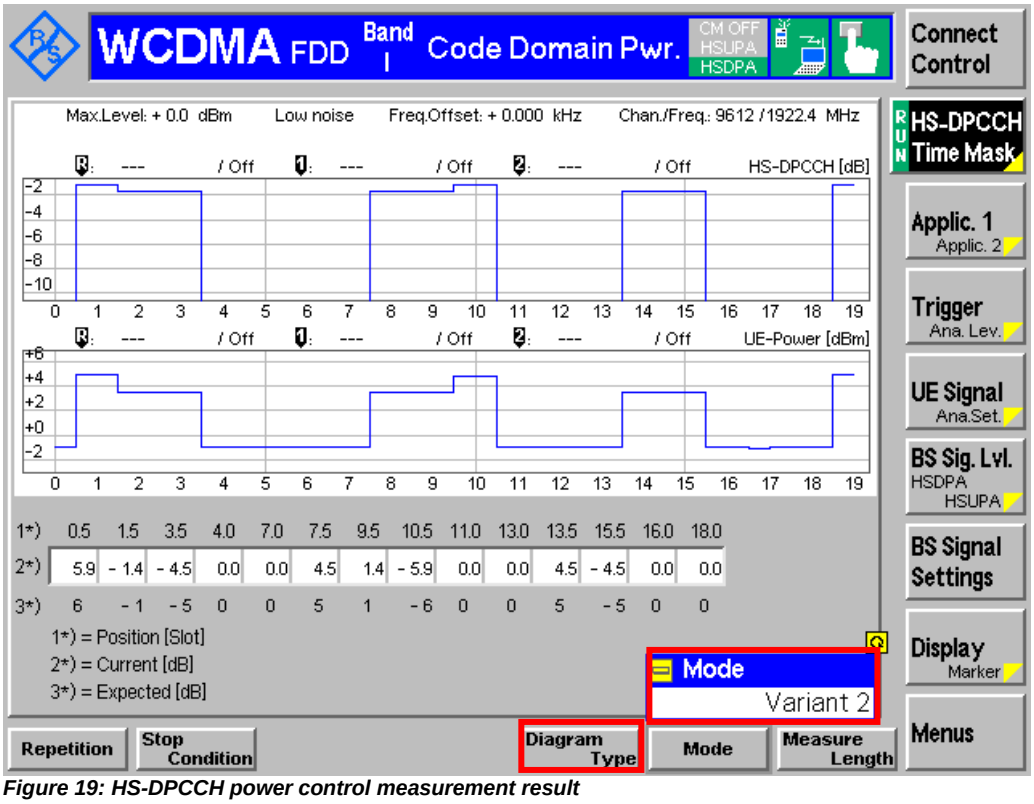


Figure 19: HS-DPCCH power control measurement result

The upper diagram can display either DPCCH, DPDCH1 or HS-DPCCH by changing the *Diagram Type*. The lower diagram displays UE-Power which matches transmit power profile in Figure 16 (TPC_cmd = 0) or Figure 17 (TPC_cmd = 1).

Configuration in R&S®CMU200:
Menus → Code Dom. Power → Applic. 1 → HS-DPCCH Time Mask
Diagram Type → DPCCH, DPDCH1 or HS-DPCCH

The span of X and Y scale of both diagrams can be configured by changing the *Scale X* and *Scale Y* in R&S®CMU200 by referring to Figure 14(b).

For transmit power template below max power with TPC_cmd = 0, recall HSDPATx3.sav, establish CS call and modify the following configurations.
BS Signal → Downlink Physical Channels → DL DPCH Timing Offset → 6 * 256 chip *BS Signal → HSDPA HS-DSCH → CQI Feedback Cycle → 4 ms*
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → ΔCQI → 7
BS Signal Settings → TPC Pattern Setup → Set 2
BS Signal Settings → TPC Pattern Setup → Set 3

For transmit power template at max power with TPC_cmd = 1, recall HSDPATx3.sav, establish CS call and modify the following configurations.
BS Signal → Downlink Physical Channels → DL DPCH Timing Offset → 6 * 256 chip
BS Signal → HSDPA HS-DSCH → CQI Feedback Cycle → 4 ms
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → ΔCQI → 7
BS Signal Settings → TPC Pattern Config. → TPC Algorithm → Algorithm 1
BS Signal Settings → TPC Pattern Config. → TPC Step Size → 1 dB

The measurement result is available at:
Menus → Code Dom. Power → Applic. 1 → HS-DPCCH Time Mask
Diagram Type → DPCCH, DPDCH1 or HS-DPCCH
HS-DPCCH Time Mask → Mode → Variant 2 (for TPC_cmd = 0, constant power) or Variant 1 (for TPC_cmd = 1, TPC bits "All 1")

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

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

This test verifies that the power of UE emission does not exceed the limit 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 the interference to other channels or to other systems.

Table 14, 14(a), 14(b) and 14(c) show the spectrum emission mask requirement and additional spectrum emission limits. Δf is the separation between the carrier frequency and the centre of the measurement bandwidth. The minimum requirement is calculated from the relative requirement or the absolute requirement, whichever is the higher power.

Spectrum Emission Mask Requirement			
Δf in MHz	**Minimum requirement**		**Measurement bandwidth**
	Relative requirement	**Absolute requirement**	
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 requirement (Table 5.9A.3 of TS 34.121 [1])

Additional spectrum emission limits for Bands II, IV, X			
Δf in MHz	**Frequency offset of measurement filter centre frequency, f_offset**	**Additional requirements Band II, IV, X**	**Measurement bandwidth**
2.5 MHz ≤ Δf < 3.5 MHz	2.515 MHz ≤ f_offset < 3.485 MHz	-15 dBm	30 kHz
3.5 MHz ≤ Δf ≤ 12.5 MHz	4.0 MHz ≤ f_offset < 12.0 MHz	-13 dBm	1 MHz

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

Additional spectrum emission limits for Band V			
Δf in MHz	**Frequency offset of measurement filter centre frequency, f_offset**	**Additional requirements Band V**	**Measurement bandwidth**
2.5 MHz ≤ Δf < 3.5 MHz	2.515 MHz ≤ f_offset < 3.485 MHz	-15 dBm	30 kHz
3.5 MHz ≤ Δf ≤ 12.5 MHz	3.55 MHz ≤ f_offset < 12.45 MHz	-13 dBm	100 kHz

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

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

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

Downlink physical channels, subtest 1, serving cell and HS-DPCCH trigger are configured in R&S®CMU200 as specified in section 2.1. Fixed Reference Channel (FRC H-Set 1, QPSK version) as shown in Figure 5 is configured in R&S®CMU200. A HSDPA call is established.

Continuous UP power control commands are sent to the UE until the UE reaches maximum output power by referring to Figure 12(a).

Configuration in R&S®CMU200:
BS Signal Settings → TPC Pattern Config. → TPC Pattern Set → Set 1
BS Signal Settings → Set 1 → Pattern Type → All 1

The spectrum emission mask with HS-DPCCH is repeated with different combination of β values as specified in Table 3(a).

Measurement result for spectrum emission mask with HS-DPCCH is available in *Emission Mask* in R&S®CMU200.

Configuration in R&S®CMU200:
Menus → Spectrum → Application → Emission Mask

Figure 20 shows the spectrum emission mask with HS-DPCCH measurement result.

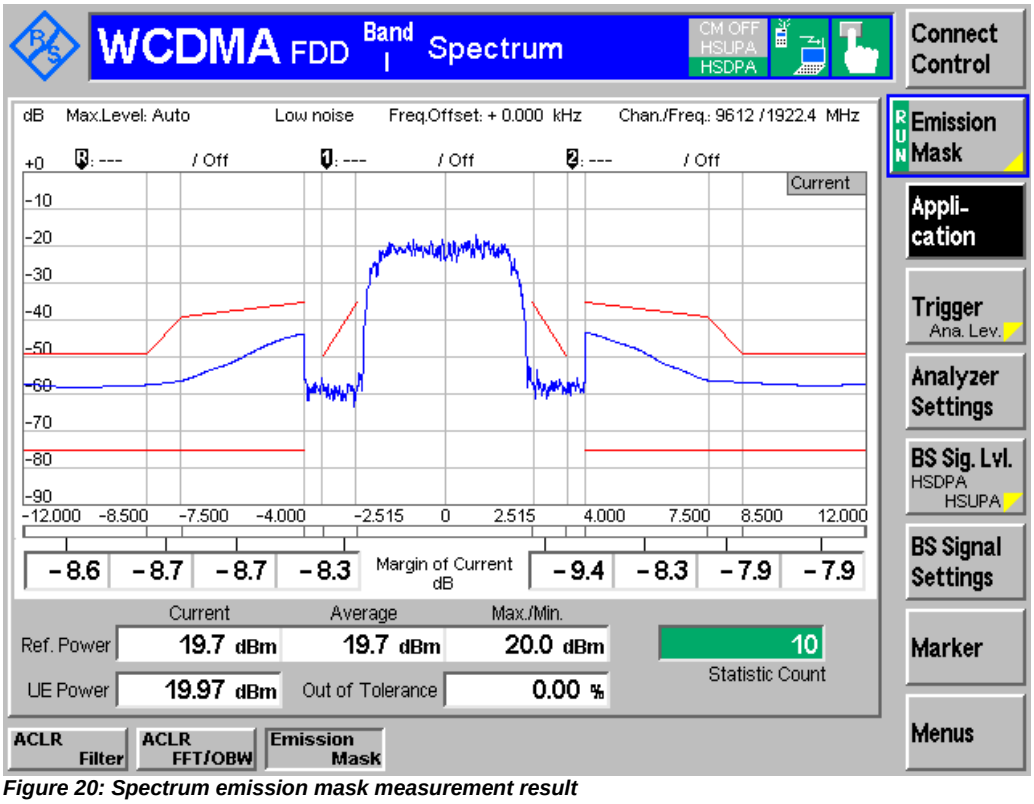


Figure 20: Spectrum emission mask measurement result

For subtest 1 with FRC H-Set 1, QPSK version, recall HSDPATx1.sav and establish CS call.

For subtest 2 with FRC H-Set 1, QPSK version, recall HSDPATx2.sav and establish CS call.

For subtest 3 with FRC H-Set 1, QPSK version, recall HSDPATx3.sav and establish CS call.

For subtest 4 with FRC H-Set 1, QPSK version, recall HSDPATx4.sav and establish CS call.

The measurement result is available at:
Menus → Spectrum → Application → Emission Mask

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

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

This test verifies that the power of UE emission does not exceed the limit 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])

Downlink physical channels, subtest 1, serving cell and HS-DPCCH trigger are configured in R&S®CMU200 as specified in section 2.1. Fixed Reference Channel (FRC H-Set 1, QPSK version) as shown in Figure 5 is configured in R&S®CMU200. A HSDPA call is established.

Continuous UP power control commands are sent to the UE until the UE reaches maximum output power by referring to Figure 12(a).

Configuration in R&S®CMU200:
BS Signal Settings → TPC Pattern Config. → TPC Pattern Set → Set 1
BS Signal Settings → Set 1 → Pattern Type → All 1

The ACLR with HS-DPCCH is repeated with different combination of β values as shown in Table 3(a).

Measurement result for ACLR with HS-DPCCH is available in *ACLR Filter* in R&S®CMU200.

Configuration in R&S®CMU200:
Menus → Spectrum → Application → ACLR Filter

Figure 21 shows the ACLR with HS-DPCCH measurement result.

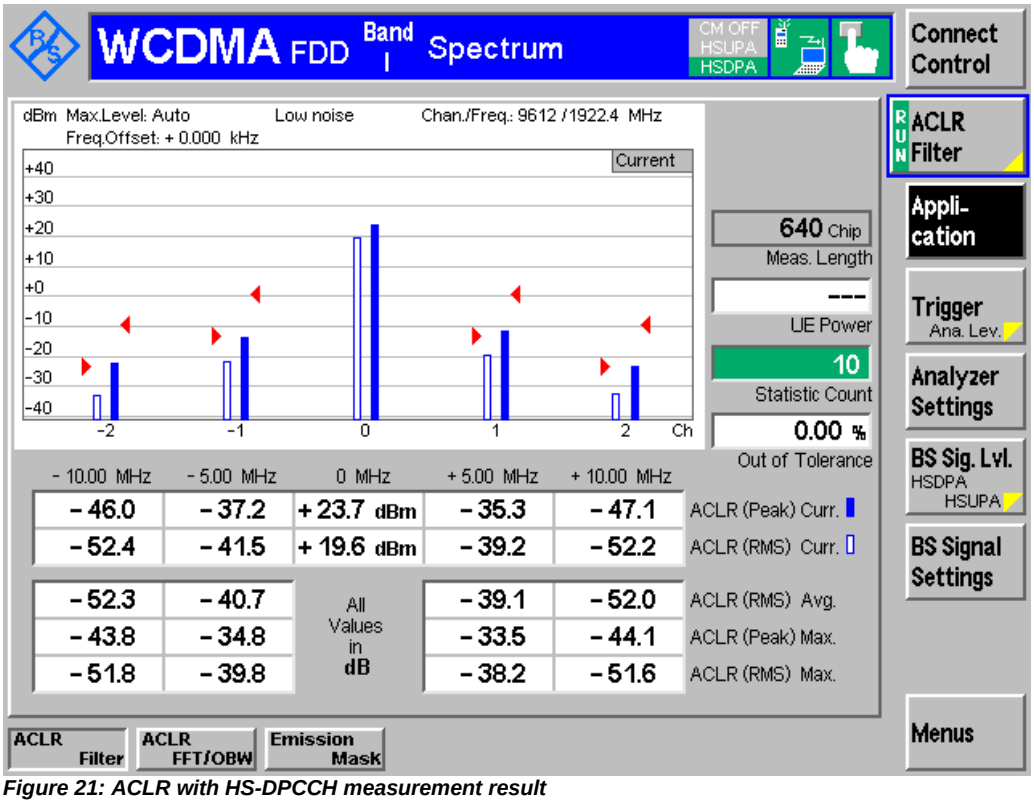


Figure 21: ACLR with HS-DPCCH measurement result

For subtest 1 with FRC H-Set 1, QPSK version, recall HSDPATx1.sav and establish CS call.

For subtest 2 with FRC H-Set 1, QPSK version, recall HSDPATx2.sav and establish CS call.

For subtest 3 with FRC H-Set 1, QPSK version, recall HSDPATx3.sav and establish CS call.

For subtest 4 with FRC H-Set 1, QPSK version, recall HSDPATx4.sav and establish CS call.

The measurement result is available at:
Menus → Spectrum → Application → ACLR Filter

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 filter with bandwidth 3.84 MHz and roll-off α = 0.22. The waveforms are further modified by selecting the frequency, absolute phase, absolute amplitude and chip clock timing to minimise 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 in percentage. This test applies to all FDD UE of Release 5 and later releases that support HSDPA.

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

Parameters for EVM / Peak code domain error			
Parameter		**Level / Status**	**Unit**
Output power		≥ –20	dBm
Operating conditions		Normal conditions	
Power control step size		1	dB
Measurement period[1]	PRACH	3904	Chips
	Any DPCH	From 1280 to 2560[2]	

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

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

Figure 22 shows the 12 ms transmit power profile to measure EVM. 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. 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 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.

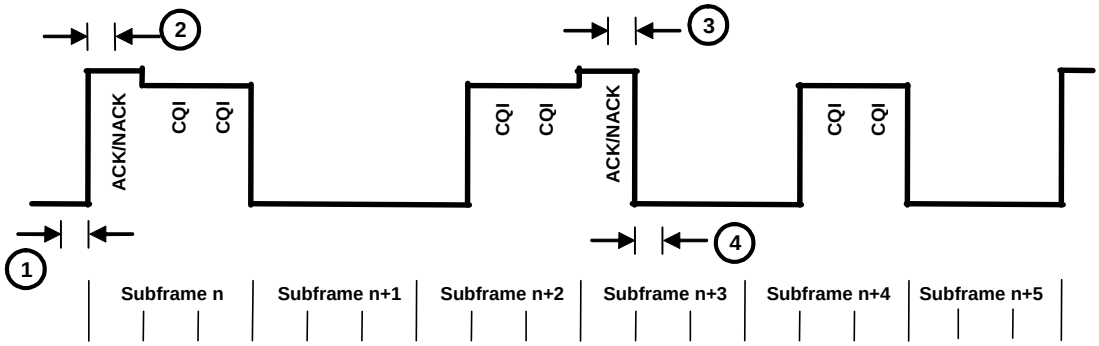


Figure 22: HS-DPCCH on/off pattern showing measurement positions (Figure 5.13.1A.1 and Figure 5.13.1AA.1 of TS 34.121 [1])

Downlink physical channels, subtest 3, serving cell and HS-DPCCH trigger are configured in R&S®CMU200 as specified in section 2.1. Fixed Reference Channel (FRC H-Set 1, QPSK version) as shown in Figure 5 is configured in R&S®CMU200.

βc and βd for subtest 3 are configured by referring to Figure 4. ΔACK and ΔNACK = 30/15 with β_{HS} = 30/15 *βc, and ΔCQI = 24/15 with β_{HS} = 24/15 * βc for this test. ΔACK, ΔNACK and ΔCQI are configured in R&S®CMU200 by referring to Figure 4.

Configuration in R&S®CMU200:
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → βc → 15
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → βd → 8
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → ΔACK → 8
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → ΔNACK → 8
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → ΔCQI → 7

The DPCH frame offset is configured according to the HS-DPCCH half slot offset to create a signal with a repeat pattern of 12 ms. Table 11 shows the TRANSPORT CHANNEL RECONFIGURATION message specific content for this test. These settings can be configured as shown in Figure 11 and 3 and by referring to Figure 2.

Configuration in R&S®CMU200:
BS Signal → Packet Switched → HSDPA Test Mode → RMC Test Loop → Loop Mode 1 RLC TM
*BS Signal → Downlink Physical Channels → DL DPCH Timing Offset → 6 * 256 chip*
BS Signal → HSDPA HS-DSCH → CQI Feedback Cycle → 4ms
BS Signal → HSDPA HS-DSCH → CQI Repetition Factor → 1
BS Signal → HSDPA HS-DSCH → ACK/NACK Repetition Factor → 1

A HSDPA call is established. Algorithm 2 is configured to interpret TPC commands. Maximum output power as specified in section 2.2 is configured. This power level is maintained by sending alternating “0” and “1” TPC commands in the downlink to satisfy condition TPC_cmd = 0. These settings can be configured by referring to Figure 12(a) and 12(b).

Configuration in R&S®CMU200:
BS Signal Settings → TPC Pattern Config. → TPC Algorithm → Algorithm 2
BS Signal Settings → TPC Pattern Config. → TPC Pattern Set → Set 1
BS Signal Settings → Set 1 → Pattern Type → All 1
BS Signal Settings → Set 1 → Pattern Type → Alternating 0, 1

Measurement points and trigger configuration in R&S®CMU200:

- To trigger a half slot EVM measurement at minumum power (i.e. where the HS-DPCCH is inactive), HS-DPCCH trigger with zero trigger slot delay is used, corresponding to points 1 and 4 in Figure 22.

- To trigger a half slot EVM measurement at maximum power (i.e. during the ACK/NACK slot of the HS-DPCCH), HS-DPCCH trigger plus a trigger slot delay of 1 slot is used, corresponding to points 2 and 3 in Figure 22.

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.

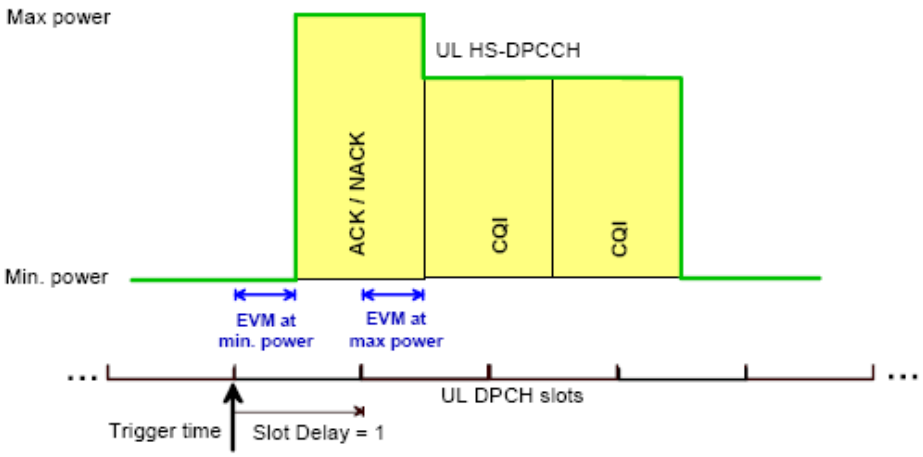


Figure 23(a): Trigger configuration in R&S®CMU200

Configuration in R&S®CMU200:
Trigger → Trigger Slot Delay → 0 Slot (minimum power) or 1 Slot (maximum power)

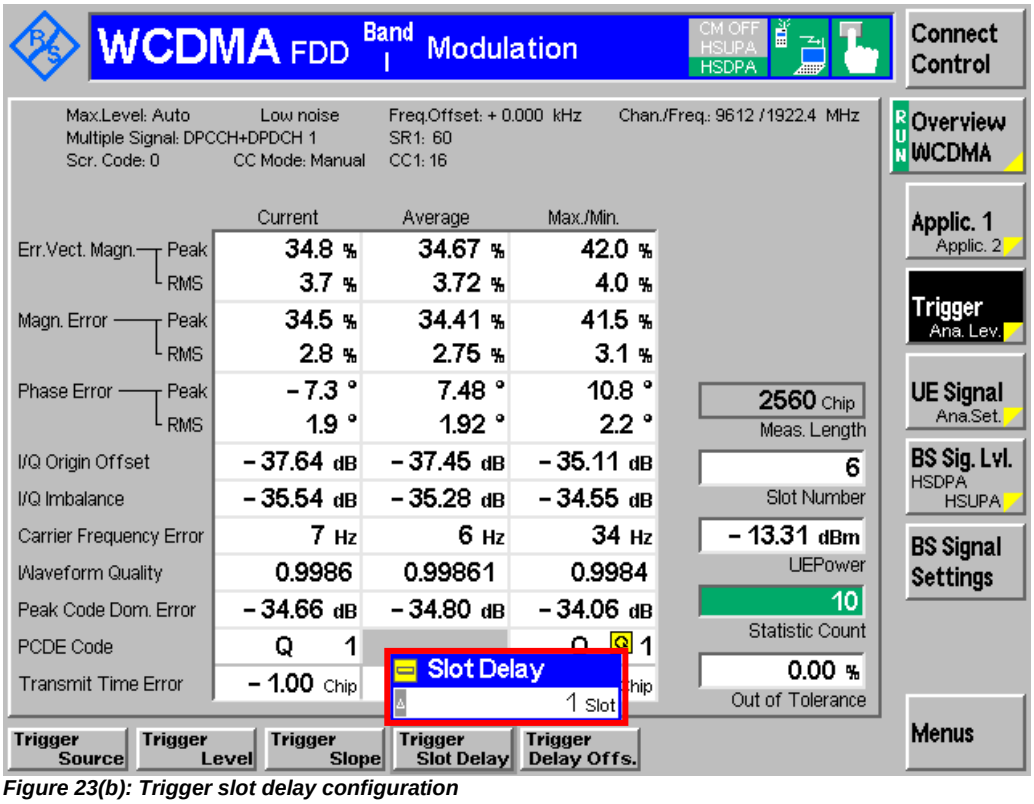


Figure 23(b): Trigger slot delay configuration

The EVM measurement is repeated with UE power level of -18 dBm with ± 2 dB tolerance. This power level is maintained by sending alternating "0" and "1" TPC commands in the downlink to satisfy condition TPC_cmd = 0. These settings can be configured in R&S®CMU200 by referring to Figure 12(a) and 12(b).

Configuration in R&S®CMU200
BS Signal Settings → TPC Pattern Config. → TPC Algorithm → Algorithm 2
BS Signal Settings → TPC Pattern Config. → TPC Pattern Set → Set 1
BS Signal Settings → Set 1 → Pattern Type → Closed Loop
BS Signal Settings → Set 1 → UL Target Power → -18.0 dBm
BS Signal Settings → Set 1 → Pattern Type → Alternating 0, 1

Measurement result for EVM with HS-DPCCH is available in *Overview WCDMA* in R&S®CMU200. Measurement length from 1280 to 2560 Chips, which the nominal power remains constant, is configured as shown in Figure 24.

Configuration in R&S®CMU200:
Menus → Modulation → Applic. 1 → Overview WCDMA
EVM WCDMA → Meas. Length → 1280 or 2560 Chip

Additional information, i.e. EVM, magnitude error and phase error are available in R&S®CMU200.

Configuration in R&S®CMU200:
Menus → Modulation → Applic. 1 → EVM WCDMA, Magn. Error WCDMA or Phase Error WCDMA

Figure 24 shows the EVM with HS-DPCCH measurement result.

