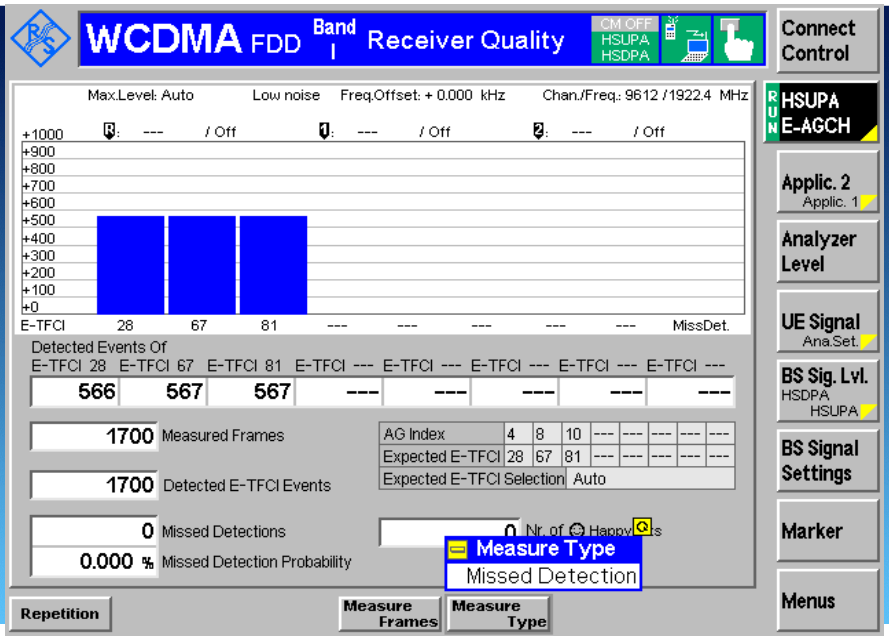

Products: R&S® CMU200

Operation Guide for HSUPA Test Set-up According to 3GPP TS 34.121

Application Note

This operation guide describes how to measure HSUPA test cases according to 3GPP TS 34.121 V8.0 with R&S®CMU200. Setting files according to the test requirements are attached.

ROHDE&SCHWARZ

Subject to change – Jenny Chen 03.08 - RCS0712-0053

Contents

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1 Overview

This operation guide is a simple step by step guide to perform measurement on HSUPA test cases (TC) according to 3GPP TS 34.121 V8.00 [2]. It does not include a technical introduction to HSUPA, which you can find in [1].

With firmware version 5.01, R&S®CMU200 can support eight test cases so far, including five transmitter (Tx) test cases and three performance (Px) test cases:

TX test cases

1) *Maximum Output power* with HS-DPCCH and E-DCH (TC 5.2B)
2) *Adjacent Channel Leakage Power Ratio* (ACLR) with E-DCH (TC 5.9B)
3) *Spectrum Emission Mask* with E-DCH (TC 5.10B)
4) *UE relative Code Domain Power Accuracy for HS-DPCCH and E-DCH (TC 5.2D)*
5) *Relative Code Domain Error with HS-DPCCH and E-DCH (TC 5.13.2B)*

PX test cases

6) *Detection of E-DCH HARQ ACK Indicator Channel (EHICH) (TC 10.2.1.1 & 10.2.1.2)*
7) *Detection of E-DCH Relative Grant Channel (E-RGCH) (TC 10.3.1.1 & 10.3.1.2)*
8) *Demodulation of E-DCH Absolute Grant Channel (E-AGCH) (TC 10.4.1)*

Section 2 describes step by step the general configuration of R&S®CMU200 for a HSUPA call setup. It applies to both transmitter and performance tests according to 3GPP TS 34.121.

Section 3 provides the step by step guide how to configure R&S®CMU200 for Tx tests, and section 4 how to configure it for Px tests.

A set of files with prepared settings (for CMU200 firmware V5.00) is attached to allow users to recall the settings and perform the measurements as described in this operation guide.

2 General Configuration for a HSUPA Call Setup

The general configuration for a HSUPA call setup is done in four steps:

1. Enable Packet Switch Domain.
2. Set the packet switched mode to be ‘HSUPA Test Mode’ and activate HSPA channels
3. Configure HSDPA channels
4. DL channel power general settings

Step 1. Enable Packet Switch Domain.