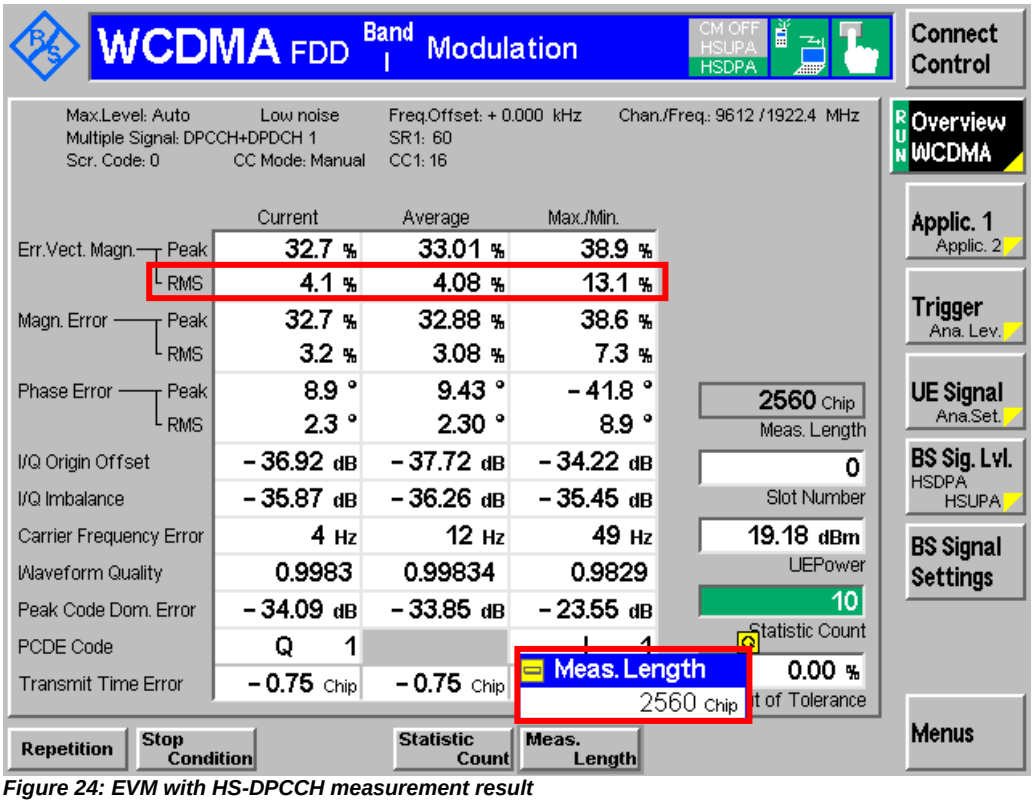


Figure 24: EVM with HS-DPCCH measurement result

For EVM with HS-DPCCH at max power, recall HSDPATx3.sav, establish CS call and modify the following configurations.
BS Signal → HSDPA HS-DSCH → CQI Feedback Cycle → 4 ms
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → ΔCQI → 7
BS Signal Settings → TPC Pattern Setup → Set 3
Trigger → Trigger Slot Delay → 1 Slot

For EVM with HS-DPCCH at -18 dBm ± 2 dB, recall HSDPATx3.sav, establish CS call and modify the following configurations.
BS Signal → HSDPA HS-DSCH → CQI Feedback Cycle → 4 ms
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → ΔCQI → 7
BS Signal Settings → TPC Pattern Setup → Set 2
BS Signal Settings → TPC Pattern Config. → Set 2 → UL Target Power → -18.0 dBm
BS Signal Settings → TPC Pattern Setup → Set 3

The measurement result is available at:
Menus → Modulation → Applic. 1 → Overview WCDMA

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 filter with bandwidth 3.84 MHz and roll-off α = 0.22. The waveforms are further modified by selecting the frequency, absolute phase, absolute amplitude and chip clock timing to minimise 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 in percentage. This test applies to all FDD UE of Release 6 and later releases that support HSDPA.

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

Phase discontinuity for HS-DPCCH measures the change in phase due to the transmission of the HS-DPCCH. If HS-DPCCH timeslot is offset from the DPCCH timeslot, the DPCCH timeslot that contains the HS-DPCCH slot boundary is used as the period of phase discontinuity evaluation. 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 remaining part of the DPCCH timeslot following the HS-DPCCH slot boundary. EVM is measured excluding the transient periods of 25 µs in all cases.

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

Phase discontinuity test requirement for HS-DPCCH at HS-DPCCH slot boundary	
Phase discontinuity for HS-DPCCH Δθ in degrees	Δθ ≤ 36

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

Figure 22 shows the 12 ms transmit power profile to measure EVM. 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.

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

Downlink physical channels, subtest 3, serving cell and HS-DPCCH trigger are configured in R&S®CMU200 as specified in section 2.1. Fixed Reference Channel (FRC H-Set 1, QPSK version) as shown in Figure 5 is configured in R&S®CMU200.

βc and βd for subtest 3 are configured by referring to Figure 4. ΔACK and ΔNACK = 30/15 with β_{HS} = 30/15 *βc, and ΔCQI = 24/15 with β_{HS} = 24/15 * βc for this test. ΔACK, ΔNACK and ΔCQI are configured in R&S®CMU200 by referring to Figure 4.

Configuration in R&S®CMU200:
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → βc → 15
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → βd → 8
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → ΔACK → 8
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → ΔNACK → 8
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → ΔCQI → 7

The DPCH frame offset is configured according to the HS-DPCCH half slot offset to create a signal with a repeat pattern of 12 ms. Table 11 shows the TRANSPORT CHANNEL RECONFIGURATION message specific content for this test. These settings can be configured as shown in Figure 11 and 3 and by referring to Figure 2.

Configuration in R&S®CMU200:
BS Signal → Packet Switched → HSDPA Test Mode → RMC Test Loop → Loop Mode 1 RLC TM
*BS Signal → Downlink Physical Channels → DL DPCH Timing Offset → 6 * 256 chip*
BS Signal → HSDPA HS-DSCH → CQI Feedback Cycle → 4ms
BS Signal → HSDPA HS-DSCH → CQI Repetition Factor → 1
BS Signal → HSDPA HS-DSCH → ACK/NACK Repetition Factor → 1

A HSDPA call is established. Algorithm 2 is configured to interpret TPC commands. Maximum output power as specified in section 2.3 is configured. This power level is maintained by sending alternating “0” and “1” TPC commands in the downlink to satisfy condition TPC_cmd = 0. These settings can be configured by referring to Figure 12(a) and 12(b).

Configuration in R&S®CMU200:
BS Signal Settings → TPC Pattern Config. → TPC Algorithm → Algorithm 2
BS Signal Settings → TPC Pattern Config. → TPC Pattern Set → Set 1
BS Signal Settings → Set 1 → Pattern Type → All 1
BS Signal Settings → Set 1 → Pattern → Alternating 0, 1

In R&S®CMU200 HS-DPCCH trigger with zero slot delay is used. This setting can be configured in R&S®CMU200 by referring to Figure 23(b).

Configuration in R&S®CMU200:
Trigger → Trigger Slot Delay → 0 Slot

The EVM and phase discontinuity measurement is repeated with UE power level of -18 dBm with ± 2 dB tolerance. This power level is maintained by sending alternating "0" and "1" TPC commands in the downlink to satisfy condition TPC_cmd = 0. These settings can be configured by referring to Figure 12(a) and 12(b).

Configuration in R&S®CMU200:
BS Signal Settings → TPC Pattern Config. → TPC Algorithm → Algorithm 2
BS Signal Settings → TPC Pattern Config. → TPC Pattern Set → Set 1
BS Signal Settings → Set 1 → Pattern Type → Closed Loop
BS Signal Settings → Set 1 → UL Target Power → -18 dBm
BS Signal Settings → Set 1 → Pattern Type → Alternating 0, 1

The measurement result for EVM and phase discontinuity with HS-DPCCH is available in *EVM & PhD HS-DPCCH* in R&S®CMU200.

Configuration in R&S®CMU200:
Menus → Modulation → Applic. 2 → EVM & PhD HS-DPCCH

Figure 25 shows the EVM and phase discontinuity with HS-DPCCH measurement result.

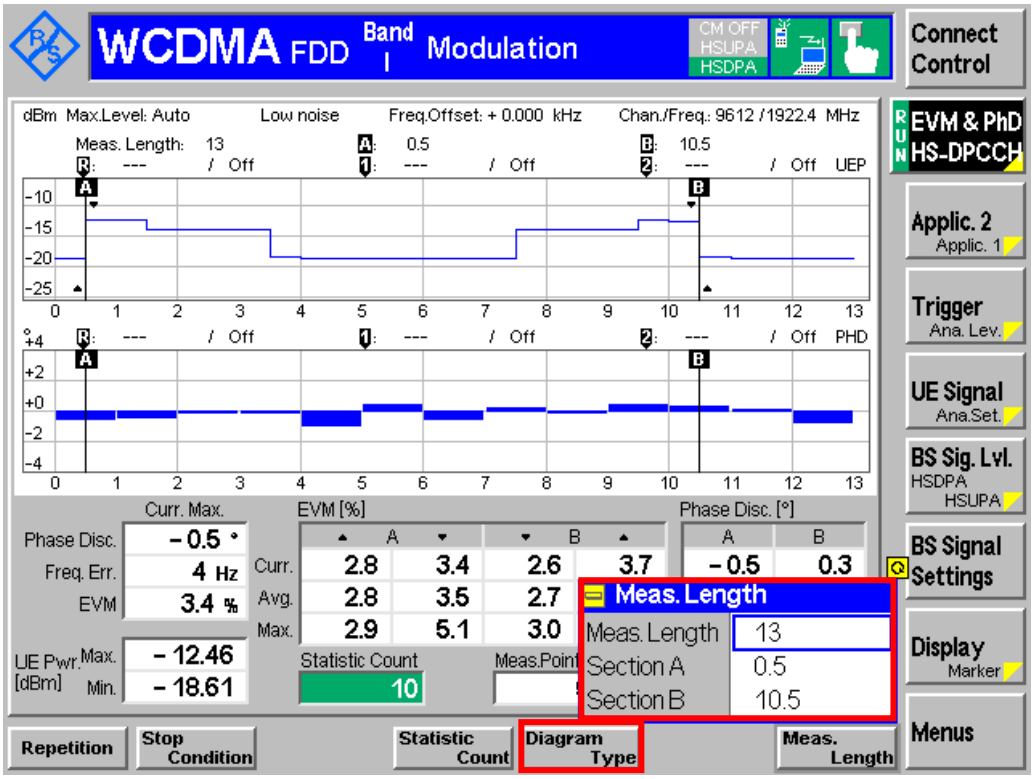


Figure 25: EVM and phase discontinuity with HS-DPCCH measurement result

It is recommended to change the measurement length to 13 slots. Position of Section A is set to 0.5 slot relative to the start of the measured time interval. Position of Section B is set to 10.5 slot relative to the start of the measured time interval.

Configuration in R&S®CMU200:
Menus → Modulation → Applic. 2 → EVM & PhD HS-DPCCH
EVM & PhD HS-DPCCH → Meas. Length → 13
EVM & PhD HS-DPCCH → Section A → 0.5
EVM & PhD HS-DPCCH → Section B → 10.5

The upper diagram of the measurement result can display UE Power, Error Vector Mag. or Frequency Error. The lower diagram can display Phase Discont., Error Vector Mag. or Frequency Error. Upper diagram in Figure 25 displays UE-Power which matches transmit power profile in Figure 22.

Configuration in R&S®CMU200:
Menus → Modulation → Applic. 2 → EVM & PhD HS-DPCCH
EVM & PhD HS-DPCCH → Diagram Type → Upper → UE Power, Error Vector Mag. or Frequency Error
EVM & PhD HS-DPCCH → Diagram Type → Lower → Phase Discont., Error Vector Mag. or Frequency Error

The span of X and Y scale of both diagrams can be configured by changing the *Scale X* and *Scale Y* in R&S®CMU200 by referring to Figure 14(b).

For EVM and phase discontinuity with HS-DPCCH at max power, recall HSDPATx3.sav, establish CS call and modify the following configurations.
BS Signal → HSDPA HS-DSCH → CQI Feedback Cycle → 4 ms
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → ΔCQI → 7
BS Signal Settings → TPC Pattern Setup → Set 3

For EVM and phase discontinuity with HS-DPCCH at -18 dBm ± 2 dB, recall HSDPATx3.sav, establish CS call and modify the following configurations.
BS Signal → HSDPA HS-DSCH → CQI Feedback Cycle → 4 ms
UE Signal → UE Gain Factors → Packet Data → HSDPA / HSUPA → ΔCQI → 7
BS Signal Settings → TPC Pattern Setup → Set 2
BS Signal Settings → TPC Pattern Config. → Set 2 → UL Target Power → -18.0 dBm
BS Signal Settings → TPC Pattern Setup → Set 3

The measurement result is available at:
Menus → Modulation → Applic. 2 → EVM & PhD HS-DPCCH

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

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

Relative code domain error is affected by both the spreading factor and beta values of the various code channels in the domain. Effective Code Domain Power (ECDP) for each used code k is defined using Nominal CDP ratio as specified in TS 25.101 [4].

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

Relative Code Domain Error is not applicable when either or both the following channel conditions occur:

i) ECDP of any code channel is < -30 dB
ii) Nominal code domain power of any code channel is < -20 dB

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

Table 18 and Table 19 show the nominal ECDP ratios and relative code domain error test requirement respectively. Relative code domain error shall meet the test requirements in Table 19 for parameters specified in Table 16.

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

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

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

Table 19: Relative code domain error test requirement (Table 5.13.2A.5 of TS 34.121 [1])

Downlink physical channels, subtest 1, serving cell and HS-DPCCH trigger are configured in R&S®CMU200 as specified in section 2.1. Fixed Reference Channel (FRC H-Set 1, QPSK version) as shown in Figure 5 is configured in R&S®CMU200.

A HSDPA call is established. Continuous UP power control commands are sent to the UE until the UE reaches maximum output power by referring to Figure 12(a).

Configuration in R&S®CMU200:
BS Signal Settings → TPC Pattern Config. → TPC Pattern Set → Set 1
BS Signal Settings → Set 1 → Pattern Type → All 1

The relative code domain error measurement is repeated with UE power level of -18 dBm with ±2 dB tolerance. These settings can be configured in R&S®CMU200 by referring to Figure 12(a) and 12(b).

Configuration in R&S®CMU200:
BS Signal Settings → Set 1 → Pattern Type → Closed Loop
BS Signal Settings → Set 1 → UL Target Power → -18 dBm

The relative code domain error measurement is repeated with different combinations of β values for subtest 3 and 4 as shown in Table 3(a). Depending on the values of gain factors, measurement threshold may require adjustment. Measurement threshold of -1 dB and -20 dB is recommended for subtest 1 and 4 respectively. This setting can be configured by referring to Figure 13.

Configuration in R&S®CMU200:
UE Signal → Measurement Settings → Threshold → -1 dB (subtest 1), -10 dB (subtest 3) or -20 dB (subtest 4)

Measurement result for relative code domain error with HS-DPCCH is available in *CDE Relative* in R&S®CMU200.

Configuration in R&S®CMU200:
Menus → Code Dom. Power → Applic. 2 → CDE/Relative

Figure 26 shows the relative code domain error with HS-DPCCH measurement result.

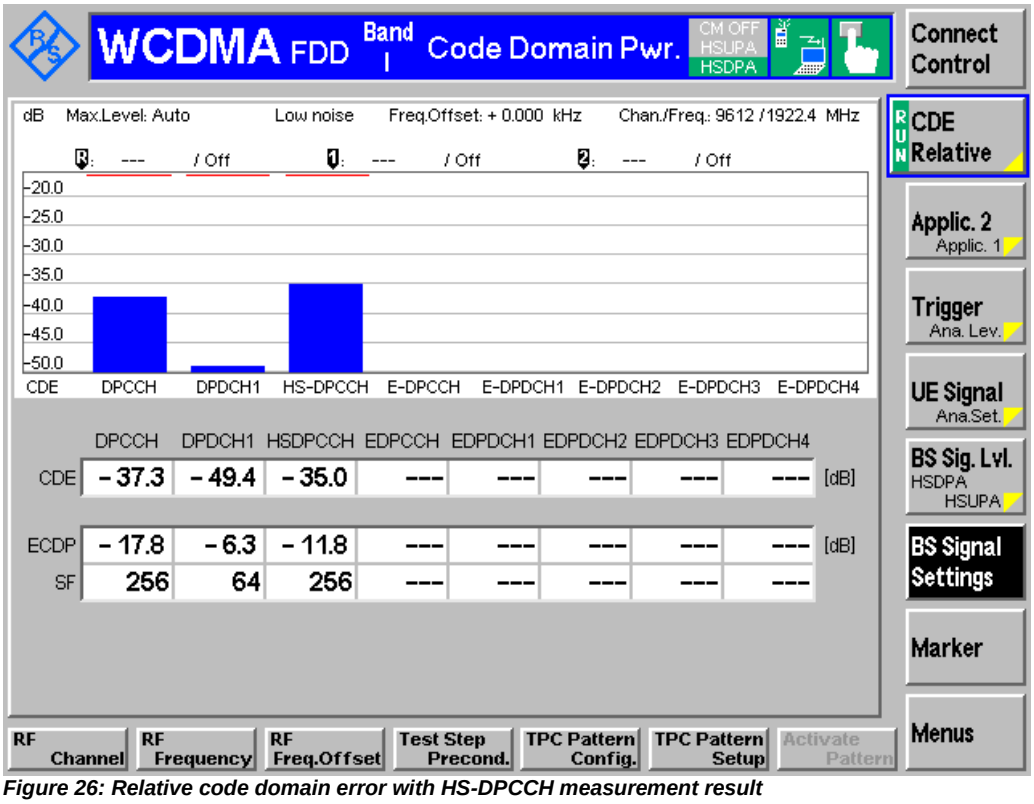


Figure 26: Relative code domain error with HS-DPCCH measurement result

For subtest 1 with FRC H-Set 1, QPSK version, at max power, recall HSDPATx1.sav, establish CS call and modify the following configuration.
UE Signal → Measurement Settings → Threshold → -1 dB
Repeat the test at -18 dBm with ± 2 dB by modifying the following configurations:
BS Signal Settings → TPC Pattern Setup → Set 2
BS Signal Settings → TPC Pattern Config. → Set 2 → UL Target Power → -18.0 dBm

For subtest 3 with FRC H-Set 1, QPSK version, at max power, recall HSDPATx3.sav and establish CS call.
Repeat the test at -18 dBm with ± 2 dB by modifying the following configurations:
BS Signal Settings → TPC Pattern Setup → Set 2
BS Signal Settings → TPC Pattern Config. → Set 2 → UL Target Power → -18.0 dBm

For subtest 4 with FRC H-Set 1, QPSK version, at max power, recall HSDPATx4.sav, establish CS call and modify the following configuration.
UE Signal → Measurement Settings → Threshold → -20 dB
Repeat the test at -18 dBm with ± 2 dB by modifying the following configurations:
BS Signal Settings → TPC Pattern Setup → Set 2
BS Signal Settings → TPC Pattern Config. → Set 2 → UL Target Power → -18.0 dBm

The measurement result is available at:
Menus → Code Dom. Power → Applic. 2 → CDE/Relative

3 Rel-5 Receiver Characteristics

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

Maximum input level for HS-PDSCH reception measures the maximum power received at the UE antenna port, which shall 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 UE that support HSDPA (16QAM).

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

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

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

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

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

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

Configuration in R&S®CMU200:
BS Signal → HSDPA HS-DSCH → Channel Configuration Type → Fixed Reference Channel
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 1 Max. Input

A HSDPA call is configured in R&S®CMU200 as shown in Figure 1(a) and 1(b). FRC H-Set 1, 16QAM version, for maximum input level, is configured in R&S®CMU200 by referring to Figure 5. Downlink physical channels in Table 5(a) and Table 21 are configured in R&S®CMU200 by referring to Figure 6. A HSDPA call is established.

BS Signal → Node-B Settings → Level Reference → Output Channel Power (Ior)
BS Signal → Node-B Settings → Output Channel Power (Ior) → -25.7 dBm
BS Signal → Downlink Physical Channels → DPDCH Level Config → -13.0 dB
BS Signal → Downlink Physical Channels → HSDPA Channels → On
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#1 → Level → -13.0 dB
BS Signal → Downlink Physical Channels → HS-PDSCH → Level (All Active Codes) → -3.0 dB

Table 22 shows the contents of RADIO BEARER SETUP message for this test. The UE output power measured shall be kept at the specified power level with ±1 dB tolerance. These settings can be configured by referring to Figure 12(a) and 12(b).

Contents of 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 RADIO BEARER SETUP message: AM or UM (Table 6.3A.3 of TS 34.121 [1])

Configuration in R&S®CMU200:
BS Signal Settings → TPC Pattern Config. → TPC Algorithm → Algorithm 2
BS Signal Settings → TPC Pattern Config. → TPC Pattern Set → Set 1
BS Signal Settings → Set 1 → Pattern Type → Closed Loop
BS Signal Settings → Set 1 → UL Target Power → 20 dBm (Power class 3 and 3bis) or 18 dBm (Power class 4)

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

Maximum input level for HS-PDSCH reception (16QAM)						
Maximum input level for HS-PDSCH reception (16QAM) 16QAM H-Set 1	Absolute test requirement (kbps)	Relative test requirement (normalized to ideal=777 kbps) No of events / No of samples 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)	2.8s (stat)	BL

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

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

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

Measurement result for measured throughput, BL test mode and RT test mode of maximum input level for HS-PDSCH reception (16QAM) is available in HSDPA ACK in R&S®CMU200.

Configuration in R&S®CMU200:
Menus → Receiver Quality → Applic. 1 → HSDPA ACK
HSDPA ACK → Measure Subframes → ≥ 467 (when Repetition is set to Single Shot)

Figure 27 shows the maximum input level for HS-PDSCH reception (16QAM) measurement result.

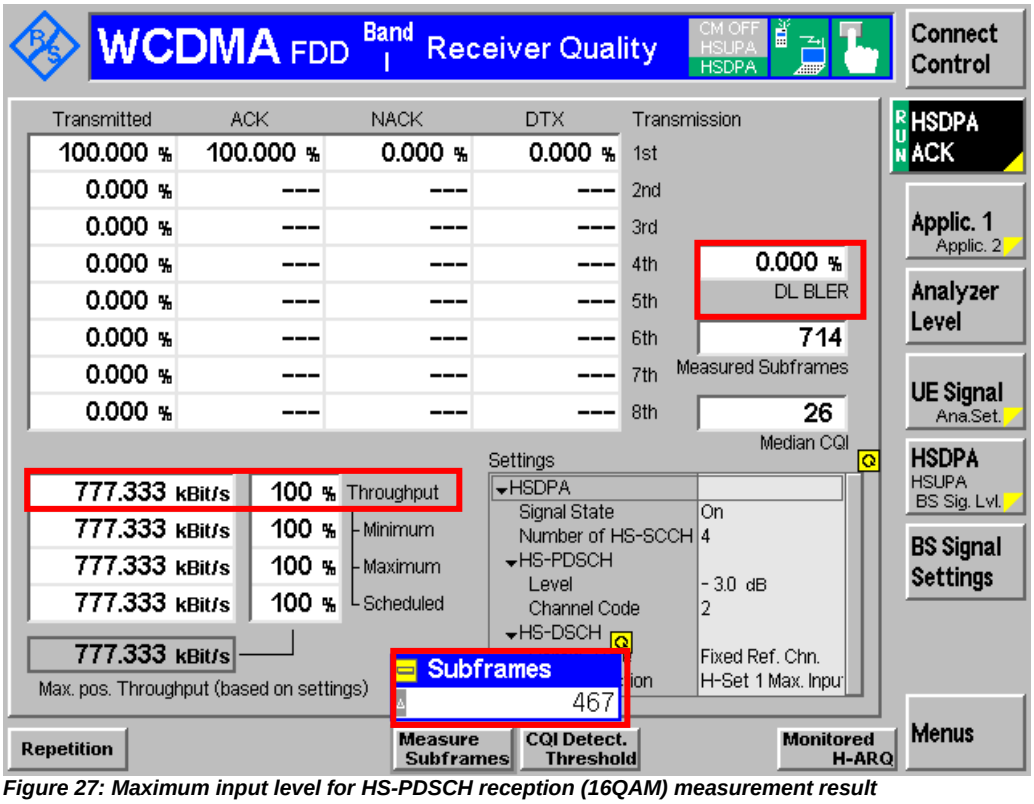


Figure 27: Maximum input level for HS-PDSCH reception (16QAM) measurement result

Recall MaxInput.sav and establish CS call.

The measurement result is available at:
Menus → Receiver Quality → Applic. 1 → HSDPA ACK

4 Rel-5 Performance Requirements

4.1 Generic Call Setup for Performance Requirements

A HSDPA call is configured in R&S®CMU200 as shown in Figure 1(a) and 1(b). Downlink physical channels in Table 5(a) are used as initial conditions for HSDPA connection setup and are configured in R&S®CMU200 by referring to Figure 6. A HSDPA call is established according to TS 34.108 [2] subclause 7.3.6. Once HSDPA connection is setup, downlink physical channels are configured in R&S®CMU200 according to Table 24 and Table 25.

Application of level sets for measurement							
Propagation conditions	Reference value						
	HS-PDSCH Ec/Ior (dB)	T-put R (kbps) Ior/Ioc = 0 dB	T-put R (kbps) Ior/Ioc = 10 dB	T-put R (kbps) Ior/Ioc = 6 dB	T-put R (kbps) Ior/Ioc =15 dB and 18 dB	T-put R (kbps) Ior/Ioc = 5 dB	T-put R (kbps) Ior/Ioc = 4 dB and 8 dB
PA3	-12	Not tested	Level set 5	Not tested	Not tested	Not tested	Not tested
	-9	Not tested	Level set 4	Not tested	Not tested	Not tested	Not tested
	-6	Level set 1	Level set 2	Not tested	Not tested	Not tested	Not tested
	-3	Level set 3	Level set 3	Not tested	Not tested	Not tested	Not tested
	-2	Not tested	Level set 6	Level set 6	Level set 6	Not tested	Not tested
	-1.5	Not tested	Not tested	Not tested	Not tested	Not tested	Not tested
PB3	-9	Not tested	Level set 4	Not tested	Not tested	Not tested	Not tested
	-6	Level set 2	Level set 2	Not tested	Not tested	Level set 2	Not tested
	-3	Level set 3	Level set 3	Not tested	Not tested	Level set 3	Not tested
VA30	-9	Not tested	Level set 4	Not tested	Not tested	Not tested	Not tested
	-6	Level set 2	Level set 2	Not tested	Not tested	Not tested	Not tested
	-3	Level set 3	Level set 3	Not tested	Not tested	Not tested	Not tested
VA120	-9	Not tested	Level set 4	Not tested	Not tested	Not tested	Not tested
	-6	Level set 2	Level set 2	Not tested	Not tested	Not tested	Not tested
	-3	Level set 3	Level set 3	Not tested	Not tested	Not tested	Not tested
VA3	-2	Not tested	Level set 6	Level set 6	Not tested	Not tested	Level set 6

Table 24: Application of level sets for measurement (Table E.5.9 of TS 34.121 [1])

Summary of level set for HSDPA measurements including test tolerances									
Parameter during measurement	**Unit**	**Level set**							
		1		**2**	**3**	**4**	**5**	**6**	**7**
P-CPICH_Ec/Ior	dB	-9.9							
P-CCPCH_Ec/Ior	dB	-11.9							
SCH_Ec/Ior	dB	-11.9							
PICH _Ec/Ior	dB	-14.9							
HS-PDSCH	dB	-5.9		-5.9	-2.9	-8.9	-11.9	-1.9	-1.4
HS-SCCH_1	dB	-7.4		-8.4	-8.4	-8.4	-8.4	-11.1	-14.2
DPCH_Ec/Ior	dB	-5		-5	-8.4	-5	-5	-11.1	-14.2
OCNS_Ec/Ior	dB	-13.3		-10.75	off	-6.75	-5.6	Off	Off
Measurement conditions:		PA3 & Case 8:	Case 8:						
HS-PDSCH	dB	-6	-9	-6	-3	-9	-12	-2	-1.5
Ior/Ioc	dB	0	0	10, 5 and 0	10, 5, 0	10	10	4, 6, 8, 10, 15 and 18	18

Table 25: Summary of level set for HSDPA measurement including test tolerances (Summary of Table E.5.6, Table E.5.7, Table E.5.8, Table E.5.8A, Table E.5.8B, Table E.5.8C and Table E.5.8D of TS 34.121 [1])

BS Signal → Node-B Settings → Level Reference → Output Channel Power (Ior)
BS Signal → Downlink Physical Channels → P-CPICH → -9.9 dB
BS Signal → Downlink Physical Channels → P-CCPCH → -11.9 dB
BS Signal → Downlink Physical Channels → P-SCH → -14.9 dB
BS Signal → Downlink Physical Channels → S-SCH → -14.9 dB
BS Signal → Downlink Physical Channels → PICH → -14.9 dB
BS Signal → Downlink Physical Channels → DPDCH Level Config → -5.0 dB (Level set 1, 2, 4 and 5), -8.4 dB (Level set 3) or -11.1 dB (Level set 6)
BS Signal → Downlink Physical Channels → HSDPA Channels → On
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#1 → Level → -7.4 dB (Level set 1) or -8.4 dB (Level set 2, 3, 4 and 5) or -11.1 dB (Level set 6)
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#2 → Level → Off
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#3 → Level → Off
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#4 → Level → Off
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH Selection → 1
BS Signal → Downlink Physical Channels → HS-SCCH → Number of HS-SCCH → 4
BS Signal → Downlink Physical Channels → HS-SCCH → Unscheduled Subframes → Transmit Dummy UEID
BS Signal → Downlink Physical Channels → HS-PDSCH → Level (All Active Codes) → -5.9 dB (Level set 1 and 2), -2.9 dB (Level set 3), -8.9 dB (Level set 4), -11.9 dB (Level set 5) or -1.9 dB (Level set 6)
BS Signal → Downlink Physical Channels → HS-PDSCH → Unscheduled Subframes → Dummy Data

UE output power for all performance requirements shall be greater than -10 dBm unless stated otherwise.

Configuration in R&S®CMU200:
BS Signal → TPC Settings → TPC Algorithm → Algorithm 2
BS Signal → TPC Settings → TPC Step Size → 1 dB
BS Signal → TPC Settings → TPC Pattern Setup → Set 1
BS Signal → TPC Settings → Set 1 → Pattern Type → Closed Loop
BS Signal → TPC Settings → Set 1 → UL Target Power → 0.0 dBm

Table 26(a) shows the minimum performance requirement for HS-DSCH categories 1 to 12. Single link minimum performance requirements for categories 7 to 10 in Pedestrian A with Ior/Ioc = 10 dB are set according to H-Set 6. Requirements in other conditions are set according to H-Set 3. For UE supporting the minimum performance requirements for HS-DSCH, the minimum requirements for HS-SCCH detection of single link are determined in Table 9.4.1.2 of TS 34.121 [1]. R&S®CMU200 supports only single link performance testing.

Table 26(b) shows the performance requirements for HS-DSCH categories 1 to 10 and supporting the optional enhanced performance requirement type 1. Single link enhanced performance requirements type 1 for categories 7 to 10 in Pedestrian A with Ior/Ioc = 10 dB are set according to H-Set 6. Requirements in other conditions are set according to H-Set 3. For UE supporting the enhanced performance requirements type 1 for HS-DSCH the requirements for HS-SCCH detection for single link are determined in Table 9.4.1A.2 of TS 34.121 [1]. R&S®CMU200 supports only single link performance testing.

Table 26(c) shows the performance requirements for HS-DSCH categories 7 to 10 and supporting the optional enhanced performance requirement type 2, and minimum performance requirements for HS-DSCH categories 13 or 14. Single link enhanced performance requirements type 2 for categories 9, 10, 13 and 14 with Ior/Ioc = 4 dB and 8 dB are set according to H-Set 10. Single link enhanced performance requirements type 2 for categories 13 and 14 with Ior/Ioc = 15 and 18 dB are set according to H-Set 8. Single link enhanced performance requirements type 2 for categories 7 to 10, 13 and 14 with Ior/Ioc = 10 dB are set according to H-Set 6. Requirements in other conditions are according to H-Set 3 minimum performance requirements. For UE supporting the enhanced performance requirements type 2 for HS-DSCH the minimum requirements for HS-SCCH detection for single link are determined in Table 9.4.1.2 of TS 34.121 [1]. R&S®CMU200 supports only single link performance testing.

Table 26(d) shows the performance requirements for HS-DSCH categories 7 to 10, 13 or 14 and supporting the optional enhanced performance requirement type 3, and minimum performance requirements for HS-DSCH categories 15 to 20. Single link enhanced performance requirements type 3 for Categories 9, 10, 13 to 20 with Ior/Ioc = 4 dB and 8 dB are set according to H-Set 10. Single link enhanced performance requirements type 3 for Categories 13, 14, 17 to 20 with Ior/Ioc = 15 dB and 18 dB are set according to H-Set 8. Single link enhanced performance requirements type 3 for categories 7 to 10, 13 to 20 with Ior/Ioc = 10 dB and Ior/Ioc = 5 dB are set according to H-Set 6. Requirements in other conditions are set according to H-Set 3 type 1 enhanced performance requirements. For UE supporting the enhanced performance requirements type 3 for HS-DSCH the requirements for HS-SCCH Type 1 detection for single link are determined in Table 9.4.1.2 of TS 34.121 [1]. R&S®CMU200 supports only single link performance testing.

Table 26(e) shows the performance requirements for HS-DSCH categories 7 to 10, 13 to 20 and supporting the optional enhanced performance requirement type 3i. Single link enhanced performance requirements type 3i for categories 7 to 20 with Ior/Ioc = 0 dB are set according to H-Set 6. Requirements in other conditions are according to type 3 enhanced performance requirements. For UE supporting the enhanced performance requirements type 3i for HS-DSCH the requirements for HS-SCCH Type 1 detection for single link are determined in Table 9.4.1.2 of TS 34.121 [1]. R&S®CMU200 supports only single link performance testing.

FRC for minimum performance requirements for different HS-DSCH categories			
HS-DSCH category	**Corresponding requirement**		
	Single link	**Open loop diversity**	**Closed loop diversity**
Category 1	H-Set 1	H-Set 1	H-Set 1
Category 2	H-Set 1	H-Set 1	H-Set 1
Category 3	H-Set 2	H-Set 2	H-Set 2
Category 4	H-Set 2	H-Set 2	H-Set 2
Category 5	H-Set 3	H-Set 3	H-Set 3
Category 6	H-Set 3	H-Set 3	H-Set 3
Category 7	H-Set 6, H-Set 3	H-Set 3	H-Set 3
Category 8	H-Set 6, H-Set 3	H-Set 3	H-Set 3
Category 9	H-Set 6, H-Set 3	H-Set 3	H-Set 3
Category 10	H-Set 6, H-Set 3	H-Set 3	H-Set 3
Category 11	H-Set 4	H-Set 4	H-Set 4
Category 12	H-Set 5	H-Set 5	H-Set 5

Table 26(a): FRC for minimum performance requirements for different HS-DSCH categories (Table 9.2.1 of TS 34.121 [1])

FRC for enhanced performance requirements type 1 for different HS-DSCH categories			
HS-DSCH category	**Corresponding requirement**		
	Single link	**Open loop diversity**	**Closed loop diversity**
Category 1	H-Set 1	H-Set 1	H-Set 1
Category 2	H-Set 1	H-Set 1	H-Set 1
Category 3	H-Set 2	H-Set 2	H-Set 2
Category 4	H-Set 2	H-Set 2	H-Set 2
Category 5	H-Set 3	H-Set 3	H-Set 3
Category 6	H-Set 3	H-Set 3	H-Set 3
Category 7	H-Set 6, H-Set 3	H-Set 3	H-Set 3
Category 8	H-Set 6, H-Set 3	H-Set 3	H-Set 3
Category 9	H-Set 6, H-Set 3	H-Set 3	H-Set 3
Category 10	H-Set 6, H-Set 3	H-Set 3	H-Set 3

Table 26(b): FRC for enhanced performance requirements type 1 for different HS-DSCH categories (Table 9.2.2 of TS 34.121 [1])

FRC for enhanced performance requirements type 2 for different HS-DSCH categories			
HS-DSCH category	**Corresponding requirement**		
	Single link	**Open loop diversity**	**Closed loop diversity**
Category 7	H-Set 6, H-Set 3	H-Set 3	H-Set 6, H-Set 3
Category 8	H-Set 6, H-Set 3	H-Set 3	H-Set 6, H-Set 3
Category 9	H-Set 10, H-Set 6, H-Set 3	H-Set 3	H-set 6, H-Set 3
Category 10	H-Set 10, H-Set 6, H-Set 3	H-Set 3	H-set 6, H-Set 3
Category 13	H-Set 10, H-Set 8, H-Set 6, H-Set 3	H-Set 3	H-Set 6, H-Set 3
Category 14	H-Set 10, H-Set 8, H-Set 6, H-Set 3	H-Set 3	H-Set 6, H-Set 3

Table 26(c): FRC for enhanced performance requirements type 2 for different HS-DSCH categories (Table 9.2.3 of TS 34.121 [1])

FRC for enhanced performance requirements type 3 for different HS-DSCH categories				
HS-DSCH category	**Corresponding requirement**			
	Single link	**Open loop diversity**	**Closed loop diversity**	**MIMO**
Category 7	H-Set 6, H-Set 3	H-Set 3	H-Set 3	N/A
Category 8	H-Set 6, H-Set 3	H-Set 3	H-Set 3	N/A
Category 9	H-Set 10, H-Set 6, H-Set 3	H-Set 3	H-Set 3	N/A
Category 10	H-Set 10, H-Set 6, H-Set 3	H-Set 3	H-Set 3	N/A
Category 13	H-Set 10, H-Set 8, H-Set 6, H-Set 3	H-Set 3	H-Set 3	N/A
Category 14	H-Set 10, H-Set 8, H-Set 6, H-Set 3	H-Set 3	H-Set 3	N/A
Category 15	H-Set 10, H-Set 6, H-Set 3	H-Set 3	H-Set 3	H-Set 9
Category 16	H-Set 10, H-Set 6, H-Set 3	H-Set 3	H-Set 3	H-Set 9
Category 17	H-Set 10, H-Set 8, H-Set 6, H-Set 3	H-Set 3	H-Set 3	H-Set 9
Category 18	H-Set 10, H-Set 8, H-Set 6, H-Set 3	H-Set 3	H-Set 3	H-Set 9
Category 19	H-Set 11, H-Set 10, H-Set 8, H-Set 6, H-Set 3	H-Set 3	H-Set 3	H-Set 11, H-Set 9
Category 20	H-Set 11, H-Set 10, H-Set 8, H-Set 6, H-Set 3	H-Set 3	H-Set 3	H-Set 11, H-Set 9

Table 26(d): FRC for enhanced performance requirements type 3 for different HS-DSCH categories (Table 9.2.3A of TS 34.121 [1])

FRC for enhanced performance requirements type 3i for different HS-DSCH categories				
HS-DSCH category	**Corresponding requirement**			
	Single link	**Open loop diversity**	**Closed loop diversity**	**MIMO**
Category 7	H-Set 6, H-Set 3	H-Set 3	H-Set 3	N/A
Category 8	H-Set 6, H-Set 3	H-Set 3	H-Set 3	N/A
Category 9	H-Set10, H-Set 6, H-Set 3	H-Set 3	H-Set 3	N/A
Category 10	H-Set10, H-Set 6, H-Set 3	H-Set 3	H-Set 3	N/A
Category 13	H-Set10, H-Set 8, H-Set 6, H-Set 3	H-Set 3	H-Set 3	N/A
Category 14	H-Set10, H-Set 8, H-Set 6, H-Set 3	H-Set 3	H-Set 3	N/A
Category 15	H-Set10, H-Set 6, H-Set 3	H-Set 3	H-Set 3	H-Set 9
Category 16	H-Set10, H-Set 6, H-Set 3	H-Set 3	H-Set 3	H-Set 9
Category 17	H-Set10, H-Set 8, H-Set 6, H-Set 3	H-Set 3	H-Set 3	H-Set 9
Category 18	H-Set10, H-Set 8, H-Set 6, H-Set 3	H-Set 3	H-Set 3	H-Set 9
Category 19	H-Set 11, H-Set-10, H-Set 8, H-Set 6, H-Set 3	H-Set 3	H-Set 3	H-Set 11, H-Set 9
Category 20	H-Set-11, H-Set-10, H-Set 8, H-Set 6, H-Set 3	H-Set 3	H-Set 3	H-Set 11, H-Set 9

Table 26(e): FRC for enhanced performance requirements type 3i for different HS-DSCH categories (Table 9.2.3B of TS 34.121 [1])

During the FRC tests the behaviour of the Node-B emulator in response to the ACK/NACK signalling field of the HS-DPCCH is specified in Table 26(f).

Node-B emulator behaviour in response to ACK/NACK/DTX	
HS-DPCCH ACK/NACK field state	**Node-B Emulator bahaviour**
ACK	ACK: new transmission using 1st redundancy and constellation version (RV)
NACK	NACK: retransmission using the next RV (up to the maximum permitted number or RV's)
DTX	DTX: retransmission using the RV previously transmitted to the same H-ARQ process

Table 26(f): Node-B emulator behaviour in response to ACK/NACK/DTX (Table 9.2.4 of TS 34.121 [1])

Table 27 shows the Fixed Reference Channel H-Set 1, H-Set 2, H-Set 3, H-Set 4, H-Set 5 and H-Set 6.

Summary of Fixed Reference Channel H-Set 1 to 6											
Paramter	**Unit**	**H-Set 1 (Note 1)**		**H-Set 2 (Note 2)**		**H-Set 3**		**H-Set 4 (Note 3)**	**H-Set 5 (Note 4)**	**H-Set 6**	
Nominal Avg. Inf. Bit Rate	kbps	534	777	801	1166	1601	2332	534	801	3219	4689
Inter-TTI Distance	TTI's	3	3	2	2	1	1	2	1	1	1
Number of HARQ Processes	Processes	2	2	3	3	6	6	2	3	6	6
Information Bit Payload (N_{INF})	Bits	3202	4664	3202	4664	3202	4664	3202	3202	6438	9377
MAC-d PDU size	Bits	336	336	336	336	336	336	336	336	336	336
Number Code Blocks	Blocks	1	1	1	1	1	1	1	1	2	2
Binary Channel Bits Per TTI	Bits	4800	7680	4800	7680	4800	7680	4800	4800	9600	15360
Total Available SML's in UE	SML's	19200	19200	28800	28800	57600	57600	14400	28800	115200	115200
Number of SML's per HARQ Proc.	SML's	9600	9600	9600	9600	9600	9600	7200	9600	19200	19200
Coding Rate		0.67	0.61	0.67	0.61	0.67	0.61	0.67	0.67	0.67	0.61
Number of Physical Channel Codes	Codes	5	4	5	4	5	4	5	5	10	8
Modulation		QPSK	16QAM	QPSK	16QAM	QPSK	16QAM	QPSK	QPSK	QPSK	16QAM

Notes:

1. The HS-DSCH shall be transmitted continuous with constant power but only every third TTI shall be allocated to the UE under test.
2. The HS-DSCH shall be transmitted continuous with constant power but only every second TTI shall be allocated to the UE under test.
3. This FRC is used to verify the minimum inter-TTI distance for UE category 11. The HS-PDSCH shall be transmitted continuously with constant power. The six sub-frame HS-SCCH signalling pattern shall repeat as follows:
   …OOXOXOOOXOXO…,
   where 'X' marks TTI in which HS-SCCH uses the identity of the UE under test and 'O' marks TTI in which HS-SCCH uses a different identity.
4. This FRC is used to verify the minimum inter-TTI distance for UE category 12. The HS-PDSCH shall be transmitted continuously with constant power. The six sub-frame HS-SCCH signalling pattern shall repeat as follows:
   …OOXXXOOOXXXO…,
   where 'X' marks TTI in which HS-SCCH uses the identity of the UE under test and 'O' marks TTI in which HS-SCCH uses a different identity.

Table 27: Summary of Fixed Reference Channel H-Set 1 to 6 (Summary of Table C.8.1.1, Table C.8.1.2, Table C.8.1.3, Table C.8.1.4, Table C.8.1.5 and Table C.8.1.6 of TS 34.121 [1])

4.2 Demodulation of HS-DSCH (Fixed Reference Channel): Single Link Performance – QPSK/16QAM, Fixed Reference Channel (FRC) H-Set 1/2/3 (9.2.1A)

The receiver single link performance HS-DSCH in different multi-path fading environments is determined by the information bit throughput *R*. The test will verify the ability of the receiver to receive and not degrade the specified HSDPA throughput performance with a multi-path fading channel test signal. Besides, the test stresses the multicode reception and channel decoding with incremental redundancy. The test applies to all FDD UE of Release 5 and later releases that support HSDPA UE categories 1 to 6.

The test requires an external multi-path fading simulator, e.g. R&S®SMU200A to generate multi-path fading signal with PA3, PB3, VA30 and VA120. The test is recommended to be performed remotely. Detail setup information on R&S®SMU200A and remote control via CMUgo are available in application notes [5] and [6].

Table 28, 29, 30 and 31 show the test parameters for testing QPSK FRC H-Set 1/2/3, test requirement for testing QPSK FRC H-Set 1/2/3, test parameters for testing 16QAM FRC H-Set 1/2/3 and test requirement for testing 16QAM FRC H-Set 1/2/3 respectively. The reference value *R* is for the FRC H-Set 1 in Table 29 and Table 31. For FRC H-Set 2 and H-Set 3 in Table 29 and Table 31 the reference values *R* should be scaled (multiplied by 1.5 and 3 respectively, and rounding to the nearest integer T-put in kbps, where values of i+1/2 are rounded up to i+1, i is integer). The measured throughput shall meet or exceed the specified throughput in Table 29 and Table 31 for FRC H-Set 1/2/3 specified in Table 27 with additional parameters in Table 28 and Table 30.

Test parameters for testing QPSK FRC H-Set 1/2/3/4/5/6						
Parameter	**Unit**	**Test 1**	**Test 2**	**Test 3**	**Test 4**	**Test 5**
Phase reference		P-CPICH				
Ioc	dBm/3.84 MHz	-60				
Redundancy and constellation version coding sequence		{0,2,5,6}				
Maximum number of HARQ transmission		4				

Note: The HS-SCCH-1 and HS-PDSCH shall be transmitted continuously with constant power. HS-SCCH-1 shall only use the identity of the UE under test for those TTI intended for the UE.

Table 28: Test parameters for testing QPSK FRC H-Set 1/2/3/4/5/6 (Table 9.2.1A.1, Table 9.2.1B.1, Table 9.2.1C.1, Table 9.2.1C.5, Table 9.2.1D.1, Table 9.2.1E.1, Table 9.2.1E.5, Table 9.2.1F.1, Table 9.2.1F.5 , Table 9.2.1G.1 and Table 9.2.1G.7 of TS 34.121 [1])

Test requirement QPSK, Fixed Reference Channel (FRC) H-Set 1/2/3				
Test number	**Propagation conditions**	**Referemce value**		
		HS-PDSCH Ec/Ior (dB)	**T-put *R* (kbps) Ior/Ioc = 0.6 dB**	**T-put *R* (kbps) Ior/Ioc = 10.6 dB**
1	PA3	-5.9	65	309
		-2.9	N/A	423
2	PB3	-5.9	23	181
		-2.9	138	287
3	VA30	-5.9	22	190
		-2.9	142	295
4	VA120	-5.9	13	181
		-2.9	140	275

Table 29: Test requirement QPSK, Fixed Reference Channel (FRC) H-Set 1/2/3 (Table 9.2.1A.6 of TS 34.121 [1])

Test parameters for testing 16QAM FRC H-Set 1/2/3/6						
Parameter	**Unit**	**Test 1**	**Test 2**	**Test 3**	**Test 4**	**Test 5**
Phase reference		P-CPICH				
Ioc	dBm/3.84 MHz	-60				
Redundancy and constellation version coding sequence		{6,2,1,5}				
Maximum number of HARQ transmission		4				

Note: The HS-SCCH-1 and HS-PDSCH shall be transmitted continuously with constant power. HS-SCCH-1 shall only use the identity of the UE under test for those TTI intended for the UE.

Table 30: Test parameters for testing 16QAM FRC H-Set 1/2/3/6 (Table 9.2.1A.3, Table 9.2.1C.3, Table 9.2.1C.7, Table 9.2.1D.3, Table 9.2.1E.3, Table 9.2.1E.7, Table 9.2.1F.3 and Table 9.2.1G.4 of TS 34.121 [1])

Test requirement 16QAM, Fixed Reference Channel (FRC) H-Set 1/2/3			
Test number	**Propagation conditions**	**Referemce value**	
		HS-PDSCH Ec/Ior (dB)	**T-put *R* (kbps) Ior/Ioc = 10.6 dB**
1	PA3	-5.9	198
		-2.9	368
2	PB3	-5.9	34
		-2.9	219
3	VA30	-5.9	47
		-2.9	214
4	VA120	-5.9	28
		-2.9	167

Table 31: Test requirement 16QAM, Fixed Reference Channel (FRC) H-Set 1/2/3 (Table 9.2.1A.8 of TS 34.121 [1])

Configuration in R&S®CMU200:
BS Signal → HSDPA HS-DSCH → Channel Configuration Type → Fixed Reference Channel
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 1 QPSK (Category 1 and 2), H-Set 2 QPSK (Category 3 and 4), H-Set 3 QPSK (Category 5 and 6), or H-Set 1 16QAM (Category 1 and 2), H-Set 2 16QAM (Category 3 and 4) or H-Set 3 16QAM (Category 5 and 6)
BS Signal → Downlink Physical Channels → HS-PDSCH → Level (All Active Codes) → -5.9 dB or -2.9 dB
BS Signal → Node-B Settings → Output Channel Power (Ior) → -59.4 dBm (Ioc/Ioc = 0.6 dB) or -49.4 dB (Ior/Ioc = 10.6 dB)
BS Signal → Node-B Settings → AWGN Noise Pwr. (@3.84 MHz, Ioc) → Off

A HSDPA call is configured in R&S®CMU200 as specified in section 4.1. FRC H-Set 1/2/3 QPSK or H-Set 1/2/3 16QAM is configured in R&S®CMU200 according to Table 26(a) by referring to Figure 5. Downlink physical channels in Table 5(a) are configured in R&S®CMU200 by referring to Figure 6 as initial conditions for HSDPA connection setup. A HSDPA call is established. PRBS15 is configured in R&S®CMU200 as shown in Figure 28.

Configuration in R&S®CMU200:
BS Signal → HSDPA HS-DSCH → Data Pattern → PRBS15

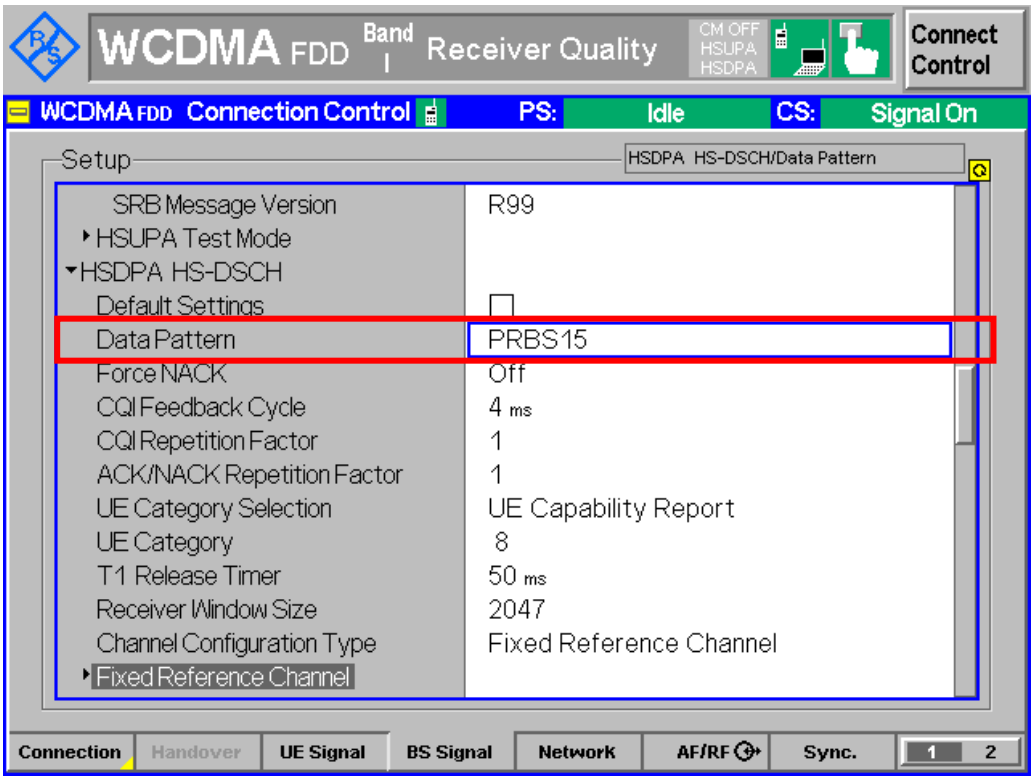


Figure 28: PRBS configuration

Once HSDPA connection is setup, downlink physical channels are configured in R&S®CMU200 according to Table 32. Table 32 shows the summary of level set to be configured in downlink physical channels for test requirement in Table 29 and Table 31. Detail of level set is specified in Table 25. Fader and AWGN noise source are configured in R&S®SMU200A according to Table 29 and Table 31.