Select **Network > Packet Switched Domain > 'On'**

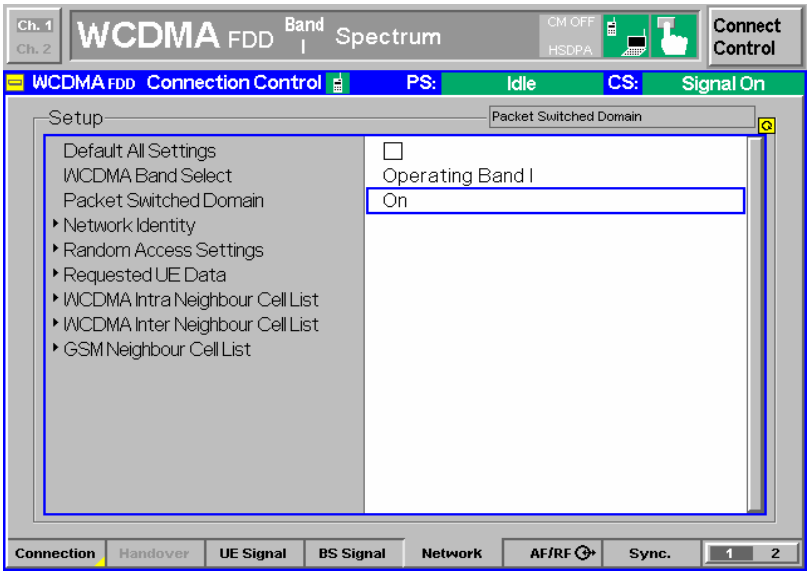

Figure 1: Activate packet switched domain

Step 2. Set the packet switched mode to be 'HSUPA Test Mode' and activate HSPA channels

Test mode connection: RMC 12.2 kbps + HSPA 34.108 with loop mode 1

Select **BS Signal > Circuit Switched > DCH (Dedicated Chn) Type > 'RMC'.**

Select **BS Signal > Circuit Switched > RMC Settings > Reference Channel Type > '12.2kbps + HSPA 34.108'**

Select **BS Signal > Circuit Switched > RMC Settings > HSPA > HSUPA UL RLC SDU Size > '2936 Bit'** (According to TS 34.121 Annex C.11.3)

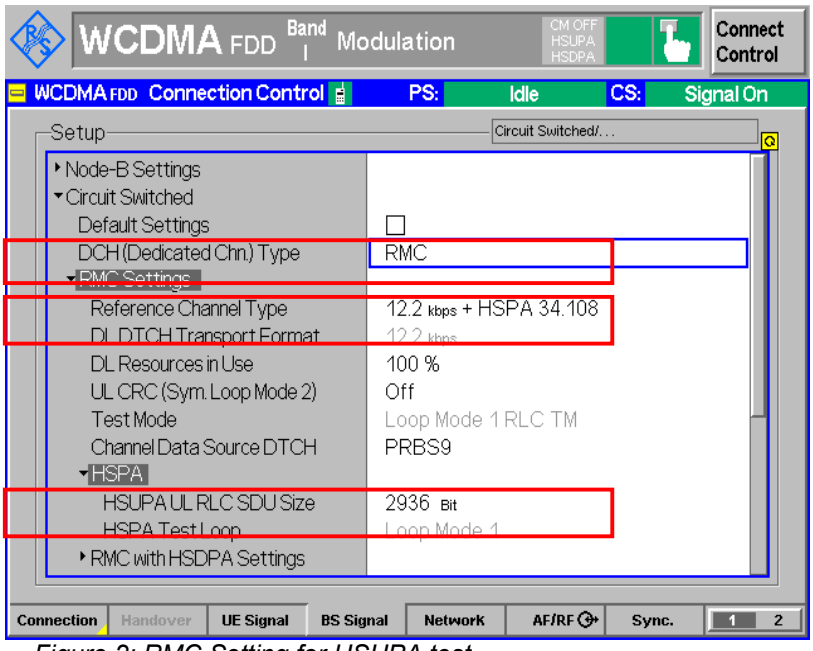

Figure 2: RMC Setting for HSUPA test

Select **BS Signal > Downlink Physical Channels > HSDPA Channels > 'ON'**

BS Signal > Downlink Physical Channels > > HSUPA channels > 'On'