Level set for test requirement of single link performance, QPSK/16QAM FRC H-Set 1/2/3				
Test number	**Propagation conditions**	**HS-PDSCH Ec/Ior (dB)**	**QPSK FRC H-Set 1/2/3 Ior/Ioc = 0.6 dB**	**QPSK/16QAM FRC H-Set 1/2/3 Ior/Ioc = 10.6 dB**
1	PA3	-5.9	Level set 1	Level set 2
		-2.9	N/A	Level set 3
2	PB3	-5.9	Level set 2	Level set 2
		-2.9	Level set 3	Level set 3
3	VA30	-5.9	Level set 2	Level set 2
		-2.9	Level set 3	Level set 3
4	VA120	-5.9	Level set 2	Level set 2
		-2.9	Level set 3	Level set 3

Table 32: Level set for test requirement of single link performance, QPSK/16QAM FRC H-Set 1/2/3

Table 33 and Table 34 show the statistical test requirement for demodulation of HS-DSCH QPSK H-Set 1/2/3 and 16QAM H-Set 1/2/3 respectively.

Single link performance for test case 9.2.1A, 9.2.1C and 9.2.1F demodulation of HS-DSCH (QPSK, H-Set 1/2/3)							
Single link performance **QPSK H-Set 1/2/3** **Test number**	**H-Set 1 Absolute test requirement (kbps)**		**Relative test requirement (normalized to ideal= 534 kbps for H-Set 1)** **No of events / No of samples in %** **BT → (RT)**	**Test limit expressed as No of events / min No of samples for H-Set 1/ 2/3** **(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**
1 (Ior/Ioc = 0 dB)	PA3	65	87.82%→ (12.18%)	60/595 (m = 1 / 1.5)	N/A	164s (fading)	RT
2 (Ior/Ioc = 0 dB)	PB3	23	95.69% → (4.31%)	64/1796 (m = 1/1.5)	N/A	164s (fading)	RT
		138	74.14%→ (25.86%)	58/268 (m = 0.682)	N/A	164s(fading)	RT
3 (Ior/Ioc = 0 dB)	VA30	22	95.9%→ (4.1%)	64/1888 (m=1/1.5)	N/A	16.4s(fading)	RT
		142	73.4%→ (26.6%)	59/264 (m = 0.684)	N/A	16.4s(fading)	RT
4 (Ior/Ioc = 0 dB)	VA120	13	97.564%→ (2.436%)	63/3224 (m = 1/1.5)	3224 (≥ 63)	H-set 1: 19.5s(stat) H-set 2: 13s (stat) H-set 3: 6.5s (stat)	RT
		140	73.77%→ (26.23%)	59/268 (m = 0.683)	N/A	4.1s(fading)	RT
1 (Ior/Ioc = 10 dB)	PA3	309	42.1%	83/171 (M = 1.295)	N/A	164s (fading)	BL
		423	20.74%	60/237 (M = 1.445)	N/A	164s (fading)	BL
2 (Ior/Ioc = 10 dB)	PB3	181	66.1%→ (33.9%)	62/215 (m = 0.703)	N/A	164s (fading)	RT
		287	46.22%→ (53.78%)	84/176 (m = 0.77)	N/A	164s(fading)	RT
3 (Ior/Ioc = 10 dB)	VA30	190	64.4%→ (35.6%)	64/211 (m = 0.708)	N/A	16.4s(fading)	RT
		295	44.72% → (55.28%)	85/173 (m = 0.775)	N/A	16.4s(fading)	RT
4 (Ior/Ioc = 10 dB)	VA120	181	66.1%→ (33.9%)	62/215 (m = 0.703)	N/A	4.1s(fading)	RT
		275	48.5%→ (51.5%)	79/174 (m = 0.761)	N/A	4.1s(fading)	RT

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

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

Table 33: Single link performance for test case 9.2.1A, 9.2.1C and 9.2.1F demodulation of HS-DSCH (QPSK, H-Set 1/2/3) (Table F.6.3.5.2.1 of TS 34.121 [1])

Single link performance for test case 9.2.1A and 9.2.1C demodulation of HS-DSCH (16QAM, H-Set 1/2/3)							
Single link performance **16QAM H-Set 1/2/3** **Test number**	**H-Set 1 Absolute test requirement (kbps)**		**Relative test requirement (normalized to ideal= 534 kbps for H-Set 1)** **No of events / No of samples in %** **BT → (RT)**	**Test limit expressed as No of events / min No of samples for H-Set 1/ 2/3** **(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**
1 (Ior/Ioc = 10 dB)	PA3	198	74.53%→ (25.47%)	58/272 (m=0.681)	N/A	164s (fading)	RT
		368	52.66%→ (47.34%)	74/179 m=0.746	N/A	164s(fading)	RT
2 (Ior/Ioc = 10 dB)	PB3	34	95.626%→ (4.374%)	64/1770 (m=1/1.5)	N/A	164s (fading)	RT
		219	71.83% → (28.17%)	58/240 (m=0.687)	N/A	164s (fading)	RT
3 (Ior/Ioc = 10 dB)	VA30	47	93.95% → (6.05%)	63/1259 (m=1/1.5)	N/A	16.4s (fading)	RT
		214	72.47% → (27.53%)	59/255 (m=0.686)	N/A	16.4s (fading)	RT
4 (Ior/Ioc = 10 dB)	VA120	28	96.4% → (3.6%)	64/2150 (m=1/1.5)	2150 (≥ 64)	12.9s H-set1 8.6s H-set2 4.3s Hset3 (stat)	RT
		167	78.51% → (21.49%)	57/319 (m=0.673)	N/A	4.1s (fading)	RT

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

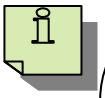
- In the BLER (BL) test mode the ratio No of errors/ No of samples is recorded. In this mode a pass is below the test limit.
- In the Relative Throughput (RT) test mode (1 - BLER) the ratio No of successes/ No of samples is recorded. In this mode a pass is above the test limit.
- The test mode used is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

Table 34: Single link performance for test case 9.2.1A and 9.2.1C demodulation of HS-DSCH (16QAM, H-Set 1/2/3) (Table F.6.3.5.2.2 of TS 34.121 [1])

Measurement result for measured throughput, BL test mode and RT test mode of single link HS-DSCH demodulation (QPSK/16QAM FRC H-Set 1/2/3) is available in *HSDPA ACK* in R&S®CMU200.

Configuration in R&S®CMU200:
Menus → Receiver Quality → Applic. 1 → HSDPA ACK
HSDPA ACK → Measure Subframes → ≥ min no of samples (when Repetition is set to Single Shot)

Figure 27 shows the measured throughput, BL test mode and RT test mode of single link HS-DSCH demodulation measurement result.



For QPSK FRC H-Set 1/2/3, Ior/Ioc = 0.6 dB, recall LevSet1.sav, LevSet2.sav or LevSet3.sav according to Table 32 and establish CS call.
Modify the H-Set selection according to UE category.
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 1 QPSK, H-Set 2 QPSK or H-Set 3 QPSK

For QPSK/16QAM FRC H-Set 1/2/3, Ior/Ioc = 10.6 dB, recall LevSet2.sav or LevSet3.sav according to Table 32 and establish CS call.
Modify the H-Set selection according to UE category.
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 1 QPSK, H-Set 2 QPSK or H-Set 3 QPSK, H-Set 1 16QAM, H-Set 2 16QAM or H-Set 3 16QAM
Modify the following configuration:
BS Signal → Node-B Settings → Output Channel Power (Ior) → -49.4 dB

The measurement result is available at:
Menus → Receiver Quality → Applic. 1 → HSDPA ACK

4.3 Demodulation of HS-DSCH (Fixed Reference Channel): Single Link Performance – QPSK, Fixed Reference Channel (FRC) H-Set 4/5 (9.2.1B)

The receiver single link performance HS-DSCH in different multi-path fading environments is determined by the information bit throughput *R*. The test will verify the ability of the receiver to receive and not degrade the specified HSDPA throughput performance with a multi-path fading channel test signal. Besides, the test stresses the multicode reception and channel decoding with incremental redundancy. The test applies to all FDD UE of Release 5 and later releases that support HSDPA UE categories 11 or 12.

The test requires an external multi-path fading simulator, e.g. R&S®SMU200A to generate multi-path fading signal with PA3, PB3, VA30 and VA120. The test is recommended to be performed remotely. Detail setup information on R&S®SMU200A and remote control via CMUgo are available in application notes [5] and [6].

Table 28, 35 and 36 show the test parameters for testing QPSK FRC H-Set 4/5, test requirement for testing QPSK FRC H-Set 4 and test requirement for testing QPSK FRC H-Set 5 respectively. The reference value *R* is for FRC H-Set 4/5 in Table 35 and Table 36 respectively. The measured throughput shall meet or exceed the specified throughput in Table 35 and Table 36 for FRC H-Set 4/5 specified in Table 27 with additional parameters in Table 28.

Test requirement QPSK, Fixed Reference Channel (FRC) H-Set 4				
Test number	**Propagation conditions**	**Referemce value**		
		HS-PDSCH Ec/Ior (dB)	**T-put *R* (kbps) Ior/Ioc = 0.6 dB**	**T-put *R* (kbps) Ior/Ioc = 10.6 dB**
1	PA3	-5.9	72	340
		-2.9	N/A	439
2	PB3	-5.9	24	186
		-2.9	142	299
3	VA30	-5.9	19	183
		-2.9	148	306
4	VA120	-5.9	11	170
		-2.9	144	284

Note: The reference value *R* is for the FRC H-Set 4

Table 35: Test requirement QPSK, Fixed Reference Channel (FRC) H-Set 4 (Table 9.2.1B.5 of TS 34.121 [1])

Test requirement QPSK, Fixed Reference Channel (FRC) H-Set 5				
Test number	**Propagation conditions**	**Referemce value**		
		HS-PDSCH Ec/Ior (dB)	**T-put *R* (kbps) Ior/Ioc = 0.6 dB**	**T-put *R* (kbps) Ior/Ioc = 10.6 dB**
1	PA3	-5.9	98	464
		-2.9	N/A	635
2	PB3	-5.9	35	272
		-2.9	207	431
3	VA30	-5.9	33	285
		-2.9	213	443
4	VA120	-5.9	20	272
		-2.9	210	413

Note: The reference value *R* is for the FRC H-Set 5

Table 36: Test requirement QPSK, Fixed Reference Channel (FRC) H-Set 5 (Table 9.2.1B.6 of TS 34.121 [1])

Configuration in R&S®CMU200:

BS Signal → HSDPA HS-DSCH → Channel Configuration Type → Fixed Reference Channel

BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 4 QPSK (Category 11) or H-Set 5 QPSK (Category 12)

BS Signal → Downlink Physical Channels → HS-PDSCH → Level (All Active Codes) → -5.9 dB or -2.9 dB

BS Signal → Node-B Settings → Output Channel Power (Ior) → -59.4 dBm (Ioc/Ioc = 0.6 dB) or -49.4 dB (Ior/Ioc = 10.6 dB)

BS Signal → Node-B Settings → AWGN Noise Pwr. (@3.84 MHz, Ioc) → Off

A HSDPA call is configured in R&S®CMU200 as specified in section 4.1. FRC H-Set 4/5 QPSK is configured in R&S®CMU200 according to Table 26(a) by referring to Figure 5. Downlink physical channels in Table 5(a) are configured in R&S®CMU200 by referring to Figure 6 as initial conditions for HSDPA connection setup. A HSDPA call is established. PRBS15 is configured in R&S®CMU200 as shown in Figure 28.

Once HSDPA connection is setup, downlink physical channels are configured in R&S®CMU200 according to Table 37. Table 37 shows the summary of level set to be configured in downlink physical channels for test requirement in Table 35 and Table 36. Detail of level set is specified in Table 25. Fader and AWGN noise source are configured in R&S®SMU200A according to Table 35 and Table 36.

Level set for test requirement of single link performance, QPSK FRC H-Set 4/5				
Test number	**Propagation conditions**	**HS-PDSCH Ec/Ior (dB)**	**QPSK FRC H-Set 4/5 Ior/Ioc = 0.6 dB**	**QPSK FRC H-Set 4/5 Ior/Ioc = 10.6 dB**
1	PA3	-5.9	Level set 1	Level set 2
		-2.9	N/A	Level set 3
2	PB3	-5.9	Level set 2	Level set 2
		-2.9	Level set 3	Level set 3
3	VA30	-5.9	Level set 2	Level set 2
		-2.9	Level set 3	Level set 3
4	VA120	-5.9	Level set 2	Level set 2
		-2.9	Level set 3	Level set 3

Table 37: Level set for test requirement of single link performance, QPSK FRC H-Set 4/5

Table 38 and Table 39 show the statistical test requirement for demodulation of HS-DSCH QPSK H-Set 4 and H-Set 5 respectively.

Single link performance for test case 9.2.1B demodulation of HS-DSCH (QPSK H-Set 4)							
Single link performance **QPSK H-Set 4** **Test number**	**Absolute test requirement (kbps)**		**Relative test requirement (normalized to ideal= 534 kbps)** **No of events / No of samples in % BT → (RT)**	**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**
1 (Ior/Ioc = 0 dB)	PA3	72	86.5% → (13.5%)	59/528 (m=1/1.5)	N/A	164s (fading)	RT
2 (Ior/Ioc = 0 dB)	PB3	24	95.5% → (4.5%)	63/1695 (m=1/1.5)	N/A	164s (fading)	RT
		142	73.4% → (26.6%)	59/264 (m=0.684)	N/A	164s (fading)	RT
3 (Ior/Ioc = 0 dB)	VA30	19	96.44% → (3.56%)	64/2176 (m=1/1.5)	N/A	16.4s (fading)	RT
		148	72.27% → (27.73%)	59/253 (m=0.686)	N/A	16.4s (fading)	RT
4 (Ior/Ioc = 0 dB)	VA120	11	98% → (2%)	65/3746 (m=1/1.5)	3746 (≥ 65)	22.5s (stat)	RT
		144	73% → (27%)	58/256 (m=0.684)	N/A	4.1s (fading)	RT
1 (Ior/Ioc = 10 dB)	PA3	340	36.29%	75/177 (M=1.334)	N/A	164s (fading)	BL
		439	17.74%	58/266 (M=1.468)	N/A	164s (fading)	BL
2 (Ior/Ioc = 10 dB)	PB3	186	65.15% → (34.85%)	62/209 (m=0.705)	N/A	164s (fading)	RT
		299	44% → (56%)	87/174 (m=0.778)	N/A	164s(fading)	RT
3 (Ior/Ioc = 10 dB)	VA30	183	65.7% →(34.3%)	63/216 (m=0.704)	N/A	16.4s (fading)	RT
		306	42.66%	86/176 (M=1.291)	N/A	16.4s (faging)	BL
4 (Ior/Ioc = 10 dB)	VA120	170	68.14% → (31.86%)	61/226 (m=697)	N/A	4.1s (fading)	RT
		284	46.78%→ (53.22%)	81/172 (m = 0.767)	N/A	4.1s (fading)	RT

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

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

Table 38: Single link performance for test case 9.2.1B demodulation of HS-DSCH (QPSK H-Set 4) (Table F.6.3.5.2.3 of TS 34.121 [1])

Demodulation of HS-DSCH (Fixed Reference Channel): Single Link Performance – QPSK, Fixed Reference Channel (FRC) H-Set 4/5 (9.2.1B)

Single link performance for test case 9.2.1B demodulation of HS-DSCH (QPSK H-Set 5)							
Single link performance **QPSK H-Set 5** **Test number**	**Absolute test requirement (kbps)**		**Relative test requirement (normalized to ideal= 801 kbps)** **No of events / No of samples in % BT → (RT)**	**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**
1 (Ior/Ioc = 0 dB)	PA3	98	87.76% → (12.24%)	59/583 (m=1/1.5)	N/A	164s (fading)	RT
2 (Ior/Ioc = 0 dB)	PB3	35	95.63% → (4.37%)	63/1746 (m=1/1.5)	N/A	164s (fading)	RT
		207	74.14% → (25.86%)	58/268 (m=0.682)	N/A	164s (fading)	RT
3 (Ior/Ioc = 0 dB)	VA30	33	95.88% → (4.12%)	64/1879 (m=1/1.5)	N/A	16.4s (fading)	RT
		213	73.4% → (26.6%)	59/264% (m=0.684)	N/A	16.2s (fading)	RT
4 (Ior/Ioc = 0 dB)	VA120	20	97.5% → (2.5%)	64/3101 (m=1/1.5)	3101 (≥ 64)	12.4s (stat)	RT
		210	73.77% → (26.23%)	59/268 (m=0.683)	N/A	4.1s (fading)	RT
1 (Ior/Ioc = 10 dB)	PA3	464	42%	84/174 (M=1.295)	N/A	164s (fading)	BL
		635	20.67%	59/234 (M=1.446)	N/A	164s (fading)	BL
2 (Ior/Ioc = 10 dB)	PB3	272	66.02% → (33.98%)	63/218 (m=0.703)	N/A	164s (fading)	RT
		431	46.16% → (53.84)	84/176 (m=0.77)	N/A	164s(fading)	RT
3 (Ior/Ioc = 10 dB)	VA30	285	64.4% → (35.6%)	64/211 (m=0.708)	N/A	16.4s (fading)	RT
		443	44.7% → (55.3%)	85/173 (m=0.775)	N/A	16.4s(fading)	RT
4 (Ior/Ioc = 10 dB)	VA120	272	66.02% → (33.98%)	63/218 (m=0.703)	N/A	4.1s (fading)	RT
		413	48.4% → (51.6%)	81/176 (m=0.761)	N/A	4.1s(fading)	RT

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

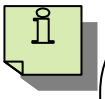
- In the BLER (BL) test mode the ratio No of errors/ No of samples is recorded. In this mode a pass is below the test limit.
- In the Relative Throughput (RT) test mode (1 - BLER) the ratio No of successes/ No of samples is recorded. In this mode a pass is above the test limit.
- The test mode used is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

Table 39: Single link performance for test case 9.2.1B demodulation of HS-DSCH (QPSK H-Set 5) (Table F.6.3.5.2.4 of TS 34.121 [1])

Measurement result for measured throughput, BL test mode and RT test mode of single link HS-DSCH demodulation (QPSK FRC H-Set 4/5) is available in *HSDPA ACK* in R&S®CMU200.

Configuration in R&S®CMU200:
Menus → Receiver Quality → Applic. 1 → HSDPA ACK
HSDPA ACK → Measure Subframes → ≥ min no of samples (when Repetition is set to Single Shot)

Figure 27 shows the measured throughput, BL test mode and RT test mode of single link HS-DSCH demodulation measurement result.



For QPSK FRC H-Set 4/5, Ior/Ioc = 0.6 dB, recall LevSet1.sav, LevSet2.sav or LevSet3.sav according to Table 37 and establish CS call.
Modify the H-Set selection according to UE category.
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 4 QPSK or H-Set 5 QPSK

For QPSK FRC H-Set 4/5, Ior/Ioc = 10.6 dB, recall LevSet2.sav or LevSet3.sav according to Table 37 and establish CS call.
Modify the H-Set selection according to UE category.
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 4 QPSK or H-Set 5 QPSK
Modify the following configuration:
BS Signal → Node-B Settings → Output Channel Power (Ior) → -49.4 dB

The measurement result is available at:
Menus → Receiver Quality → Applic. 1 → HSDPA ACK

4.4 Demodulation of HS-DSCH (Fixed Reference Channel): Single Link Performance – QPSK/16QAM, Fixed Reference Channel (FRC) H-Set 6/3 (9.2.1C)

The receiver single link performance HS-DSCH in different multi-path fading environments is determined by the information bit throughput *R*. The test will verify the ability of the receiver to receive and not degrade the specified HSDPA throughput performance with a multi-path fading channel test signal. Besides, the test stresses the multicode reception and channel decoding with incremental redundancy. The test applies to all FDD UE of Release 6 and later releases that support HSDPA UE categories 7 to 10 but not supporting the optional enhanced performance requirement types 1, 2 or 3.

The test requires an external multi-path fading simulator, e.g. R&S®SMU200A to generate multi-path fading signal with PA3, PB3, VA30 and VA120. The test is recommended to be performed remotely. Detail setup information on R&S®SMU200A and remote control via CMUgo are available in application notes [5] and [6].

Table 28, 30, 40, 41, 42 and 43 show the test parameters for testing QPSK FRC H-Set 6/3, test parameters for testing 16QAM FRC H-Set 6/3, test requirement for testing QPSK FRC H-Set 6, test requirement for testing 16QAM FRC H-Set 6, test requirement for testing QPSK FRC H-Set 3 and test requirement for testing 16QAM FRC H-Set 3 respectively. The reference value *R* in Table 42 and Table 43 is for FRC H-Set 1. For FRC H-Set 3 the reference values *R* in Table 42 and Table 43 should be scaled (multiplied by 3 and rounding to the nearest integer T-put in kbps, where values of i+1/2 are rounded up to i+1, i is integer). The measured throughput shall meet or exceed the specified throughput in Table 40, Table 41, Table 42 and Table 43 for FRC H-Set 6/3 specified in Table 27 with additional parameters in Table 28 and Table 30.

Test requirement QPSK, Fixed Reference Channel (FRC) H-Set 6			
Test number	**Propagation conditions**	**Referemce value**	
		HS-PDSCH Ec/Ior (dB)	**T-put *R* (kbps) Ior/Ioc = 10.6 dB**
1	PA3	-5.9	1407
		-2.9	2090

Table 40: Test requirement QPSK, Fixed Reference Channel (FRC) H-Set 6 (Table 9.2.1C.10 of TS 34.121 [1])

Test requirement 16QAM, Fixed Reference Channel (FRC) H-Set 6			
Test number	**Propagation conditions**	**Referemce value**	
		HS-PDSCH Ec/Ior (dB)	**T-put *R* (kbps) Ior/Ioc = 10.6 dB**
1	PA3	-5.9	887
		-2.9	1664

Table 41: Test requirement 16QAM, Fixed Reference Channel (FRC) H-Set 6 (Table 9.2.1C.12 of TS 34.121 [1])

Test requirement QPSK, Fixed Reference Channel (FRC) H-Set 3				
Test number	Propagation conditions	Referemce value		
		HS-PDSCH Ec/Ior (dB)	T-put *R* (kbps) Ior/Ioc = 0.6 dB	T-put *R* (kbps) Ior/Ioc = 10.6 dB
2	PB3	-5.9	23	181
		-2.9	138	287
3	VA30	-5.9	22	190
		-2.9	142	295
4	VA120	-5.9	13	181
		-2.9	140	275

Table 42: Test requirement QPSK, Fixed Reference Channel (FRC) H-Set 3 (Table 9.2.1C.14 of TS 34.121 [1])

Test requirement 16QAM, Fixed Reference Channel (FRC) H-Set 3			
Test number	Propagation conditions	Referemce value	
		HS-PDSCH Ec/Ior (dB)	T-put *R* (kbps) Ior/Ioc = 10.6 dB
2	PB3	-5.9	34
		-2.9	219
3	VA30	-5.9	47
		-2.9	214
4	VA120	-5.9	28
		-2.9	167

Table 43: Test requirement 16QAM, Fixed Reference Channel (FRC) H-Set 3 (Table 9.2.1C.16 of TS 34.121 [1])

Configuration in R&S®CMU200:
BS Signal → HSDPA HS-DSCH → Channel Configuration Type → Fixed Reference Channel
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 6 QPSK, H-Set 3 QPSK, H-Set 6 16QAM or H-Set 3 16QAM
BS Signal → Downlink Physical Channels → HS-PDSCH → Level (All Active Codes) → -5.9 dB or -2.9 dB
BS Signal → Node-B Settings → Output Channel Power (Ior) → -59.4 dBm (Ioc/Ioc = 0.6 dB) or -49.4 dB (Ior/Ioc = 10.6 dB)
BS Signal → Node-B Settings → AWGN Noise Pwr. (@3.84 MHz, Ioc) → Off

A HSDPA call is configured in R&S®CMU200 as specified in section 4.1. FRC H-Set 6/3 QPSK/16QAM is configured in R&S®CMU200 according to Table 26(a) by referring to Figure 5. Downlink physical channels in Table 5(a) are configured in R&S®CMU200 by referring to Figure 6 as initial conditions for HSDPA connection setup. A HSDPA call is established. PRBS15 is configured in R&S®CMU200 as shown in Figure 28.

Once HSDPA connection is setup, downlink physical channels are configured in R&S®CMU200 according to Table 44. Table 44 shows the summary of level set to be configured in downlink physical channels for test requirement in Table 40 to Table 43. Detail of level set is specified in Table 25. Fader and AWGN noise source are configured in R&S®SMU200A according to Table 40 to Table 43.

Level set for test requirement of single link performance, QPSK/16QAM FRC H-Set 6/3					
Test number	**Propagation conditions**	**HS-PDSCH Ec/Ior (dB)**	**QPSK/16QAM FRC H-Set 6 Ior/Ioc = 10.6 dB**	**QPSK FRC H-Set 3 Ior/Ioc = 0.6 dB**	**QPSK/16QAM FRC H-Set 3 Ior/Ioc = 10.6 dB**
1	PA3	-5.9	Level set 2	N/A	N/A
		-2.9	Level set 3	N/A	N/A
2	PB3	-5.9	N/A	Level set 2	Level set 2
		-2.9	N/A	Level set 3	Level set 3
3	VA30	-5.9	N/A	Level set 2	Level set 2
		-2.9	N/A	Level set 3	Level set 3
4	VA120	-5.9	N/A	Level set 2	Level set 2
		-2.9	N/A	Level set 3	Level set 3

Table 44: Level set for test requirement of single link performance, QPSK/16QAM FRC H-Set 6/3

Table 33, Table 34, Table 45 and Table 46 show the statistical test requirement for demodulation of HS-DSCH QPSK H-Set 3, 16QAM H-Set 3, QPSK H-Set 6 and 16QAM H-Set 6 respectively.

Single link performance for test case 9.2.1C demodulation of HS-DSCH (QPSK H-Set 6)							
Single link performance **QPSK H-Set 6** **Test number**	**Absolute test requirement (kbps)**		**Relative test requirement (normalized to ideal= 3219 kbps)** **No of events / No of samples in % BT → (RT)**	**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**
1 (Ior/Ioc = 10 dB)	PA3	1407	56.29% → (43.71%)	70/185	N/A	164s (fading)	RT
		2090	35.07% → (64.93%)	73/179	N/A	164s (fading)	BL

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

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

Table 45: Single link performance for test case 9.2.1C demodulation of HS-DSCH (QPSK H-Set 6) (Table F.6.3.5.2.5 of TS 34.121 [1])

Single link performance for test case 9.2.1C demodulation of HS-DSCH (16QAM H-Set 6)							
Single link performance **16QAM H-Set 6** **Test number**	**Absolute test requirement (kbps)**		**Relative test requirement (normalized to ideal= 4689 kbps)** **No of events / No of samples in % BT → (RT)**	**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**
1 (Ior/Ioc = 10 dB)	PA3	887	81.08% → (18.92%)	56/362 (m = 0.669)	N/A	164s (fading)	RT
		1664	64.51% → (35.49%)	63/209 (m = 0.707)	N/A	164s (fading)	RT

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

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

Table 46: Single link performance for test case 9.2.1C demodulation of HS-DSCH (16QAM H-Set 6) (Table F.6.3.5.2.6 of TS 34.121 [1])

Measurement result for measured throughput, BL test mode and RT test mode of single link HS-DSCH demodulation (QPSK/16QAM FRC H-Set 6/3) is available in *HSDPA ACK* in R&S®CMU200.

Configuration in R&S®CMU200:
Menus → Receiver Quality → Applic. 1 → HSDPA ACK
HSDPA ACK → Measure Subframes → ≥ min no of samples (when Repetition is set to Single Shot)

Figure 27 shows the measured throughput, BL test mode and RT test mode of single link HS-DSCH demodulation measurement result.

For QPSK/16QAM FRC H-Set 6, Ior/Ioc = 10.6 dB, recall LevSet2.sav or LevSet3.sav according to Table 44 and establish CS call.
Modify the H-Set selection according to UE category.
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 6 QPSK or H-Set 6 16QAM
Modify the following configuration:
BS Signal → Node-B Settings → Output Channel Power (Ior) → -49.4 dB

For QPSK FRC H-Set 3, Ior/Ioc = 0.6 dB, recall LevSet2.sav or LevSet3.sav according to Table 44 and establish CS call.
Modify the H-Set selection according to UE category.
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 3 QPSK

For QPSK/16QAM FRC H-Set 3, Ior/Ioc = 10.6 dB, recall LevSet2.sav or LevSet3.sav according to Table 44 and establish CS call.
Modify the H-Set selection according to UE category.
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 3 QPSK or H-Set 3 16QAM
Modify the following configuration:
BS Signal → Node-B Settings → Output Channel Power (Ior) → -49.4 dB

The measurement result is available at:
Menus → Receiver Quality → Applic. 1 → HSDPA ACK

4.5 Demodulation of HS-DSCH (Fixed Reference Channel): Single Link Performance – Enhanced Performance Requirements Type 1 - QPSK/16QAM, Fixed Reference Channel (FRC) H-Set 1/2/3 (9.2.1D)

The receiver single link performance HS-DSCH in different multi-path fading environments is determined by the information bit throughput *R*. The test will verify the ability of the receiver to receive and not degrade the specified HSDPA throughput performance with a multi-path fading channel test signal. Besides, the test stresses the multicode reception and channel decoding with incremental redundancy. The test applies to all FDD UE of Release 6 and later releases that support HSDPA UE categories 1 to 6 and the optional enhanced performance requirements types 1.

The test requires an external multi-path fading simulator, e.g. R&S®SMU200A to generate multi-path fading signal with PA3, PB3, VA30 and VA120. The test is recommended to be performed remotely. Detail setup information on R&S®SMU200A and remote control via CMUgo are available in application notes [5] and [6].

Table 28, 30, 47 and 48 show the test parameters for testing QPSK H-Set 1/2/3, test parameters for testing 16QAM FRC H-Set 1/2/3, test requirement for testing enhanced requirement type 1 QPSK FRC H-Set 1/2/3 and test requirement for testing enhanced requirement type 1 16QAM FRC H-Set 1/2/3 respectively. The reference value *R* is for the FRC H-Set 1 in Table 47 and Table 48. For FRC H-Set 2 and H-Set 3 in Table 47 and Table 48 the reference values *R* should be scaled (multiplied by 1.5 and 3 respectively, and rounding to the nearest integer T-put in kbps, where values of i+1/2 are rounded up to i+1, i is integer). The measured throughput shall meet or exceed the specified throughput in Table 47 and Table 48 for FRC H-Set 1/2/3 specified in Table 27 with additional parameters in Table 28 and Table 30.

Test requirement enhanced requirement type 1 QPSK, Fixed Reference Channel (FRC) H-Set 1/2/3				
Test number	**Propagation conditions**	**Referemce value**		
		HS-PDSCH Ec/Ior (dB)	**T-put *R* (kbps) Ior/Ioc = 0.6 dB**	**T-put *R* (kbps) Ior/Ioc = 10.6 dB**
1	PA3	-11.9	N/A	247
		-8.9	N/A	379
		-5.9	195	N/A
		-2.9	329	N/A
2	PB3	-8.9	N/A	195
		-5.9	156	316
		-2.9	263	N/A
3	VA30	-8.9	N/A	212
		-5.9	171	329
		-2.9	273	N/A
4	VA120	-8.9	N/A	191
		-5.9	168	293
		-2.9	263	N/A

Table 47: Test requirement enhanced requirement type 1 QPSK, Fixed Reference Channel (FRC) H-Set 1/2/3 (Table 9.2.1D.6 of TS 34.121 [1])

Test requirement enhanced requirement type 1 16QAM, Fixed Reference Channel (FRC) H-Set 1/2/3			
Test number	**Propagation conditions**	**Referemce value**	
		HS-PDSCH Ec/Ior (dB)	**T-put *R* (kbps) Ior/Ioc = 10.6 dB**
1	PA3	-8.9	312
		-5.9	487
2	PB3	-5.9	275
		-2.9	408
3	VA30	-5.9	296
		-2.9	430
4	VA120	-5.9	271
		-2.9	392

Table 48: Test requirement enhanced requirement type 1 16QAM, Fixed Reference Channel (FRC) H-Set 1/2/3 (Table 9.2.1D.8 of TS 34.121 [1])

Configuration in R&S®CMU200:
BS Signal → HSDPA HS-DSCH → Channel Configuration Type → Fixed Reference Channel
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 1 QPSK (Category 1 and 2), H-Set 2 QPSK (Category 3 and 4), H-Set 3 QPSK (Category 5 and 6), or H-Set 1 16QAM (Category 1 and 2), H-Set 2 16QAM (Category 3 and 4) or H-Set 3 16QAM (Category 5 and 6)
BS Signal → Downlink Physical Channels → HS-PDSCH → Level (All Active Codes) → -11.9 dB, -8.9 dB, -5.9 dB or -2.9 dB
BS Signal → Node-B Settings → Output Channel Power (Ior) → -59.4 dBm (Ioc/Ioc = 0.6 dB) or -49.4 dB (Ior/Ioc = 10.6 dB)
BS Signal → Node-B Settings → AWGN Noise Pwr. (@3.84 MHz, Ioc) → Off
A HSDPA call is configured in R&S®CMU200 as specified in section 4.1. FRC H-Set 1/2/3 QPSK/16QAM is configured in R&S®CMU200 according to Table 26(b) by referring to Figure 5. Downlink physical channels in Table 5(a) are configured in R&S®CMU200 by referring to Figure 6 as initial conditions for HSDPA connection setup. A HSDPA call is established. PRBS15 is configured in R&S®CMU200 as shown in Figure 28.

Once HSDPA connection is setup, downlink physical channels are configured in R&S®CMU200 according to Table 49. Table 49 shows the summary of level set to be configured in downlink physical channels for test requirement in Table 47 and Table 48. Detail of level set is specified in Table 25. Fader and AWGN noise source are configured in R&S®SMU200A according to Table 47 and Table 48.

Level set for test requirement of single link performance – enhanced performance requirement type 1, QPSK/16QAM FRC H-Set 1/2/3					
Test number	**Propagation conditions**	**HS-PDSCH Ec/Ior (dB)**	**Enhanced requirement type 1 QPSK FRC H-Set 1/2/3 Ior/Ioc = 0.6 dB**	**Enhanced requirement type 1 QPSK FRC H-Set 1/2/3 Ior/Ioc = 10.6 dB**	**Enhanced requirement type 1 16QAM FRC H-Set 1/2/3 Ior/Ioc = 10.6 dB**
1	PA3	-11.9	N/A	Level set 5	N/A
		-8.9	N/A	Level set 4	Level set 4
		-5.9	Level set 1	N/A	Level set 2
		-2.9	Level set 3	N/A	N/A
2	PB3	-8.9	N/A	Level set 4	N/A
		-5.9	Level set 2	Level set 2	Level set 2
		-2.9	Level set 3	N/A	Level set 3
3	VA30	-8.9	N/A	Level set 4	N/A
		-5.9	Level set 2	Level set 2	Level set 2
		-2.9	Level set 3	N/A	Level set 3
4	VA120	-8.9	N/A	Level set 4	N/A
		-5.9	Level set 2	Level set 2	Level set 2
		-2.9	Level set 3	N/A	Level set 3

Table 49: Level set for test requirement of single link performance – enhanced performance requirement type 1, QPSK/16QAM FRC H-Set 1/2/3

Table 50 and Table 51 show the statistical test requirement for demodulation of HS-DSCH enhanced requirement type 1 QPSK H-Set 1/2/3 and 16QAM H-Set 1/2/3 respectively.

Single link performance for test case 9.2.1D and 9.2.1E demodulation of HS-DSCH (enhanced requirement type 1, QPSK H-Set 1/2/3)

Single link enhanced requirement type 1 performance QPSK H-Set 1/2/3 Test number	H-Set 1 Absolute test requirement (kbps)		Relative test requirement (normalized to ideal = 534 kbps for H-Set 1) No of events / No of samples in % BT → (RT)	Test limit expressed as No of events / min No of samples for H-Set 1, 2, 3 (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
1 (Ior/Ioc = 0 dB)	PA3	195	63.46% → (36.54%)	64/205 (m = 0.710)	N/A	164s (fading)	RT
		329	38.35% →(61.65%)	78/175 (M = 1.320)	N/A	164s (fading)	BL
2 (Ior/Ioc = 0 dB)	PB3	156	70.77% → (29.23%)	59/239 (m = 0.690)	N/A	164s (fading)	RT
		263	50.72% → (49.28%)	76/176 (m = 0.753)	N/A	164s (fading)	RT
3 (Ior/Ioc = 0 dB)	VA30	171	67.96% → (32.04%)	61/225 (m = 0.697)	N/A	16.4s(fading)	RT
		273	48.84% → (51.16%)	96/174 (M =1.252)	N/A	16.4s(fading)	BL
4 (Ior/Ioc = 0 dB)	VA120	168	68.52% → (34.48%)	60/228 (m = 0.696)	N/A	4.1s(fading)	RT
		263	50.72% → (49.28%)	76/176 (m = 0.753)	N/A	4.1s(fading)	RT
1 (Ior/Ioc = 10 dB)	PA3	247	53.72% → (46.28%)	72/180 (m = 0.742)	N/A	164s (fading)	RT
		379	28.95% → (71.02%)	66/193 (M = 1.386)	N/A	164s (fading)	BL
2 (Ior/Ioc = 10 dB)	PB3	195	63.46% → (36.54%)	63/204 (m = 0.710)	N/A	164s (fading)	RT
		316	40.79% → (59.21%)	81/172 (M = 1.303)	N/A	164s (fading)	BL
3 (Ior/Ioc = 10 dB)	VA30	212	60.27% → (39.73%)	66/194 (m = 0.720)	N/A	16.4s(fading)	RT
		329	38.35% → (61.65%)	78/175 (M = 1.320)	N/A	16.4s(fading)	BL
4 (Ior/Ioc = 10 dB)	VA120	191	64.21% → (35.79%)	63/208 (m = 0.708)	N/A	4.1s(fading)	RT
		293	45.10% → (54.90%)	89/173 (M = 1.275)	N/A	4.1s(fading)	BL

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

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

Table 50: Single link performance for test case 9.2.1D and 9.2.1E demodulation of HS-DSCH (enhanced requirement type 1, QPSK H-Set 1/2/3) (Table F.6.3.5.2.1A of TS 34.121 [1])

Single link performance for test case 9.2.1D and 9.2.1E demodulation of HS-DSCH (enhanced requirement type 1, 16QAM H-Set 1/2/3)							
Single link enhanced requirement type 1 performance **16QAM H-Set 1/2/3** **Test number**	**H-Set 1 Absolute test requirement (kbps)**		**Relative test requirement (normalized to ideal = 777 kbps for H-Set 1)** **No of events / No of samples in % BT → (RT)**	**Test limit expressed as No of events / min No of samples for H-Set 1, 2, 3** **(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**
1 (Ior/Ioc = 10 dB)	PA3	312	59.86% → (40.14%)	66/193 (m = 0.722)	N/A	164s (fading)	RT
		487	37.35% → (62.65)	76/176 (M = 1.327)	N/A	164s (fading)	BL
2 (Ior/Ioc = 10 dB)	PB3	275	64.62% → (35.38%)	63/209 (m = 0.707)	N/A	164s (fading)	RT
		408	47.51% → (52.49)	94/174 (M = 1.260)	N/A	164s (fading)	BL
3 (Ior/Ioc = 10 dB)	VA30	296	61.92% → (38.08%)	65/199 (m = 0.715)	N/A	16.4s (fading)	RT
		430	44.68% → (55.32%)	88/173 (M = 1.278)	N/A	16.4s (fading)	BL
4 (Ior/Ioc = 10 dB)	VA120	271	65.14% → (34.86%)	62/211 (m = 0.705)	N/A	4.1s (fading)	RT
		392	49.57% → (50.43%)	97/175	N/A	4.1s (fading)	BL

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

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

Table 51: Single link performance for test case 9.2.1D and 9.2.1E demodulation of HS-DSCH (enhanced requirement type 1, 16QAM H-Set 1/2/3) (Table F.6.3.5.2.2A of TS 34.121 [1])

Measurement result for measured throughput, BL test mode and RT test mode of single link HS-DSCH demodulation (enhanced requirement type 1 QPSK/16QAM FRC H-Set 1/2/3) is available in *HSDPA ACK* in R&S®CMU200.

Configuration in R&S®CMU200:
Menus → Receiver Quality → Applic. 1 → HSDPA ACK

Figure 27 shows the measured throughput, BL test mode and RT test mode of single link HS-DSCH demodulation measurement result.

For enhanced performance requirement type 1 QPSK FRC H-Set 1/2/3, Ior/Ioc = 0.6 dB, recall LevSet1.sav, LevSet2.sav or LevSet3.sav according to Table 49 and establish CS call.
Modify the H-Set selection according to UE category.
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 1 QPSK, H-Set 2 QPSK or H-Set 3 QPSK

For enhanced performance requirement type 1 QPSK FRC H-Set 1/2/3, Ior/Ioc = 10.6 dB, recall LevSet2.sav, LevSet4.sav or LevSet5.sav according to Table 49 and establish CS call.
Modify the H-Set selection according to UE category.
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 1 QPSK, H-Set 2 QPSK or H-Set 3 QPSK
Modify the following configuration:
BS Signal → Node-B Settings → Output Channel Power (Ior) → -49.4 dB

For enhanced performance requirement type 1 16QAM FRC H-Set 1/2/3, Ior/Ioc = 10.6 dB, recall LevSet2.sav, LevSet3.sav or LevSet4.sav according to Table 49 and establish CS call.
Modify the H-Set selection according to UE category.
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 1 16QAM, H-Set 2 16QAM or H-Set 3 16QAM
Modify the following configuration:
BS Signal → Node-B Settings → Output Channel Power (Ior) → -49.4 dB

The measurement result is available at:
Menus → Receiver Quality → Applic. 1 → HSDPA ACK

4.6 Demodulation of HS-DSCH (Fixed Reference Channel): Single Link Performance – Enhanced Performance Requirements Type 1 - QPSK/16QAM, Fixed Reference Channel (FRC) H-Set 6/3 (9.2.1E)

The receiver single link performance HS-DSCH in different multi-path fading environments is determined by the information bit throughput *R*. The test will verify the ability of the receiver to receive and not degrade the specified HSDPA throughput performance with a multi-path fading channel test signal. Besides, the test stresses the multicode reception and channel decoding with incremental redundancy. The test applies to all FDD UE of Release 6 and later releases that support HSDPA UE categories 7 to 10 and the optional enhanced performance requirements types 1.

The test requires an external multi-path fading simulator, e.g. R&S®SMU200A to generate multi-path fading signal with PA3, PB3, VA30 and VA120. The test is recommended to be performed remotely. Detail setup information on R&S®SMU200A and remote control via CMUgo are available in application notes [5] and [6].

Table 28, 30, 52, 53, 54 and 55 show the test parameters for testing QPSK H-Set 6/3, test parameters for testing 16QAM FRC H-Set 6/3, test requirement for testing enhanced requirement type 1 QPSK FRC H-Set 6, test requirement for testing enhanced requirement type 1 16QAM FRC H-Set 6, test requirement for testing enhanced requirement type 1 QPSK FRC H-Set 3 and test requirement for testing enhanced requirement type 1 16QAM FRC H-Set 3 respectively.

The reference value *R* in Table 54 and Table 55 is for FRC H-Set 1. For FRC H-Set 3 the reference values *R* in Table 54 and Table 55 should be scaled (multiplied by 3 and rounding to the nearest integer T-put in kbps, where values of i+1/2 are rounded up to i+1, i is integer). The measured throughput shall meet or exceed the specified throughput in Table 52, Table 53, Table 54 and Table 55 for FRC H-Set 6/3 specified in Table 27 with additional parameters in Table 28 and Table 30.

Test requirement enhanced requirements type 1 QPSK, Fixed Reference Channel (FRC) H-Set 6			
Test number	**Propagation conditions**	**Referemce value**	
		HS-PDSCH Ec/Ior (dB)	**T-put *R* (kbps) Ior/Ioc = 10.6 dB**
1	PA3	-11.9	672
		-8.9	1305

Table 52: Test requirement enhanced requirement type 1 QPSK, Fixed Reference Channel (FRC) H-Set 6 (Table 9.2.1E.10 of TS 34.121 [1])

Test requirement enhanced requirements type 1 16QAM, Fixed Reference Channel (FRC) H-Set 6			
Test number	**Propagation conditions**	**Referemce value**	
		HS-PDSCH Ec/Ior (dB)	**T-put *R* (kbps) Ior/Ioc = 10.6 dB**
1	PA3	-8.9	912
		-5.9	1730

Table 53: Test requirement enhanced requirements type 1 16QAM, Fixed Reference Channel (FRC) H-Set 6 (Table 9.2.1E.12 of TS 34.121 [1])

Test requirement enhanced requirement type 1 QPSK, Fixed Reference Channel (FRC) H-Set 3				
Test number	Propagation conditions	Referemce value		
		HS-PDSCH Ec/Ior (dB)	T-put *R* (kbps) Ior/Ioc = 0.6 dB	T-put *R* (kbps) Ior/Ioc = 10.6 dB
2	PB3	-8.9	N/A	195
		-5.9	156	316
		-2.9	263	N/A
3	VA30	-8.9	N/A	212
		-5.9	171	329
		-2.9	273	N/A
4	VA120	-8.9	N/A	191
		-5.9	168	293
		-2.9	263	N/A

Table 54: Test requirement enhanced requirement type 1 QPSK, Fixed Reference Channel (FRC) H-Set 3 (Table 9.2.1E.14 of TS 34.121 [1])

Test requirement enhanced requirement type 1 16QAM, Fixed Reference Channel (FRC) H-Set 3			
Test number	Propagation conditions	Referemce value	
		HS-PDSCH Ec/Ior (dB)	T-put *R* (kbps) Ior/Ioc = 10.6 dB
2	PB3	-5.9	275
		-2.9	408
3	VA30	-5.9	296
		-2.9	430
4	VA120	-5.9	271
		-2.9	392

Table 55: Test requirement enhanced requirement type 1 16QAM, Fixed Reference Channel (FRC) H-Set 3 (Table 9.2.1E.16 of TS 34.121 [1])

Configuration in R&S®CMU200:
BS Signal → HSDPA HS-DSCH → Channel Configuration Type → Fixed Reference Channel
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 6 QPSK, H-Set 3 QPSK, H-Set 6 16QAM or H-Set 3 16QAM
BS Signal → Downlink Physical Channels → HS-PDSCH → Level (All Active Codes) → -11.9 dB, -8.9 dB, -5.9 dB or -2.9 dB
BS Signal → Node-B Settings → Output Channel Power (Ior) → -59.4 dBm (Ioc/Ioc = 0.6 dB) or -49.4 dB (Ior/Ioc = 10.6 dB)
BS Signal → Node-B Settings → AWGN Noise Pwr. (@3.84 MHz, Ioc) → Off

A HSDPA call is configured in R&S®CMU200 as specified in section 4.1. FRC H-Set 6/3 QPSK/16QAM is configured in R&S®CMU200 according to Table 26(b) by referring to Figure 5. Downlink physical channels in Table 5(a) are configured in R&S®CMU200 by referring to Figure 6 as initial conditions for HSDPA connection setup. A HSDPA call is established. PRBS15 is configured in R&S®CMU200 as shown in Figure 28.

Once HSDPA connection is setup, downlink physical channels are configured in R&S®CMU200 according to Table 56. Table 56 shows the summary of level set to be configured in downlink physical channels for test requirement in Table 52 to Table 55.

Detail of level set is specified in Table 25. Fader and AWGN noise source are configured in R&S®SMU200A according to Table 52 to Table 55.

Level set for test requirement of single link performance – enhanced performance requirement type 1, QPSK/16QAM FRC H-Set 6/3							
Test number	**Propagation conditions**	**HS-PDSCH Ec/Ior (dB)**	**QPSK FRC H-Set 6 Ior/Ioc = 10.6 dB**	**16QAM FRC H-Set 6 Ior/Ioc = 10.6 dB**	**QPSK FRC H-Set 3 Ior/Ioc = 0.6 dB**	**QPSK FRC H-Set 3 Ior/Ioc = 10.6 dB**	**16QAM FRC H-Set 3 Ior/Ioc = 10.6 dB**
1	PA3	-11.9	Level set 5	N/A	N/A	N/A	N/A
		-8.9	Level set 4	Level set 4	N/A	N/A	N/A
		-5.9	N/A	Level set 2	N/A	N/A	N/A
2	PB3	-8.9	N/A	N/A	N/A	Level set 4	N/A
		-5.9	N/A	N/A	Level set 2	Level set 2	Level set 2
		-2.9	N/A	N/A	Level set 3	N/A	Level set 3
3	VA30	-8.9	N/A	N/A	N/A	Level set 4	N/A
		-5.9	N/A	N/A	Level set 2	Level set 2	Level set 2
		-2.9	N/A	N/A	Level set 3	N/A	Level set 3
4	VA120	-8.9	N/A	N/A	N/A	Level set 4	N/A
		-5.9	N/A	N/A	Level set 2	Level set 2	Level set 2
		-2.9	N/A	N/A	Level set 3	N/A	Level set 3

Table 56: Level set for test requirement of single link performance – enhanced performance requirement type 1, QPSK/16QAM FRC H-Set 6/3

Table 50, Table 51, Table 57 and Table 58 show the statistical test requirement for demodulation of HS-DSCH enhanced requirement type 1 QPSK H-Set 3, 16QAM H-Set 3, QPSK H-Set 6 and 16QAM H-Set 6 respectively.

Single link performance for test case 9.2.1E demodulation of HS-DSCH (enhanced requirement type 1, QPSK H-Set 6)							
Single link enhanced requirement type 1 performance **QPSK H-Set 6** **Test number**	**Absolute test requirement (kbps)**		**Relative test requirement (normalized to ideal= 3219 kbps)** **No of events / No of samples in % BT → (RT)**	**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**
1 (Ior/Ioc = 10 dB)	PA3	672	79.12% → (20.88%)	57/328 (m = 0.672)	N/A	164s (fading)	RT
		1305	59.46% → (40.54%)	67/193 (m = 0.723)	N/A	164s (fading)	RT

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

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

Table 57: Single link performance for test case 9.2.1E demodulation of HS-DSCH (enhanced requirement type 1, QPSK H-Set 6) (Table F.6.3.5.2.5A of TS 34.121 [1])

Single link performance for test case 9.2.1E demodulation of HS-DSCH (enhanced requirement type 1, 16QAM H-Set 6)							
Single link enhanced requirement type 1 performance **16QAM H-Set 6** **Test number**	**Absolute test requirement (kbps)**		**Relative test requirement (normalized to ideal = 4689 kbps)** **No of events / No of samples in % BT → (RT)**	**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**
1 (Ior/Ioc = 10 dB)	PA3	912	80.55% → (19.45%)	56/352 (m = 0.670)	N/A	164s (fading)	RT
		1730	63.10% → (36.90%)	64/203 (m = 0.712)	N/A	164s (fading)	RT

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

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

Table 58: Single link performance for test case 9.2.1E demodulation of HS-DSCH (enhanced requirement type 1, 16QAM H-Set 6) (Table F.6.3.5.2.6A of TS 34.121 [1])

Measurement result for measured throughput, BL test mode and RT test mode of single link HS-DSCH demodulation (enhanced requirement type 1 QPSK/16QAM FRC H-Set 6/3) is available in *HSDPA ACK* in R&S®CMU200.

Configuration in R&S®CMU200:
Menus → Receiver Quality → Applic. 1 → HSDPA ACK
HSDPA ACK → Measure Subframes → ≥ min no of samples (when Repetition is set to Single Shot)

Figure 27 shows the measured throughput, BL test mode and RT test mode of single link HS-DSCH demodulation measurement result.