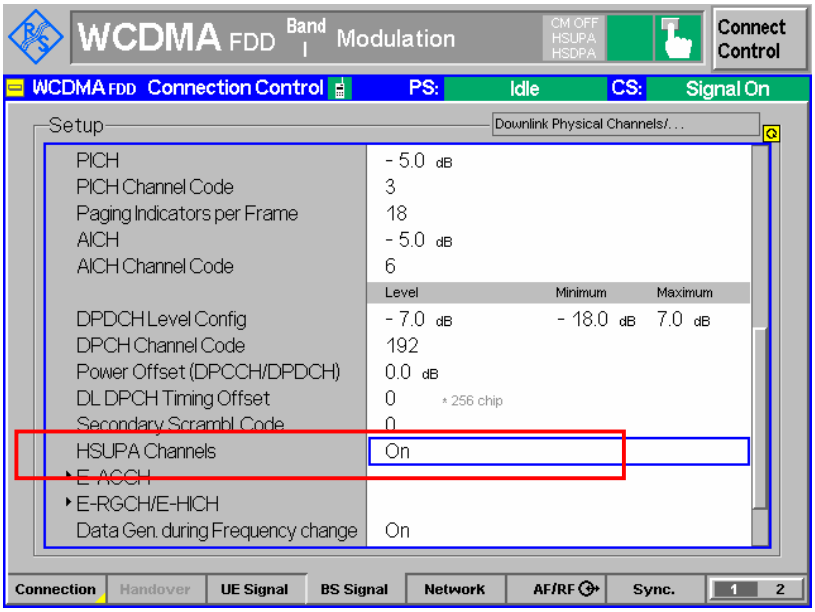

Figure 3: Activate HSDPA and HSUPA channels

Step 3. Configure HSDPA channels

CQI feedback cycle **4 ms**
CQI repetition factor **2**
ACK-NACK repetition factor **3**

HS-DSCH settings: **Fixed Reference Channel** with **H-Set 1 with QPSK**

All these settings are according to Contents of RADIO BEARER SETUP message defined in all the Tx test cases.

H-Set 1 with QPSK is used according to the test specification.

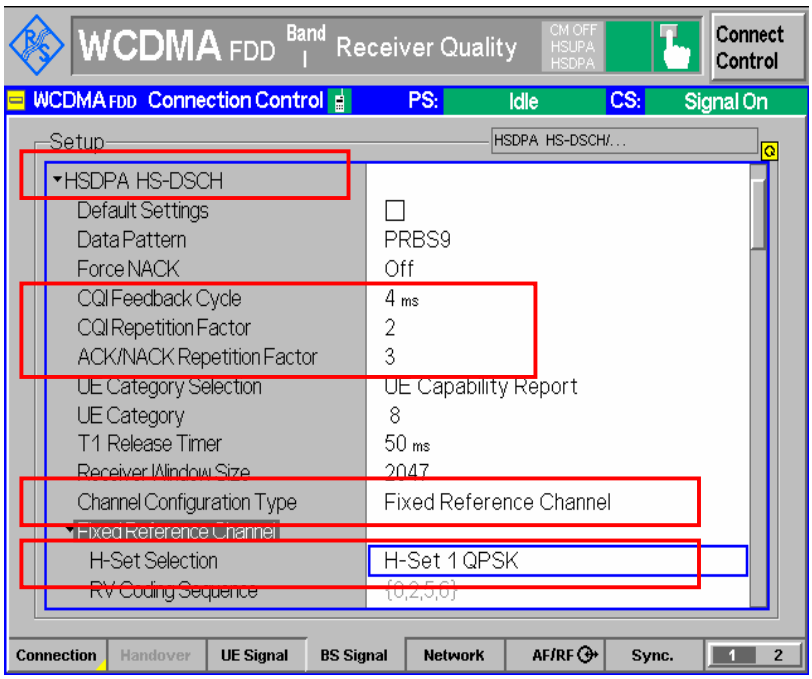

Figure 4: HSDPA settings

Step 4. DL channel power general settings (according to TS 34.121 Annex E.5A)

The level reference should be set as '**Output channel Power (Ior)**'

Select **BS Signal> Node-B Settings > level reference > 'Output channel Power (Ior)'**

The power setting can be found at **BS Signal > Downlink Physical Channels**. The power setting should be done before connecting the DUT with CMU200.