For enhanced performance requirement type 1 QPSK FRC H-Set 6, Ior/Ioc = 10.6 dB, recall LevSet5 or LevSet4.sav according to Table 56 and establish CS call.
Modify the H-Set selection according to UE category.
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 6 QPSK
Modify the following configuration:
BS Signal → Node-B Settings → Output Channel Power (Ior) → -49.4 dB

For enhanced performance requirement type 1 16QAM FRC H-Set 6, Ior/Ioc = 10.6 dB, recall LevSet4.sav or LevSet2.sav according to Table 56 and establish CS call.
Modify the H-Set selection according to UE category.
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 6 16QAM
Modify the following configuration:
BS Signal → Node-B Settings → Output Channel Power (Ior) → -49.4 dB

For enhanced performance requirement type 1 QPSK FRC H-Set 3, Ior/Ioc = 0.6 dB, recall LevSet2.sav or LevSet3.sav according to Table 56 and establish CS call.
Modify the H-Set selection according to UE category.
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 3 QPSK

For enhanced performance requirement type 1 QPSK FRC H-Set 3, Ior/Ioc = 10.6 dB, recall LevSet4.sav or LevSet2.sav according to Table 56 and establish CS call.
Modify the H-Set selection according to UE category.
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 3 QPSK
Modify the following configuration:
BS Signal → Node-B Settings → Output Channel Power (Ior) → -49.4 dB

For enhanced performance requirement type 1 16QAM FRC H-Set 3, Ior/Ioc = 10.6 dB, recall LevSet2.sav or LevSet3.sav according to Table 56 and establish CS call.
Modify the H-Set selection according to UE category.
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 3 16QAM
Modify the following configuration:
BS Signal → Node-B Settings → Output Channel Power (Ior) → -49.4 dB

The measurement result is available at:
Menus → Receiver Quality → Applic. 1 → HSDPA ACK

4.7 Demodulation of HS-DSCH (Fixed Reference Channel): Single Link Performance – Enhanced Performance Requirements Type 2 - QPSK/16QAM, Fixed Reference Channel (FRC) H-Set 6/3 (9.2.1F)

The receiver single link performance HS-DSCH in different multi-path fading environments is determined by the information bit throughput *R*. The test will verify the ability of the receiver to receive and not degrade the specified HSDPA throughput performance with a multi-path fading channel test signal. Besides, the test stresses the multicode reception and channel decoding with incremental redundancy. The test applies to all FDD UE of Release 6 and later releases that support HSDPA UE categories 7 to 10 and the optional enhanced performance requirements types 2. It also applies to all FDD UE of Release 7 and later releases that support HSDPA UE categories 13 or 14.

The test requires an external multi-path fading simulator, e.g. R&S®SMU200A to generate multi-path fading signal with PA3, PB3, VA30 and VA120. The test is recommended to be performed remotely. Detail setup information on R&S®SMU200A and remote control via CMUgo are available in application notes [5] and [6].

Table 28, 30, 59, 60 and 61 show the test parameters for testing QPSK H-Set 6/3, test parameters for testing 16QAM FRC H-Set 6/3, test requirement for testing enhanced requirement type 2 QPSK FRC H-Set 6, test requirement for testing enhanced requirement type 2 16QAM FRC H-Set 6 and test requirement for testing QPSK FRC H-Set 3 respectively.

The reference value *R* in Table 61 is for FRC H-Set 1. For FRC H-Set 3 the reference values *R* in Table 61 should be scaled (multiplied by 3 and rounding to the nearest integer T-put in kbps, where values of i+1/2 are rounded up to i+1, i is integer). For UE supporting enhanced performance requirement type 2 and condition Ior/Ioc = 10 dB in Table 61, Fixed Reference Channel (FRC) H-Set 6 is used for testing.The measured throughput shall meet or exceed the specified throughput in Table 59, Table 60 and Table 61 for FRC H-Set 6/3 specified in Table 27 with additional parameters in Table 28 and Table 30.

Test requirement enhanced requirement type 2 QPSK, Fixed Reference Channel (FRC) H-Set 6			
Test number	**Propagation conditions**	**Referemce value**	
		HS-PDSCH Ec/Ior (dB)	**T-put *R* (kbps) Ior/Ioc = 10.6 dB**
1	PA3	-5.9	1494
		-2.9	2153
2	PB3	-5.9	1038
		-2.9	1744
3	VA30	-5.9	1142
		-2.9	1782
4	VA120	-5.9	909
		-2.9	1467

Table 59: Test requirement enhanced requirement type 2 QPSK, Fixed Reference Channel (FRC) H-Set 6 (Table 9.2.1F.8 of TS 34.121 [1])

Test requirement enhanced requirement type 2 16QAM, Fixed Reference Channel (FRC) H-Set 6			
Test number	**Propagation conditions**	**Referemce value**	
		HS-PDSCH Ec/Ior (dB)	**T-put *R* (kbps) Ior/Ioc = 10.6 dB**
1	PA3	-5.9	991
		-2.9	1808
2	PB3	-5.9	465
		-2.9	1370
3	VA30	-5.9	587
		-2.9	1488
4	VA120	-5.9	386
		-2.9	1291

Table 60: Test requirement enhanced requirement type 2 16QAM, Fixed Reference Channel (FRC) H-Set 6 (Table 9.2.1F.10 of TS 34.121 [1])

Test requirement QPSK, Fixed Reference Channel (FRC) H-Set 3				
Test number	**Propagation conditions**	**Referemce value**		
		HS-PDSCH Ec/Ior (dB)	**T-put *R* (kbps) Ior/Ioc = 0.6 dB**	**T-put *R* (kbps) Ior/Ioc = 10.6 dB**
1	PA3	-5.9	65	N/A
		-2.9	N/A	N/A
2	PB3	-5.9	23	N/A
		-2.9	138	N/A
3	VA30	-5.9	22	N/A
		-2.9	142	N/A
4	VA120	-5.9	13	N/A
		-2.9	140	N/A

Table 61: Test requirement QPSK, Fixed Reference Channel (FRC) H-Set 3 (Table 9.2.1F.12 of TS 34.121 [1])

Configuration in R&S®CMU200:
BS Signal → HSDPA HS-DSCH → Channel Configuration Type → Fixed Reference Channel
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 6 QPSK, H-Set 3 QPSK, H-Set 6 16QAM or H-Set 3 16QAM
BS Signal → Downlink Physical Channels → HS-PDSCH → Level (All Active Codes) → -5.9 dB or -2.9 dB
BS Signal → Node-B Settings → Output Channel Power (Ior) → -59.4 dBm (Ioc/Ioc = 0.6 dB) or -49.4 dBm (Ior/Ioc = 10.6 dB)
BS Signal → Node-B Settings → AWGN Noise Pwr. (@3.84 MHz, Ioc) → Off

A HSDPA call is configured in R&S®CMU200 as specified in section 4.1. FRC H-Set 6/3 QPSK/16QAM is configured in R&S®CMU200 according to Table 26(c) by referring to Figure 5. Downlink physical channels in Table 5(a) are configured in R&S®CMU200 by referring to Figure 6 as initial conditions for HSDPA connection setup. A HSDPA call is established. PRBS15 is configured in R&S®CMU200 as shown in Figure 28.

Once HSDPA connection is setup, downlink physical channels are configured in R&S®CMU200 according to Table 62. Table 62 shows the summary of level set to be configured in downlink physical channels for test requirement in Table 59, Table 60 and

Table 61. Detail of level set is specified in Table 25. Fader and AWGN noise source are configured in R&S®SMU200A according to Table 59, Table 60 and Table 61.

Level set for test requirement of single link performance – enhanced performance requirement type 2, QPSK/16QAM FRC H-Set 6/3					
Test number	**Propagation conditions**	**HS-PDSCH Ec/Ior (dB)**	**Enhanced requirement type 2 QPSK/16QAM FRC H-Set 6 Ior/Ioc = 10.6 dB**	**QPSK FRC H-Set 3 Ior/Ioc = 0.6 dB**	**QPSK FRC H-Set 3 Ior/Ioc = 10.6 dB**
1	PA3	-5.9	Level set 2	Level set 1	N/A
		-2.9	Level set 3	N/A	N/A
2	PB3	-5.9	Level set 2	Level set 2	N/A
		-2.9	Level set 3	Level set 3	N/A
3	VA30	-5.9	Level set 2	Level set 2	N/A
		-2.9	Level set 3	Level set 3	N/A
4	VA120	-5.9	Level set 2	Level set 2	N/A
		-2.9	Level set 3	Level set 3	N/A

Table 62: Level set for test requirement of single link performance – enhanced performance requirement type 2, QPSK/16QAM FRC H-Set 6/3

Table 33, Table 63 and Table 64 show the statistical test requirement for demodulation of HS-DSCH QPSK H-Set 3, enhanced requirement type 2 QPSK H-Set 6, enhanced requirement type 2 16QAM H-Set 6 respectively.

Single link performance for test case 9.2.1F demodulation of HS-DSCH (enhanced requirement type 2, QPSK H-Set 6)							
Single link enhanced requirement type 2 performance **QPSK H-Set 6** **Test number**	**Absolute test requirement (kbps)**		**Relative test requirement (normalized to ideal = 3219 kbps)** **No of events / No of samples in %** **BT → (RT)**	**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**
1 (Ior/Ioc = 10 dB)	PA3	1494	53.59% → (46.41%)	72/179 (m = 0.743)	N/A	164s (fading)	RT
		2153	33.12% → (66.88%)	71/182 (M = 1.356)	N/A	164s (fading)	BL
2 (Ior/Ioc = 10 dB)	PB3	1038	67.75% → (32.25%)	61/224 (m = 0.698)	N/A	164s (fading)	RT
		1744	45.82% → (54.18%)	90/172 (M = 1.271)	N/A	164s (fading)	BL
3 (Ior/Ioc = 10 dB)	VA30	1142	64.52% → (35.48%)	63/209 (m = 0.707)	N/A	16.4s(fading)	RT
		1782	44.64% → (55.36%)	88/172 (M = 1.278)	N/A	16.4s(fading)	BL
4 (Ior/Ioc = 10 dB)	VA120	909	71.76% → (28.24%)	59/248 (m = 0.687)	N/A	4.1s(fading)	RT
		1467	54.43% → (45.57%)	72/181 (m = 0.740)	N/A	4.1s(fading)	RT

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

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

Table 63: Single link performance for test case 9.2.1F demodulation of HS-DSCH (enhanced requirement type 2, QPSK H-Set 6) (Table F.6.3.5.2.5B of TS 34.121 [1])

Single link performance for test case 9.2.1F demodulation of HS-DSCH (enhanced requirement type 2, 16QAM H-Set 6)							
Single link enhanced requirement type 2 performance **16QAM H-Set 6** **Test number**	**Absolute test requirement (kbps)**		**Relative test requirement (normalized to ideal = 4689 kbps)** **No of events / No of samples in %** **BT → (RT)**	**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**
1 (Ior/Ioc = 10 dB)	PA3	991	78.86% → (21.14%)	57/324 (m = 0.673)	N/A	164s (fading)	RT
		1808	61.44% → (38.56%)	65/197 (m = 0.717)	N/A	164s (fading)	RT
2 (Ior/Ioc = 10 dB)	PB3	465	90.08% → (9.92%)	60/740 (m = 1/1.5)	N/A	164s (fading)	RT
		1370	70.78% → (29.22%)	59/242 (m = 0.690)	N/A	164s (fading)	RT
3 (Ior/Ioc = 10 dB)	VA30	587	87.48% → (12.52%)	59/573 (m = 1/1.5)	N/A	16.4s(fading)	RT
		1488	68.26% → (31.74%)	60/226 (m = 0.697)	N/A	16.4s(fading)	RT
4 (Ior/Ioc = 10 dB)	VA120	386	91.77% → (8.23%)	61/905 (m = 1/1.5)	N/A	4.1s(fading)	RT
		1291	72.46% → (27.54%)	58/254	N/A	4.1s(fading)	RT

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

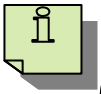
- In the BLER (BL) test mode the ratio No of errors/ No of samples is recorded. In this mode a pass is below the test limit.
- In the Relative Throughput (RT) test mode (1 - BLER) the ratio No of successes/ No of samples is recorded. In this mode a pass is above the test limit.
- The test mode used is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

Table 64: Single link performance for test case 9.2.1F demodulation of HS-DSCH (enhanced requirement type 2, 16QAM H-Set 6) (Table F.6.3.5.2.6B of TS 34.121 [1])

Measurement result for measured throughput, BL test mode and RT test mode of single link HS-DSCH demodulation (enhanced requirement type 2 QPSK/16QAM FRC H-Set 6/3) is available in *HSDPA ACK* in R&S®CMU200.

Configuration in R&S®CMU200:
Menus → Receiver Quality → Applic. 1 → HSDPA ACK
HSDPA ACK → Measure Subframes → ≥ min no of samples (when Repetition is set to Single Shot)

Figure 27 shows the measured throughput, BL test mode and RT test mode of single link HS-DSCH demodulation measurement result.



For enhanced performance requirement type 2 QPSK/16QAM FRC H-Set 6, Ior/Ioc = 10.6 dB, recall LevSet2.sav or LevSet3.sav according to Table 62 and establish CS call.
Modify the H-Set selection according to UE category.
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 6 QPSK or H-Set 6 16QAM
Modify the following configuration:
BS Signal → Node-B Settings → Output Channel Power (Ior) → -49.4 dB

For QPSK FRC H-Set 3, Ior/Ioc = 0.6 dB, recall LevSet1.sav, LevSet2.sav or LevSet3.sav according to Table 62 and establish CS call.
Modify the H-Set selection according to UE category.
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 3 QPSK

The measurement result is available at:
Menus → Receiver Quality → Applic. 1 → HSDPA ACK

4.8 Demodulation of HS-DSCH (Fixed Reference Channel): Single Link Performance – Enhanced Performance Requirements Type 3 - QPSK/16QAM, Fixed Reference Channel (FRC) H-Set 6/3 (9.2.1G)

The receiver single link performance HS-DSCH in different multi-path fading environments is determined by the information bit throughput *R*. The test will verify the ability of the receiver to receive and not degrade the specified HSDPA throughput performance with a multi-path fading channel test signal. Besides, the test stresses the multicode reception and channel decoding with incremental redundancy. The test applies to all FDD UE of Release 7 and later releases that support HSDPA UE categories 7 to 10, 13 or 14 and the optional enhanced performance requirements type 3. It also applies to all FDD UE of Release 7 and later releases that support HSDPA UE categories 15 to 18. Besides, it applies to all FDD UE of Release 8 and later releases that support HSDPA UE categories 19 or 20.

Table 28, 30, 65, 66, 67, 68 and 69 show the test parameters for testing QPSK H-Set 6/3, test parameters for testing 16QAM FRC H-Set 6/3, test requirement for testing enhanced requirement type 3 QPSK FRC H-Set 6 (Ior/Ioc = 10 dB), test requirement for testing enhanced requirement type 3 QPSK FRC H-Set 6 (Ior/Ioc = 5 dB), test requirement for testing enhanced requirement type 3 16QAM FRC H-Set 6 (Ior/Ioc = 10 dB), test requirement for testing enhanced requirement type 3 16QAM (Ior/Ioc = 5 dB) and test requirement for enhanced requirement type 3 QPSK FRC H-Set 3 respectively.

The reference value *R* in Table 69 is for FRC H-Set 1. For FRC H-Set 3 the reference values *R* in Table 69 should be scaled (multiplied by 3 and rounding to the nearest integer T-put in kbps, where values of i+1/2 are rounded up to i+1, i is integer). The measured throughput shall meet or exceed the specified throughput in Table 65 to Table 69 for FRC H-Set 6/3 specified in Table 27 with additional parameters in Table 28 and Table 30.

Test requirement enhanced requirement type 3 QPSK at Ior/Ioc = 10 dB, Fixed Reference Channel (FRC) H-Set 6			
Test number	**Propagation conditions**	**Referemce value**	
		HS-PDSCH Ec/Ior (dB)	**T-put *R* (kbps) Ior/Ioc = 10.6 dB**
1	PA3	-8.9	1554
		-5.9	2495
2	PB3	-8.9	1190
		-5.9	2098
3	VA30	-8.9	1229
		-5.9	2013
4	VA120	-8.9	1060
		-5.9	1674

Table 65: Test requirement enhanced requirement type 3 QPSK at Ior/Ioc = 10 dB, Fixed Reference Channel (FRC) H-Set 6 (Table 9.2.1G.10 of TS 34.121 [1])

Test requirement enhanced requirement type 3 QPSK at Ior/Ioc = 5 dB, Fixed Reference Channel (FRC) H-Set 6			
Test number	**Propagation conditions**	**Referemce value**	
		HS-PDSCH Ec/Ior (dB)	**T-put *R* (kbps) Ior/Ioc = 5.6 dB**
5	PB3	-5.9	1248
		-2.9	2044

Table 66: Test requirement enhanced requirement type 3 QPSK at Ior/Ioc = 5 dB, Fixed Reference Channel (FRC) H-Set 6 (Table 9.2.1G.11 of TS 34.121 [1])

Test requirement enhanced requirement type 3 16QAM at Ior/Ioc = 10 dB, Fixed Reference Channel (FRC) H-Set 6			
Test number	**Propagation conditions**	**Referemce value**	
		HS-PDSCH Ec/Ior (dB)	**T-put *R* (kbps) Ior/Ioc = 10.6 dB**
1	PA3	-5.9	1979
		-2.9	3032
2	PB3	-5.9	1619
		-2.9	2464
3	VA30	-5.9	1710
		-2.9	2490
4	VA120	-5.9	1437
		-2.9	2148

Table 67: Test requirement enhanced requirement type 3 16QAM at Ior/Ioc = 10 dB, Fixed Reference Channel (FRC) H-Set 6 (Table 9.2.1G.13 of TS 34.121 [1])

Test requirement enhanced requirement type 3 16QAM at Ior/Ioc = 5 dB, Fixed Reference Channel (FRC) H-Set 6			
Test number	**Propagation conditions**	**Referemce value**	
		HS-PDSCH Ec/Ior (dB)	**T-put *R* (kbps) Ior/Ioc = 5.6 dB**
5	PB3	-5.9	779
		-2.9	1688

Table 68: Test requirement enhanced requirement type 3 16QAM at Ior/Ioc = 5 dB, Fixed Reference Channel (FRC) H-Set 6 (Table 9.2.1G.14 of TS 34.121 [1])

Test requirement enhanced requirement type 3 QPSK, Fixed Reference Channel (FRC) H-Set 3				
Test number	**Propagation conditions**	**Referemce value**		
		HS-PDSCH Ec/Ior (dB)	**T-put *R* (kbps) Ior/Ioc = 0.6 dB**	**T-put *R* (kbps) Ior/Ioc = 10.6 dB**
1	PA3	-11.9	N/A	N/A
		-8.9	N/A	N/A
		-5.9	195	N/A
		-2.9	329	N/A
2	PB3	-8.9	N/A	N/A
		-5.9	156	N/A
		-2.9	263	N/A
3	VA30	-8.9	N/A	N/A
		-5.9	171	N/A
		-2.9	273	N/A
4	VA120	-8.9	N/A	N/A
		-5.9	168	N/A
		-2.9	263	N/A

Table 69: Test requirement enhanced requirement type 3 QPSK, Fixed Reference Channel (FRC) H-Set 3 (Table 9.2.1G.16 of TS 34.121 [1])

Configuration in R&S®CMU200:
BS Signal → HSDPA HS-DSCH → Channel Configuration Type → Fixed Reference Channel
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 6 QPSK, H-Set 3 QPSK or H-Set 6 16QAM
BS Signal → Downlink Physical Channels → HS-PDSCH → Level (All Active Codes) → -11.9 dB, -8.9 dB, -5.9 dB or -2.9 dB
BS Signal → Node-B Settings → Output Channel Power (Ior) → -59.4 dBm (Ioc/Ioc = 0.6 dB), -49.4 dB (Ior/Ioc = 10.6 dB) or -54.4 dBm (Ior/Ioc = 5.6 dB)
BS Signal → Node-B Settings → AWGN Noise Pwr. (@3.84 MHz, Ioc) → Off

A HSDPA call is configured in R&S®CMU200 as specified in section 4.1. FRC H-Set 6/3 QPSK/16QAM is configured in R&S®CMU200 according to Table 26(d) by referring to Figure 5. Downlink physical channels in Table 5(a) are configured in R&S®CMU200 by referring to Figure 6 as initial conditions for HSDPA connection setup. A HSDPA call is established. PRBS15 is configured in R&S®CMU200 as shown in Figure 28.

Once HSDPA connection is setup, downlink physical channels are configured in R&S®CMU200 according to Table 70. Table 70 shows the summary of level set to be configured in downlink physical channels for test requirement in Table 65 to Table 69. Detail of level set is specified in Table 25. Fader and AWGN noise source are configured in R&S®SMU200A according to Table 65 to Table 69.

Level set for test requirement of single link performance – enhanced performance requirement type 3, QPSK/16QAM FRC H-Set 6/3							
Test number	**Propagation conditions**	**HS-PDSCH Ec/Ior (dB)**	**Enhanced requirement type 3 QPSK FRC H-Set 6 Ior/Ioc = 10.6 dB**	**Enhanced requirement type 3 QPSK/16QAM FRC H-Set 6 Ior/Ioc = 5.6**	**Enhanced requirement type 3 16QAM FRC H-Set 6 Ior/Ioc = 10.6 dB**	**Enhanced requirement type 3 QPSK FRC H-Set 3 Ior/Ioc = 0.6 dB**	**Enhanced requirement type 3 QPSK FRC H-Set 3 Ior/Ioc = 10.6 dB**
1	PA3	-11.9	N/A	N/A	N/A	N/A	N/A
		-8.9	Level set 4	N/A	N/A	N/A	N/A
		-5.9	Level set 2	N/A	Level set 2	Level set 1	N/A
		-2.9	N/A	N/A	Level set 3	Level set 3	N/A
2	PB3	-8.9	Level set 4	N/A	N/A	N/A	N/A
		-5.9	Level set 2	N/A	Level set 2	Level set 2	N/A
		-2.9	N/A	N/A	Level set 3	Level set 3	N/A
3	VA30	-8.9	Level set 4	N/A	N/A	N/A	N/A
		-5.9	Level set 2	N/A	Level set 2	Level set 2	N/A
		-2.9	N/A	N/A	Level set 3	Level set 3	N/A
4	VA120	-8.9	Level set 4	N/A	N/A	N/A	N/A
		-5.9	Level set 2	N/A	Level set 2	Level set 2	N/A
		-2.9	N/A	N/A	Level set 3	Level set 3	N/A
5	PB3	-5.9	N/A	Level set 2	N/A	N/A	N/A
		-2.9	N/A	Level set 3	N/A	N/A	N/A

Table 70: Level set for test requirement of single link performance – enhanced performance requirement type 3, QPSK/16QAM FRC H-Set 6/3

Table 33, Table 71 and Table 72 show the statistical test requirement for demodulation of HS-DSCH QPSK H-Set 3, enhanced requirement type 3 QPSK H-Set 6, enhanced requirement type 3 16QAM H-Set 6 respectively.

Single link performance for test case 9.2.1G demodulation of HS-DSCH (enhanced requirement type 3, QPSK H-Set 6)							
Single link enhanced requirement type 3 performance **QPSK H-Set 6** **Test number**	**Absolute test requirement (kbps)**		**Relative test requirement (normalized to ideal = 3219 kbps)** **No of events / No of samples in %** **BT → (RT)**	**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**
1 (Ior/Ioc = 10 dB)	PA3	1554	51.72% → (48.28%)	75/178 (m = 0.749)	N/A	164s (fading)	RT
		2495	22.49% → (77.51%)	61/226 (M = 1.433)	N/A	164s (fading)	BL
2 (Ior/Ioc = 10 dB)	PB3	1190	63.03% → (36.94%)	64/205 (m = 0.712)	N/A	164s (fading)	RT
		2098	34.82% → (65.18%)	73/180 (M = 1.344)	N/A	164s (fading)	BL
3 (Ior/Ioc = 10 dB)	VA30	1299	59.65% → (40.35%)	66/192 (m = 0.722)	N/A	16.4s(fading)	RT
		2013	37.46% → (62.54%)	77/176 (M = 1.326)	N/A	16.4s(fading)	BL
4 (Ior/Ioc = 10 dB)	VA120	1060	67.07% → (39.93%)	61/221 (m = 0.700)	N/A	4.1s(fading)	RT
		1647	48.84% → (51.16%)	96/174 (M = 1.252)	N/A	4.1s(fading)	BL
5 (Ior/Ioc = 5 dB)	PB3	1248	61.23% → (38.77%)	66/198 (m = 0.717)	N/A	164s (fading)	RT
		2044	36.50% → (63.50%)	75/176 (M = 1.332)	N/A	164s (fading)	BL

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

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

Table 71: Single link performance for test case 9.2.1G demodulation of HS-DSCH (enhanced requirement type 3, QPSK H-Set 6) (Table F.6.3.5.2.5C of TS 34.121 [1])

Single link performance for test case 9.2.1G demodulation of HS-DSCH (enhanced requirement type 3, 16QAM H-Set 6)							
Single link enhanced requirement type 3 performance **16QAM H-Set 6** **Test number**	**Absolute test requirement (kbps)**		**Relative test requirement (normalized to ideal = 3219 kbps)** **No of events / No of samples in %** **BT → (RT)**	**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**
1 (Ior/Ioc = 10 dB)	PA3	1979	57.79% → (42.21%)	69/190 (m = 0.728)	N/A	164s (fading)	RT
		3032	35.34% → (64.66%)	73/178 (M = 1.340)	N/A	164s (fading)	BL
2 (Ior/Ioc = 10 dB)	PB3	1619	65.47% → (34.53%)	62/211 (m = 0.704)	N/A	164s (fading)	RT
		2464	47.45% → (52.55%)	92/171 (M = 1.260)	N/A	164s (fading)	BL
3 (Ior/Ioc = 10 dB)	VA30	1710	63.53% → (36.47%)	63/204 (m = 0.710)	N/A	16.4s(fading)	RT
		2490	46.90% → (53.10%)	91/171 (M = 1.264)	N/A	16.4s(fading)	BL
4 (Ior/Ioc = 10 dB)	VA120	1437	69.35% → (30.65%)	59/231 (m = 0.694)	N/A	4.1s(fading)	RT
		2148	54.19% → (45.81%)	72/182 (m = 0.740)	N/A	4.1s(fading)	RT
5 (Ior/Ioc = 5 dB)	PB3	779	83.39% → (16.61%)	57/414 (m = 0.667)	N/A	164s (fading)	RT
		1688	64.00% → (36.00%)	63/207 (m = 0.709)	N/A	164s (fading)	RT

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

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

Table 72: Single link performance for test case 9.2.1G demodulation of HS-DSCH (enhanced requirement type 3, 16QAM H-Set 6) (Table F.6.3.5.2.6C of TS 34.121 [1])

Measurement result for measured throughput, BL test mode and RT test mode of single link HS-DSCH demodulation (enhanced requirement type 3 QPSK/16QAM FRC H-Set 6/3) is available in *HSDPA ACK* in R&S®CMU200.

Configuration in R&S®CMU200:
Menus → Receiver Quality → Applic. 1 → HSDPA ACK

Figure 27 shows the measured throughput, BL test mode and RT test mode of single link HS-DSCH demodulation measurement result.

For enhanced performance requirement type 3 QPSK FRC H-Set 6, Ior/Ioc = 10.6 dB, recall LevSet4.sav or LevSet2.sav according to Table 70 and establish CS call.
Modify the H-Set selection according to UE category.
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 6 QPSK
Modify the following configuration:
BS Signal → Node-B Settings → Output Channel Power (Ior) → -49.4 dB

For enhanced performance requirement type 3 QPSK/16QAM FRC H-Set 6, Ior/Ioc = 5.6 dB, recall LevSet2.sav or LevSet3.sav according to Table 70 and establish CS call.
Modify the H-Set selection according to UE category.
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 6 QPSK or H-Set 6 16QAM
Modify the following configuration:
BS Signal → Node-B Settings → Output Channel Power (Ior) → -54.4 dB

For enhanced performance requirement type 3 16QAM FRC H-Set 6, Ior/Ioc = 10.6 dB, recall LevSet2.sav or LevSet3.sav according to Table 70 and establish CS call.
Modify the H-Set selection according to UE category.
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 6 16QAM
Modify the following configuration:
BS Signal → Node-B Settings → Output Channel Power (Ior) → -49.4 dB

For enhanced performance requirement type 3 QPSK FRC H-Set 3, Ior/Ioc = 0.6 dB, recall LevSet1.sav, LevSet2.sav or LevSet3.sav according to Table 70 and establish CS call.
Modify the H-Set selection according to UE category.
BS Signal → HSDPA HS-DSCH → Fixed Reference Channel → H-Set Selection → H-Set 3 QPSK

The measurement result is available at:
Menus → Receiver Quality → Applic. 1 → HSDPA ACK

4.9 Reporting of Channel Quality Indicator: Single Link Performance – AWGN Propagation Conditions (9.3.1)

The reporting accuracy of channel quality indicator (CQI) under AWGN environments is determined by the reporting variance and the BLER performance using the transport format indicated by the reported CQI median. This test will verify that the variance of the CQI reports when using transport format (TF) based on CQI 16 is within the limits defined and that a BLER of 10 % falls between the TF based on Median CQI - 1 and the TF based on Median CQI or between the TF based on Median CQI and the TF based on Median CQI + 2. This test applies to all FDD UE of Release 6 and later releases that support HSDPA.

The reported CQI value shall be in the range of +/-2 of the reported median more than 90 % of the time. If the HS-PDSCH BLER using the transport format indicated by Median CQI is less than or equal to 0.1, the BLER using the transport format indicated by the (Median CQI + 2) shall be greater than 0.1. If the HS-PDSCH BLER using the transport format indicated by the Median CQI is greater than 0.1, the BLER using transport format indicated by (Median CQI - 1) shall be less than or equal to 0.1. Median CQI is the CQI that is at or crosses 50% distribution from the lower CQI side.

Table 73 and Table 74 show the test parameters for CQI test in AWGN – single link and contents of RADIO BEARER SETUP message: AM or UM (HSDPA) respectively.

Test parameters for CQI test in AWGN – single link				
Parameter	**Unit**	**Test 1**	**Test 2**	**Test 3**
Ior/Ioc	dB	0	5	10
Ioc	dBm/3.84 MHz	-60		
Phase reference	-	P-CPICH		
HS-PDSCH Ec/Ior	dB	-3		
HS-SCCH_1 Ec/Ior	dB	-10		
DPCH Ec/Ior	dB	-10		
Maximum number of H-ARQ transmission	-	1		
Number of HS-SCCH set to be monitored	-	1		
CQI feedback cycle	ms	2		
CQI repetition factor	-	1		
HS-SCCH-1 signalling pattern	-	To incorporate inter-TTI = 3 the six sub-frame HS-SCCH-1 signalling pattern shall be "…XOOXOO…", where "X" indicates TTI in which the HS-SCCH-1 uses the identity of the UE under test, and "O" indicates TTI in which the HS-SCCH-1 uses a different UE identity.		

Note: UE categories 13-20 shall be configured in 16QAM, non-MIMO mode and use appropriate CQI tables according to TS 25.214 [3].

Table 73: Test parameters for CQI test in AWGN – single link (Table 9.3.1.1 of TS 34.121 [1])

Contents of RADIO BEARER SETUP message: AM or UM (HSDPA)	
Information Element	**Value/Remark**
Downlink HS-PDSCH Information	
- HS-SCCH Info	
- CHOICE mode	FDD
- DL Scrambling Code	
- HS-SCCH Channelisation Code Info	
- HS-SCCH Channelisation Code	2
- Measurement Feedback Info	
- CHOICE mode	FDD
- POhsdsch	Compatible with the values in Table 71 (AWGN propagation conditions) or Table 74 (Fading propagation conditions) and according to TS 25.214 [3] clause 6A.2
- Added or Reconfigured DL TrCH information	
- CHOICE DL parameters	HS-DSCH
- HARQ Info	
- Number of Processes	2
- Added or reconfigured MAC-d flow	
- MAC-hs queue to add or reconfigure list	(one queue)
- MAC-d PDU size Info	
- MAC-d PDU size	112 bits (Note 1)
- MAC-d PDU size index	0
- MAC-d PDU size	448 bits (Note 1)
- MAC-d PDU size index	1

Note: For UE Categories 1-6, 11 and 12, MAC-d PDU size of 112 is used. For other UE categories, MAC-d PDU sizes of 112 and 448 are used. Less than CQI value of 23 according to TS 25.214 [3], 112 is used, and above the CQI values, 448 is used.

Table 74: Contents of RADIO BEARER SETUP message: AM or UM (HSDPA) (Table 9.3.1.2 and Table 9.3.2.3 of TS 34.121 [1])

Configuration in R&S®CMU200:
BS Signal → Node-B Settings → AWGN Noise Pwr (@3.84 MHz, Ioc) → -60 dBm
BS Signal → Node-B Settings → Geometry Factor (Ior/Ioc) → 0.0 dB, 5.0 dB or 10.0 dB
BS Signal → Downlink Physical Channels → DPDCH Level Config → -10.0 dB
BS Signal → Downlink Physical Channels → HSDPA Channels → On
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#1 → Level → -10.0 dB
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#1→ Ch.Code → 2
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#2 → Level → Off
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#3 → Level → Off
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#4 → Level → Off
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH Selection → 1
BS Signal → Downlink Physical Channels → HS-SCCH → Number of HS-SCCH → 4
BS Signal → Downlink Physical Channels → HS-SCCH → Unscheduled Subframes → Transmit Dummy UEID
BS Signal → Downlink Physical Channels → HS-PDSCH → Level (All Active Codes) → -3.0 dB
BS Signal → Downlink Physical Channels → HS-PDSCH → Unscheduled Subframes → Dummy Data
BS Signal → HSDPA HS-DSCH → CQI Feedback Cycle → 2 ms
BS Signal → HSDPA HS-DSCH → CQI Repetition Factor → 1

A HSDPA call is configured in R&S®CMU200 as specified in section 4.1. Downlink physical channels in Table 5(a) are configured in R&S®CMU200 as shown in Figure 6. Test parameters and RADIO BEARER MESSAGE are configured in R&S®CMU200 by referring to Figure 6 and Figure 2. A HSDPA call is established.

To verify whether the UE reports a limited range of CQI values under the predefined channel conditions, the SS shall send the TF according to CQI value 16 and keep it regardless of the CQI value sent by the UE. HS-PDSCH is transmitted continuously until 2000 CQI reports have been collected every 2 ms, including cases where UE transmits nothing in its CQI field. If 1800 or more of the CQI values are in the range (Median CQI - 2) ≤ Median CQI ≤ (Median CQI + 2) then correct sense of BLER versus CQI is checked, otherwise fail the UE.

BS Signal → HSDPA HS-DSCH → Channel Configuration Type → CQI
BS Signal → HSDPA HS-DSCH → CQI Channel Configuration → CQI Table Index → Conformance Test
BS Signal → HSDPA HS-DSCH → CQI Channel Configuration → Fixed Value → 16
BS Signal → HSDPA HS-DSCH → CQI Channel Configuration → No. of H-ARQ Processes → 2

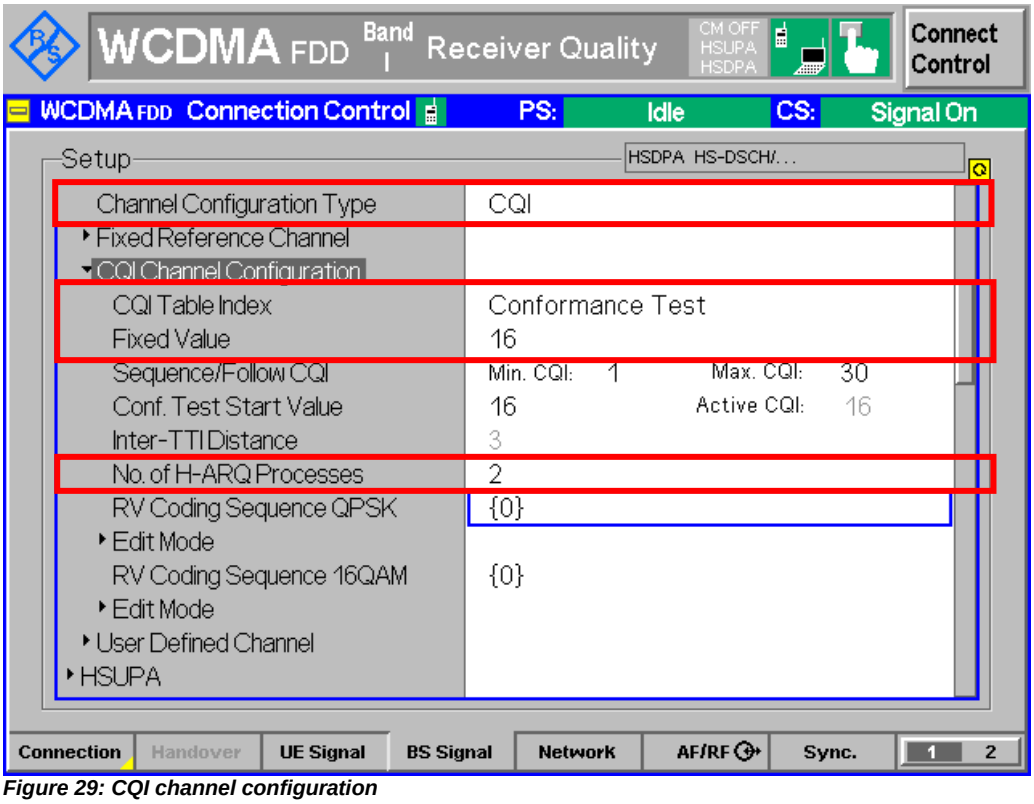


Figure 29: CQI channel configuration

To verify whether the BLER versus CQI has the correct sense, the SS shall transmit the TF according to the Median CQI value and shall not react to the UE's CQI reports. The associated ACK, NACK and statDTX responses are recorded until the number of filtered ACK + NACK responses reaches 1000 to determine whether Median CQI + 2 or Median CQI -1 is used for subsequent testing.

In R&S®CMU200, filtered ACK + NACK responses is indicated as BLER. BLER in R&S®CMU200 is defined as the percentage of transmission packets (HSDPA subframes) received in error, i.e. the ratio of (DTX + NACK)/(DTX + NACK + ACK) packets.

If the ratio (NACK / ACK + NACK) < 0.1, the SS shall transmit the TF according to the Median CQI + 2 value and shall not react to the UE's CQI reports. The associated ACK, NACK and statDTX responses are recorded until the number of filtered ACK + NACK responses reaches 1000.
Test requirement: ratio (NACK / ACK + NACK) ≥ 0.1

If the ratio (NACK /ACK + NACK) ≥ 0.1, the SS shall transmit the TF according to the Median CQI - 1 value and shall not react to the UE's CQI report. The associated ACK, NACK and statDTX responses are recorded until the number of filtered ACK + NACK responses reaches 1000.
Test requirement: (NACK / ACK + NACK) < 0.1

This test is repeated with Ior/Ioc of 5 dB and 10 dB.

Measurement result for channel quality indicator is available in *HSDPA CQI* in R&S®CMU200.

Configuration in R&S®CMU200:
Menus → Receiver Quality → Applic. 1 → HSDPA CQI
HSDPA CQI → Test Case → AWGN
HSDPA CQI → Measure Subframes → Subrames → CQI → 2000
HSDPA CQI → Measure Subframes → Subframes → BLER → 1000

Figure 30 shows the HSDPA CQI measurement result.

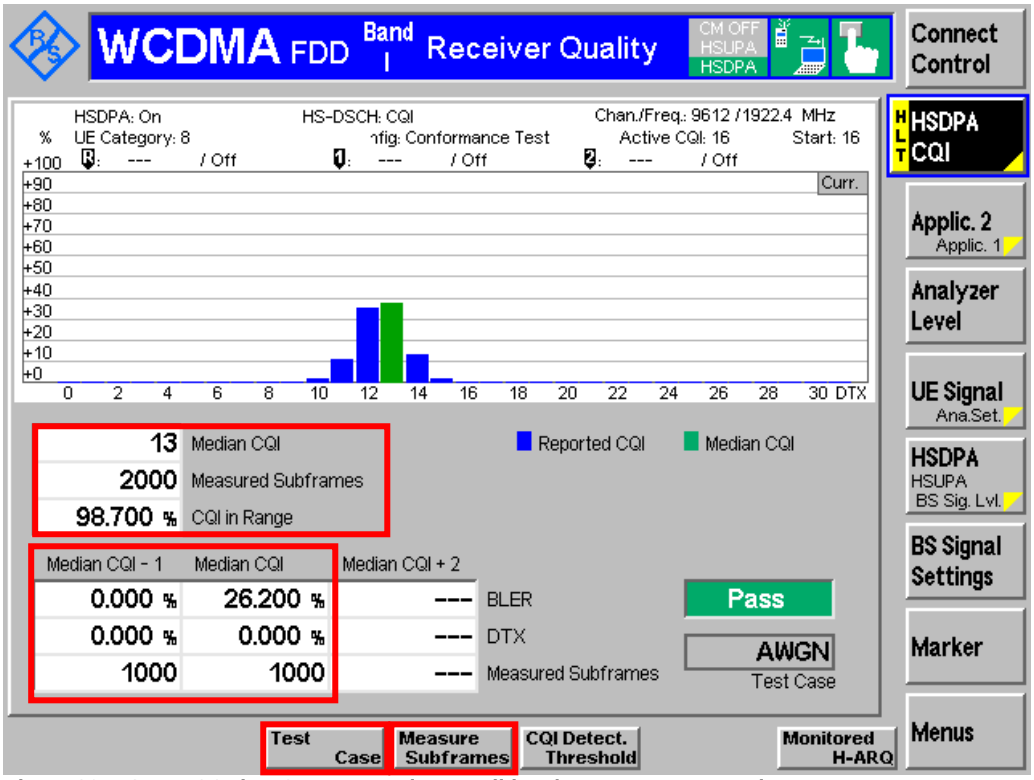


Figure 30: HSDPA CQI (AWGN propagation conditions) measurement result

Recall CQI.sav and establish CS call.
Repeat the test at Ior/Ioc = 5 dB and 10 dB by modifying the following configurations:
BS Signal → Node-B Settings → Geometry Factor (Ior/Ioc) → 5.0 dB or 10.0 dB

The measurement result is available at:
Menus → Receiver Quality → Applic. 1 → HSDPA CQI

4.10 Reporting of Channel Quality Indicator: Single Link Performance – Fading Propagation Conditions (9.3.2)

The reporting accuracy of the channel quality indicator (CQI) under fading environments is determined by the BLER performance using the transport format indicated by the reported CQI median. This test will verify that that the BLER for blocks associated with CQI reports of Median CQI is ≤ 60% and that the BLER for blocks associated with CQI reports of Median CQI + 3 is ≤ 15% when using the TF based on the Median CQI. The BLER at a particular reported CQI is obtained by associating a particular CQI reference measurement period with the HS-PDSCH subframe overlapping with the end of this CQI reference measurement period and calculating the fraction of erroneous HS-PDSCH subframes as shown in Figure 30. This test applies to all FDD UE of Release 6 and later releases that support HSDPA.

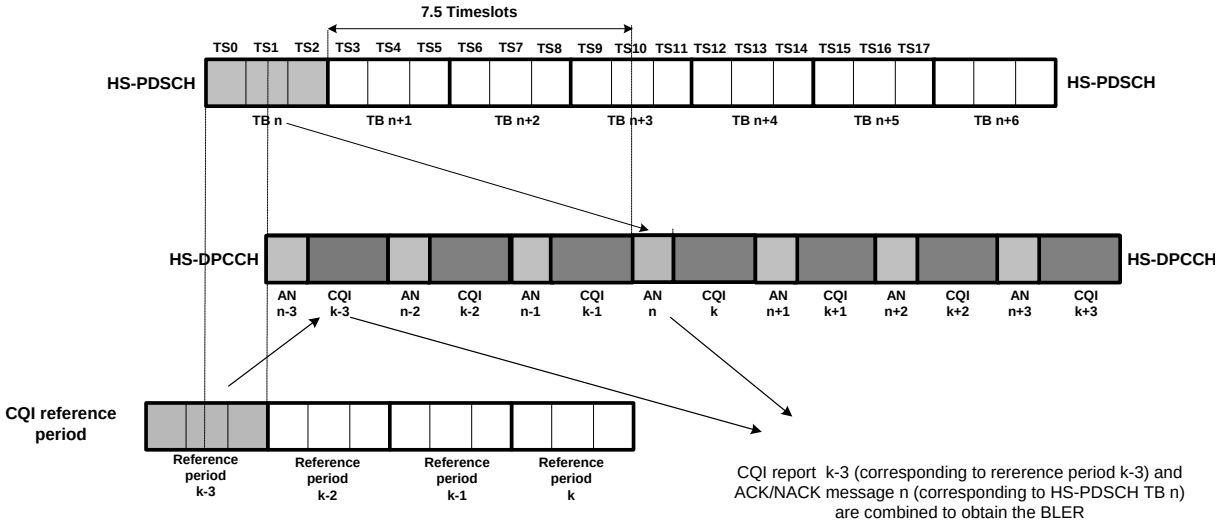


Figure 30: Combination of ACK/NACK message and the CQI report for BLER calculation (Figure 9.3.2.1 of TS 34.121 [1])

Table 75 shows the minimum requirement for CQI testing in fading – single link.

Minimum requirement for CQI test in fading – single link		
Reported CQI	**Maximum BLER**	
	Test 1	**Test 2**
CQI Median	60%	60%
CQI Median + 3	15%	15%

Table 75: Minimum requirement for CQI test in fading- single link (Table 9.3.2.2 of TS 34.121 [1])

The test requires an external multi-path fading simulator, e.g. R&S®SMU200A to generate Case 8 fading signal. The test is recommended to be performed remotely. Detail setup information on R&S®SMU200A and remote control via CMUgo are available in application notes [5] and [6].

Table 76 and Table 74 show the test parameters for CQI test in fading – single link and contents of RADIO BEARER SETUP message: AM or UM (HSDPA) respectively.

Test parameters for CQI test in fading – single link			
Parameter	**Unit**	**Test 1**	**Test 2**
HS-PDSCH Ec/Ior	dB	-8	-4
Ior/Ioc	dB	0	5
Ioc	dBm/3.84 MHz	-60	
Phase reference	-	P-CPICH	
HS-SCCH_1 Ec/Ior	dB	-8.5	
DPCH Ec/Ior	dB	-6	
Maximum number of H-ARQ transmission	-	1	
Number of HS-SCCH set to be monitored	-	1	
CQI feedback cycle	ms	2	
CQI repetition factor	-	1	
HS-SCCH-1 signalling pattern	-	To incorporate inter-TTI = 3 the six sub-frame HS-SCCH-1 signalling pattern shall be "…XOOXOO…", where "X" indicates TTI in which the HS-SCCH-1 uses the identity of the UE under test, and "O" indicates TTI in which the HS-SCCH-1 uses a different UE identity.	
Propagation Channel		Case 8	

Note: UE categories 13-20 shall be configured in 16QAM, non-MIMO mode and use appropriate CQI tables according to TS 25.214 [3].

Table 76: Test parameters for CQI test in fading – single link (Table 9.3.2.1 of TS 34.121 [1])

Configuration in R&S®CMU200:

BS Signal → Node-B Settings → Output Channel Power (Ior) → -60.0 dBm (Ioc/Ioc = 0 dB) or -55.0 dBm (Ior/Ioc = 5 dB)
BS Signal → Node-B Settings → AWGN Noise Pwr (@3.84 MHz, Ioc) → Off
BS Signal → Downlink Physical Channels → DPDCH Level Config → -6.0 dB
BS Signal → Downlink Physical Channels → HSDPA Channels → On
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#1 → Level → -8.5 dB
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#1 → Ch.Code → 2
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#2 → Level → Off
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#3 → Level → Off
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#4 → Level → Off
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH Selection → 1
BS Signal → Downlink Physical Channels → HS-SCCH → Number of HS-SCCH → 4
BS Signal → Downlink Physical Channels → HS-SCCH → Unscheduled Subframes → Transmit Dummy UEID
BS Signal → Downlink Physical Channels → HS-PDSCH → Level (All Active Codes) → -8.0 dB or -4.0 dB
BS Signal → Downlink Physical Channels → HS-PDSCH → Unscheduled Subframes → Dummy Data
BS Signal → HSDPA HS-DSCH → CQI Feedback Cycle → 2 ms
BS Signal → HSDPA HS-DSCH → CQI Repetition Factor → 1

A HSDPA call is configured in R&S®CMU200 as specified in section 4.1. Downlink physical channels in Table 5(a) are configured in R&S®CMU200 as shown in Figure 6. Test parameters and RADIO BEARER MESSAGE are configured in R&S®CMU200 by referring to Figure 6 and Figure 2. A HSDPA call is established.

The SS shall send the TF according to CQI value 16 and keep it regardless of the CQI value sent by the UE. HS-PDSCH is transmitted continuously until 8200 CQI reports have been collected every 2 ms, including cases where UE transmits nothing in its CQI field.

BS Signal → HSDPA HS-DSCH → Channel Configuration Type → CQI
BS Signal → HSDPA HS-DSCH → CQI Channel Configuration → CQI Table Index → Conformance Test
BS Signal → HSDPA HS-DSCH → CQI Channel Configuration → Fixed Value → 16
BS Signal → HSDPA HS-DSCH → CQI Channel Configuration → No. of H-ARQ Processes → 2

The SS shall transmit the TF according to the Median CQI value and shall not react to the UE's CQI reports. The ACK, NACK and statDTX responses are associated with each response of CQI report that correspondes to the CQI evaluation period in which the end of the HS-PDSCH is received as shown in Figure 30 until 1000 fillted responses with Median CQI and Median CQI + 3 are collected. BLER as shown in Figure 30 at Median CQI and Median CQI + 3 are measured.

In R&S®CMU200, filtered ACK + NACK responses is indicated as BLER. BLER in R&S®CMU200 is defined as the percentage of transmission packets (HSDPA subframes) received in error, i.e. the ratio of (DTX + NACK)/(DTX + NACK + ACK) packets.

The test is repeated with Ior/Ioc of 5 dB.

Measurement result for channel quality indicator is available in *HSDPA CQI* in R&S®CMU200.

Configuration in R&S®CMU200:
Menus → Receiver Quality → Applic. 1 → HSDPA CQI
HSDPA CQI → Test Case → Fading
HSDPA CQI → Measure Subframes → Subrames → CQI → 8200
HSDPA CQI → Measure Subframes → Subframes → BLER → 1000

Figure 31 shows the HSDPA CQI measurement result.

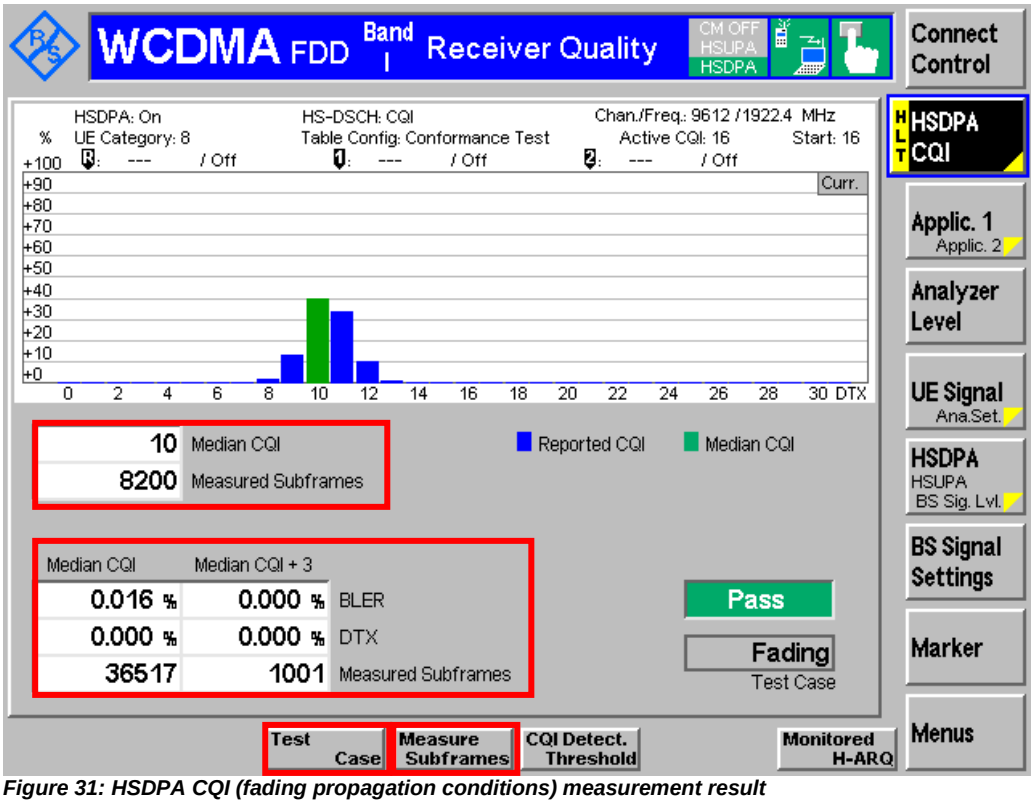


Figure 31: HSDPA CQI (fading propagation conditions) measurement result

Recall CQI.sav, establish CS call and modify the following configurations:
BS Signal → Node-B Settings → Output Channel Power (Ior) → -60.0 dBm
BS Signal → Node-B Settings → AWGN Noise Pwr (@3.84 MHz, Ioc) → Off
BS Signal → Downlink Physical Channels → HS-PDSCH → Level (All Active Codes) → -8.0 dB
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#1 → Level → -8.5 dB
BS Signal → Downlink Physical Channels → DPDCH Level Config → -6.0 dB

Repeat the test at Ior/Ioc = 5 dB by modifying the following configurations:
BS Signal → Node-B Settings → Output Channel Power (Ior) → -55.0 dBm
BS Signal → Downlink Physical Channels → HS-PDSCH → Level (All Active Codes) → -4.0 dB

The measurement result is available at:
Menus → Receiver Quality → Applic. 1 → HSDPA CQI
HSDPA CQI → Test Case → Fading
HSDPA CQI → Measure Subframes → Subrames → CQI → 8200
HSDPA CQI → Measure Subframes → Subframes → BLER → 1000

4.11 HS-SCCH Detection Performance: Single Link Performance (9.4.1)

The HS-SCCH detection performance is determined by the probability of event, Em, which is declared when the UE is signalled on HS-SCCH-1, but DTX is observed in the corresponding HS-DPCCH ACK/NACK field. The probability of event Em is denoted P(Em). This test applies to all FDD UE that support HSDPA.

The test requires an external multi-path fading simulator, e.g. R&S®SMU200A to generate multi-path fading signal with PA3 and VA30. The test is recommended to be performed remotely. Detail setup information on R&S®SMU200A and remote control via CMUgo are available in application notes [5] and [6].

Table 77 and Table 78 show the test requirement and test parameters for HS-SCCH detection – single link respectively. The measured P(Em) shall be less than or equal to the corresponding specified value of P(Em) in Table 77.

Test requirement for HS-SCCH detection – single link				
Test number	**Propagation conditions**	**Reference value**		
		HS-SCCH_1 Ec/Ior (dB)	**Ior/Ioc (dB)**	**P(Em)**
1	PA3	-8.9	0.6	0.05
2	PA3	-9.8	5.6	0.01
3	VA30	-9.9	0.6	0.01

Table 77: Test requirement for HS-SCCH detection – single link (Table 9.4.1.4 of TS 34.121[1])

Test parameters for HS-SCCH detection – single link				
Parameter	**Unit**	**Test 1**	**Test 2**	**Test 3**
Ioc	dBm/3.84 MHz	-60		
Phase reference	-	P-CPICH		
P-CPICH Ec_Ior	dB	-9.9		
HS-SCCH UE Identity (Xue,$_1$, Xue, $_2$, …, Xue, $_{16}$)		HS-SCCH-1: 1010101010101010 (every third TTI only, UE under test addressed solely via HS-SCCH-1) HS-SCCH-2: 0001001010101010 HS-SCCH-3: 0001101010101010 HS-SCCH-4: 0001111110101010		
HS-DSCH TF of UE1		TF corresponding to CQI1		
MAC-d PDU size	Bits	112		
HS-SCCH-1 transmission pattern		The HS-SCCH-1 shall be transmitted continuously with constant power.		
HS-PDSCH transmission pattern		The HS-PDSCH shall be transmitted continuously with constant power.		
HS-SCCH-1 TTI Signalling Pattern	-	The six sub-frame HS-SCCH-1 signalling pattern shall be “…XOOXOO…”, where “X” indicates TTI in which the HS-SCCH-1 uses the identity of the UE under test, and “O” indicates TTI in which the HS-SCCH-1 uses a different UE identity.		
Number of HARQ processes		2		

Table 78: Test parameters for HS-SCCH – single link (Table 9.4.1.3 and Table 9.4.1A.3 of TS 34.121 [1])

A HSDPA call is configured in R&S®CMU200 as specified in section 4.1. Downlink physical channels in Table 5(a) are configured in R&S®CMU200 as shown in Figure 6. A HSDPA call is established. Once HSDPA connection is setup, test parameters in Table 78 and downlink physical channels in Table 79 are configured in R&S®CMU200.

Downlink physical channels for HSDPA receiver testing for HS-SCCH detection performance		
Parameter	**Units**	**Value**
CPICH Ec/Ior	dB	-10
CCPCH Ec/Ior	dB	-12
SCH Ec/Ior	dB	-12
PICH Ec/Ior	dB	-15
HS-PDSCH-1 Ec/Ior	dB	-10
HS-PDSCH-2 Ec/Ior	dB	DTX*
HS-PDSCH-3 Ec/Ior	dB	DTX*
HS-PDSCH-4 Ec/Ior	dB	DTX*
DPCH Ec/Ior	dB	-8
HS-SCCH-1 Ec/Ior	dB	Test Specific
HS-SCCH-2 Ec/Ior	dB	
HS-SCCH-3 Ec/Ior	dB	
HS-SCCH-4 Ec/Ior	dB	
OCNS Ec/Ior	dB	Remaining power at Node-B (including HS-SCCH power allocation when HS-SCCH's inactive)

Note:
* HS-PDSCH-2, HS-PDSCH-3 and HS-PDSCH-4 are associated with HS-SCCH-2

Table 79: Downlink physical channels for HSDPA receiver testing for HS-SCCH detection performance (Table E.5.4 of TS 34.121 [1])

Configuration in R&S®CMU200:

BS Signal → Node-B Settings → Level Reference → Output Channel Power (Ior)
BS Signal → Node-B Settings → Output Channel Power (Ior) → -59.4 dBm (Ior/Ioc = 0.6 dB) or -54.4 dBm (Ior/Ioc = 5.6 dB)
BS Signal → Node-B Settings → AWGN Noise Pwr. (@3.84 MHz, Ioc) → Off
BS Signal → HSDPA HS-DSCH → Channel Configuration Type → CQI
BS Signal → HSDPA HS-DSCH → CQI Channel Configuration → CQI Table Index → Conformance Test
BS Signal → HSDPA HS-DSCH → CQI Channel Configuration → No. of H-ARQ Processes → 2
BS Signal → Downlink Physical Channels → P-CPICH → -9.9 dB
BS Signal → Downlink Physical Channels → P-CCPCH → -12.0 dB
BS Signal → Downlink Physical Channels → P-SCH → -15.0 dB
BS Signal → Downlink Physical Channels → S-SCH → -15.0 dB
BS Signal → Downlink Physical Channels → PICH → -15.0 dB
BS Signal → Downlink Physical Channels → DPDCH Level Config → -8.0 dB
BS Signal → Downlink Physical Channels → HSDPA Channels → On

BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#1 → Level → -8.9 dB (Test number 1), -9.8 dB (Test number 2) or -9.9 dB (Test number 3)
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#2 → Level → Off
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#3 → Level → Off
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#4 → Level → Off

BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#1 → UE ID → AAAA
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#2 → Dummy UE ID → 12AA
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#3 → Dummy UE ID → 1AAA
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#3 → Dummy UE ID → 1FAA
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH Selection → 1
BS Signal → Downlink Physical Channels → HS-SCCH → Number of HS-SCCH → 4
BS Signal → Downlink Physical Channels → HS-SCCH → Unscheduled Subframes → Transmit Dummy UEID
BS Signal → Downlink Physical Channels → HS-PDSCH → Level (All Active Codes) → -10.0 dB
BS Signal → Downlink Physical Channels → HS-PDSCH → Unscheduled Subframes → Dummy Data

These downlink physical channels can be configured in R&S®CMU200 by referring to Figure 6 and Figure 29.

The number of NACK, ACK and statDTX on the UL HS-DPCCH during the test interval are counted. NACK and ACK are counted as a pass and statDTX is counted as a failure.

Table 80 shows the test conditions for a single BER/BLER tests in statistical testing.

Test conditions for a single BER/BLER tests

Type of test (BER)	Test requirement (BER/BLER)	Test limit (BER/BLER) = Test requirement (BER/BLER) x TL TL	Target number of error events (time)	Minimum number of samples	Prob that good unit will fail = Prob that bad unit will pass [%]	Bad unit BER/BLER factor M
HS-SCCH Detection Performance	0.05	1.234	345 (34s)	Note 1	0.2	1.5
	0.01	1.234	345 (168s)	Note 1	0.2	1.5

Note 1: Conditions to check early pass/fail limit.
Table 80: Test conditions for a single BER/BLER tests (Table F.6.1.8 of TS 34.121[1])

Measurement result for HS-SCCH detection performance - single link performance is available in *HSDPA ACK* in R&S®CMU200.

Configuration in R&S®CMU200:
Menus → Receiver Quality → Applic. 1 → HSDPA ACK

Figure 32 shows the HS-SCCH detection performance – single link performance measurement result. The probability of event P(Em) is calculated as follow:

$$P(Em) = 1 - \frac{ACK(\%) + NACK(\%)}{100\%}$$

$$P(Em) = 1 - \frac{0.000\% + 100.000\,\%}{100\%} = 0.00$$

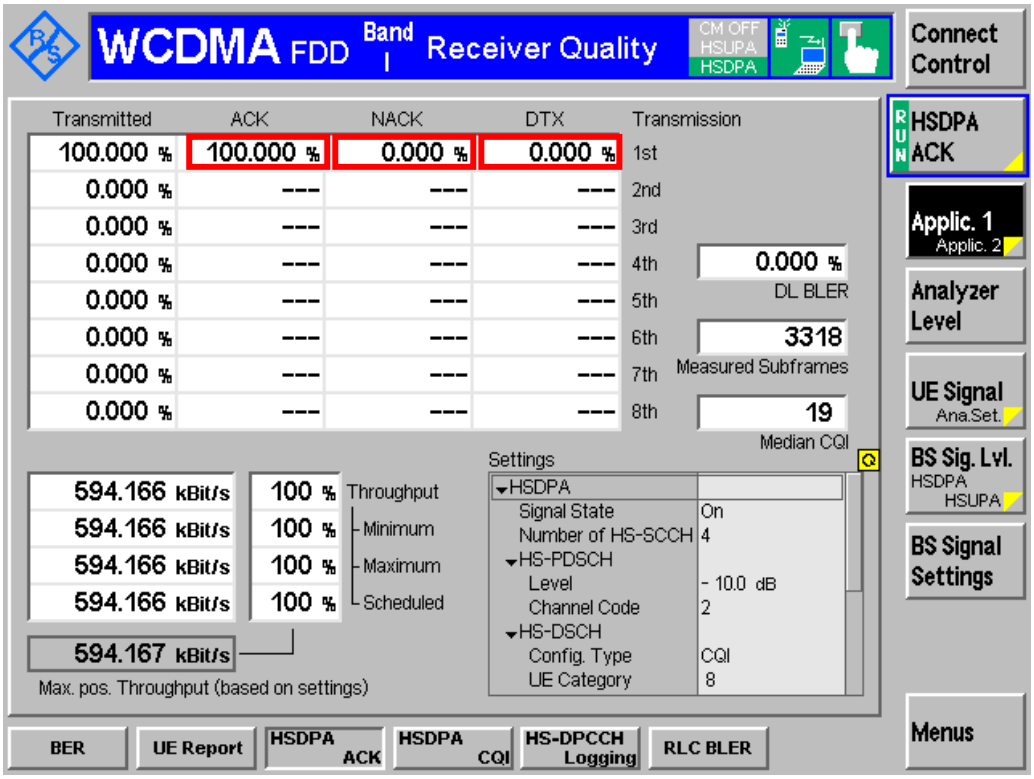


Figure 32: HS-SCCH detection performance – single link performance measurement result

Recall HSSCCH.sav and establish CS call.
Repeat the test at HS-SCCH_1 Ec/Ior = -9.8 dB and -9.9 dB by modifying the following configurations:
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#1 → Level → -9.8 dB or -9.9 dB
BS Signal → Node-B Settings → Output Channel Power (Ior) → -59.4 dBm (Ior/Ioc = 0.6 dB) or -54.4 dBm (Ior/Ioc = 5.6 dB)

The measurement result is available at:
Menus → Receiver Quality → Applic. 1 → HSDPA ACK

4.12 HS-SCCH Detection Performance: Single Link Performance – Enhanced Performance Requirement Type 1 (9.4.1A)

The HS-SCCH detection performance is determined by the probability of event, Em, which is declared when the UE is signalled on HS-SCCH-1, but DTX is observed in the corresponding HS-DPCCH ACK/NACK field. The probability of event Em is denoted P(Em). This test applies to all FDD UE of Release 6 and later releases that support HSDPA and the optional enhanced performance requirement type 1. It also applies to all FDD UE of Release 7 and later releases that support HSDPA and the optional enhanced performance requirement type 3.

The test requires an external multi-path fading simulator, e.g. R&S®SMU200A to generate multi-path fading signal with PA3 and VA30. The test is recommended to be performed remotely. Detail setup information on R&S®SMU200A and remote control via CMUgo are available in application notes [5] and [6].

Table 81 and Table 78 show the test requirement and test parameters for HS-SCCH detection – single link respectively. The measured P(Em) shall be less than or equal to the corresponding specified value of P(Em) in Table 81.

Test requirement for enhanced performance requirements type 1 for HS-SCCH detection – single link				
Test number	**Propagation conditions**	**Reference value**		
		HS-SCCH_1 Ec/Ior (dB)	**Ior/Ioc (dB)**	**P(Em)**
1	PA3	-11.9	0.6	0.01
2	VA30	-15.5	0.6	0.01

Table 81: Test requirement for enhanced performance requirement type 1 for HS-SCCH detection - single link (Table 9.4.1A.4 of TS 34.121[1])

A HSDPA call is configured in R&S®CMU200 as specified in section 4.1. Downlink physical channels in Table 5(a) are configured in R&S®CMU200 as shown in Figure 6. A HSDPA call is established. Once HSDPA connection is setup, test parameters in Table 78 and downlink physical channels in Table 79 are configured in R&S®CMU200.

Configuration in R&S®CMU200:
BS Signal → Node-B Settings → Level Reference → Output Channel Power (Ior)
BS Signal → Node-B Settings → Output Channel Power (Ior) → -59.4 dBm
BS Signal → Node-B Settings → AWGN Noise Pwr. (@3.84 MHz, Ioc) → Off
BS Signal → HSDPA HS-DSCH → Channel Configuration Type → CQI
BS Signal → HSDPA HS-DSCH → CQI Channel Configuration → CQI Table Index → Conformance Test
BS Signal → HSDPA HS-DSCH → CQI Channel Configuration → No. of H-ARQ Processes → 2

BS Signal → Downlink Physical Channels → P-CPICH → -9.9 dB
BS Signal → Downlink Physical Channels → P-CCPCH → -12.0 dB
BS Signal → Downlink Physical Channels → P-SCH → -15.0 dB
BS Signal → Downlink Physical Channels → S-SCH → -15.0 dB
BS Signal → Downlink Physical Channels → PICH → -15.0 dB
BS Signal → Downlink Physical Channels → DPDCH Level Config → -8.0 dB
BS Signal → Downlink Physical Channels → HSDPA Channels → On
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#1 → Level → -11.9 dB (Test number 1) or -15.5 dB (Test number 2)
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#2 → Level → Off
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#3 → Level → Off
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#4 → Level → Off
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#1 → UE ID → AAAA
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#2 → Dummy UE ID → 12AA
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#3 → Dummy UE ID → 1AAA
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#3 → Dummy UE ID → 1FAA
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH Selection → 1
BS Signal → Downlink Physical Channels → HS-SCCH → Number of HS-SCCH → 4
BS Signal → Downlink Physical Channels → HS-SCCH → Unscheduled Subframes → Transmit Dummy UEID
BS Signal → Downlink Physical Channels → HS-PDSCH → Level (All Active Codes) → -10.0 dB
BS Signal → Downlink Physical Channels → HS-PDSCH → Unscheduled Subframes → Dummy Data

These downlink physical channels can be configured in R&S®CMU200 by referring to Figure 6 and Figure 29.

The number of NACK, ACK and statDTX on the UL HS-DPCCH during the test interval are counted. NACK and ACK are counted as a pass and statDTX is counted as a failure.

Table 80 shows the test conditions for a single BER/BLER tests in statistical testing.

Measurement result for enhanced performance requirement type 1 HS-SCCH detection performance - single link performance is available in *HSDPA ACK* in R&S®CMU200.

Configuration in R&S®CMU200:
Menus → Receiver Quality → Applic. 1 → HSDPA ACK

Figure 32 shows the enhanced performance requirement type 1 HS-SCCH detection performance – single link measurement result. The probability of event P(Em) is calculated as follow:

$$P(Em) = 1 - \frac{ACK(\%) + NACK(\%)}{100\%}$$

$$P(Em) = 1 - \frac{0.000\% + 100.000\,\%}{100\%} = 0.00$$

Recall HSSCCH.sav, establish CS call and modify the following configuration:
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#1 → Level → -11.9 dB

Repeat the test at HS-SCCH_1 Ec/Ior = -15.5 dB by modifying the following configuration:
BS Signal → Downlink Physical Channels → HS-SCCH → HS-SCCH#1 → Level → -15.5 dB

The measurement result is available at:
Menus → Receiver Quality → Applic. 1 → HSDPA ACK

5 Summary of R&S®CMU200 *.SAV Files

Table below summarizes the available *.sav files based on R&S®CMU200 firmware V5.22A for UE supporting operating band I with power class 3 in RMC 12.2 kbps + HSDPA.

Summary of *.SAV files (Firmware V5.22A, UE operating band I and power class 3)

Clause	Test parameter	*.SAV filename
5.2A	Maximum Output Power with HS-DPCCH (Release 5 only)	HSDPATx1.sav HSDPATx2.sav HSDPATx3.sav HSDPATx4.sav
5.2AA	Maximum Output Power with HS-DPCCH (Release 6 and later)	
5.2C	UE Relative Code Domain Power Accuracy	
5.7A	HS-DPCCH Power Control	
5.9A	Spectrum Emission Mask with HS-DPCCH	
5.10A	Adjacent Channel Leakage Power Ratio (ACLR) with HS-DPCCH	
5.13.1A	Error Vector Magnitude (EVM) with HS-DPCCH	
5.13.1AA	Error Vector Magnitude (EVM) and Phase Discontinuity with HS-DPCCH	
5.13.2A	Relative Code Domain Error with HS-DPCCH	
6.3A	Maximum Input Level for HS-PDSCH Reception (16QAM)	MaxInput.sav
9.2.1A	Demodulation of HS-DSCH (Fixed Reference Channel): Single Link Performance – QPSK/16QAM, Fixed Reference Channel (FRC) H-Set 1/2/3	LevSet1.sav LevSet2.sav LevSet3.sav LevSet4.sav LevSet5.sav
9.2.1B	Demodulation of HS-DSCH (Fixed Reference Channel): Single Link Performance – QPSK, Fixed Reference Channel (FRC) H-Set 4/5	
9.2.1C	Demodulation of HS-DSCH (Fixed Reference Channel): Single Link Performance – QPSK/16QAM, Fixed Reference Channel (FRC) H-Set 6/3	
9.2.1D	Demodulation of HS-DSCH (Fixed Reference Channel): Single Link Performance – Enhanced Performance Requirements Type 1 - QPSK/16QAM, Fixed Reference Channel (FRC) H-Set 1/2/3	
9.2.1E	Demodulation of HS-DSCH (Fixed Reference Channel): Single Link Performance – Enhanced Performance Requirements Type 1 - QPSK/16QAM, Fixed Reference Channel (FRC) H-Set 6/3	
9.2.1F	Demodulation of HS-DSCH (Fixed Reference Channel): Single Link Performance – Enhanced Performance Requirements Type 2 - QPSK/16QAM, Fixed Reference Channel (FRC) H-Set 6/3	
9.2.1G	Demodulation of HS-DSCH (Fixed Reference Channel): Single Link Performance – Enhanced Performance Requirements Type 3 - QPSK/16QAM, Fixed Reference Channel (FRC) H-Set 6/3	
9.3.1	Reporting of Channel Quality Indicator: Single Link Performance – AWGN Propagation Conditions	CQI.sav
9.3.2	Reporting of Channel Quality Indicator: Single Link Performance – Fading Propagation Conditions	CQI.sav
9.4.1	HS-SCCH Detection Performance: Single Link Performance	HSSCCH.sav
9.4.1A	HS-SCCH Detection Performance: Single Link Performance – Enhanced Performance Requirement Type 1	HSSCCH.sav

6 Reference

[1] Technical Specification Group Radio Access Network; User Equipment (UE) Conformance Specification; 3GPP TS 34.121-1 V8.7.0, June 2009

[2] Technical Specification Group Radio Access Network; Common test environments for User Equipment (UE); 3GPP TS 34.108 V8.7.0, June 2009

[3] Technical Specification Group Radio Access Network; Physical layer procedures (FDD); 3GPP TS 25.214 V8.6.0, May 2009

[4] Technical Specification Group Radio Access Network; User Equipment (UE) radio transmission and reception (FDD); 3GPP TS 25.101 V8.7.0, May 2009

[5] Rohde & Schwarz; Application Note: Testing HSDPA UE RX Diversity, 1MA87, June 2008

[6] Rohde & Schwarz; Application Note: Measurements on 3GPP UE's according to TS34.121 with CMUgo: Tests with combined Instruments, 1MA130, October 2008

[7] Rohde & Schwarz; Reiner Stuhlfauth; High Speed Downlink Packet Access, HSDPA – RF measurements with CMU200 radio communication tester

[8] Rohde & Schwarz; Application Note: How to do Measurements according to TS 34.121 in presence of the HS-DPCCH with the R&S®CMU200, 1CM62, November 2005

7 Ordering Information

Ordering information		
Type	**Description**	**Order no.**
R&S®CMU200	Base unit with following accessories: power cord, operating and service manual for instrument	1100.0008.02
R&S®CMU-B21	Unversal signaling unit; provides multistandard signaling hardware; required for WCDMA 3GPP FDD	1100.5200.14
R&S®CMU-B56	WCDMA (3GPP FDD) signaling module for CMU-B21 model 14	1150.1850.14
R&S®CMU-B68	Versatile baseband board for WCDMA (3GPP FDD) layer 1, DL and UL, non-signaling	1149.9809.02
R&S®CMU-K16	WCDMA (3GPP FDD) band 10, UE test signaling software (R&S®CMU200-B68, R&S®CMU200-B21 model 14 or 54, R&S®CMU200-B56 necessary)	1200.9158.02
R&S®CMU-K17	WCDMA (3GPP FDD) band 11, UE test signaling software (R&S®CMU200-B68, R&S®CMU200-B21 model 14 or 54, R&S®CMU200-B56 necessary)	1200.9258.02
R&S®CMU-K57	WCDMA signaling 3GPP/FDD/UE, band 7 (R&S®CMU200-B68, R&S®CMU200-B21 model 14 or 54, R&S®CMU200-B56 necessary)	1200.7903.02
R&S®CMU-K58	WCDMA signaling 3GPP/FDD/UE, band 8 (R&S®CMU200-B68, R&S®CMU200-B21 model 14 or 54, R&S®CMU200-B56 necessary)	1200.8000.02
R&S®CMU-K59	WCDMA signaling 3GPP/FDD/UE, band 9 (R&S®CMU200-B68, R&S®CMU200-B21 model 14 or 54, R&S®CMU200-B56 necessary)	1200.8100.02
R&S®CMU-K60	HSDPA 14 Mbit/s extension 3GPP/FDD/UE, Rel. 5 (¸CMU-K64 necessary)	1200.8200.02
R&S®CMU-K61	WCDMA (3GPP FDD) band 4, UE test signaling software	1157.3670.02
R&S®CMU-K62	WCDMA (3GPP FDD) band 5, UE test signaling software	1157.3770.02
R&S®CMU-K63	WCDMA (3GPP FDD) band 6, UE test signaling software	1157.3870.02
R&S®CMU-K64	3.6 Mbit/s HSDPA	1157.3970.02
R&S®CMU-K65	WCDMA (3GPP FDD) UL user equipment TX test, non-signaling test software	1115.4891.02
R&S®CMU-K66	WCDMA (3GPP FDD) DL generator, non-signaling test software	1115.5100.02
R&S®CMU-K67	WCDMA (3GPP FDD) band 3, UE test signaling software	1150.3000.02
R&S®CMU-K68	WCDMA (3GPP FDD) band 1, UE test signaling software	1115.5300.02
R&S®CMU-K69	WCDMA (3GPP FDD) band 2, UE test signaling software	1115.5400.02

About Rohde & Schwarz
Rohde & Schwarz is an independent group of companies specializing in electronics. It is a leading supplier of solutions in the fields of test and measurement, broadcasting, radiomonitoring and radiolocation, as well as secure communications. Established 75 years ago, Rohde & Schwarz has a global presence and a dedicated service network in over 70 countries. Company headquarters are in Munich, Germany.

Regional contact
Europe, Africa, Middle East
+49 1805 12 42 42* or +49 89 4129 137 74
customersupport@rohde-schwarz.com

North America
1-888-TEST-RSA (1-888-837-8772)
customer.support@rsa.rohde-schwarz.com

Latin America
+1-410-910-7988
customersupport.la@rohde-schwarz.com

Asia/Pacific
+65 65 13 04 88
customersupport.asia@rohde-schwarz.com

Certified Quality System
ISO 9001
DQS REG. NO 1954 QM

Certified Environmental System
ISO 14001
DQS REG. NO 1954 UM

Rohde & Schwarz GmbH & Co. KG
Mühldorfstraße 15 | D - 81671 München
Phone + 49 89 4129 - 0 | Fax + 49 89 4129 – 13777

www.rohde-schwarz.com