Channel	Level (dB)
P-CPICH	-10
S-CPICH	Off
P-SCH	-15
S-SCH	-15
P-CCPCH	-12
S-CCPCH	-12
PICH	-15
AICH	-12
DPDCH	-10

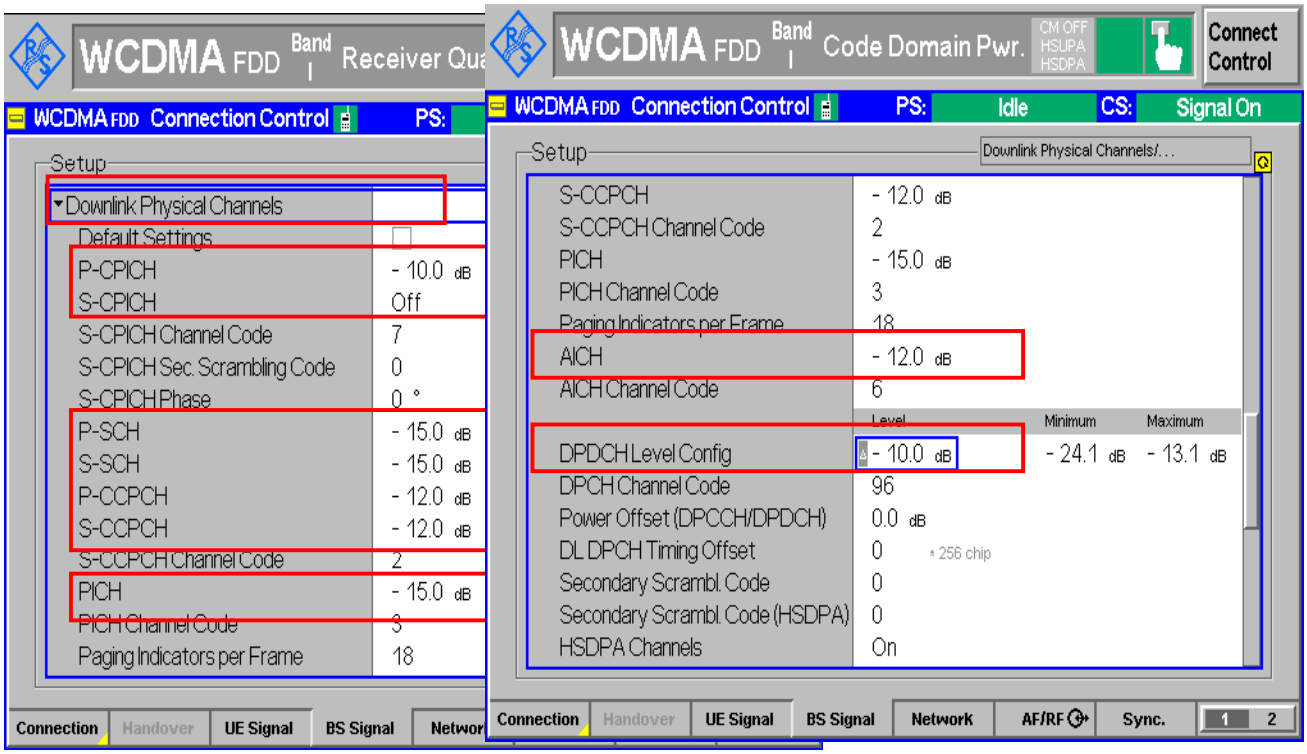

Figure 5: WCDMA downlink channel power level settings

3 Transmitter Tests

3.1 General Settings for Transmitter Tests

3.1.1 Test Specific DL Power Settings

Select **BS Signal > Node-B Settings > Output Channel Power (I_{or}) >'-86 dBm'** (according to the I_{or} setting defined in the Tx test cases)

Select **BS Signal > Downlink Physical Channels** and change the power setting according to the table below (set E-AGCH and E-HICH power, followed by HS-PDSCH power). These settings are defined in TS 34.121 Annex E.5A.1.

Channel	Level (dB)
HS-SCCH	-8
HS-PDSCH	-3
E-AGCH	-20
E-RGCH/E-HICH	-20
E-RGCH Active	Off
$\hat{I}_{or}$ (Output Channel power)	-86

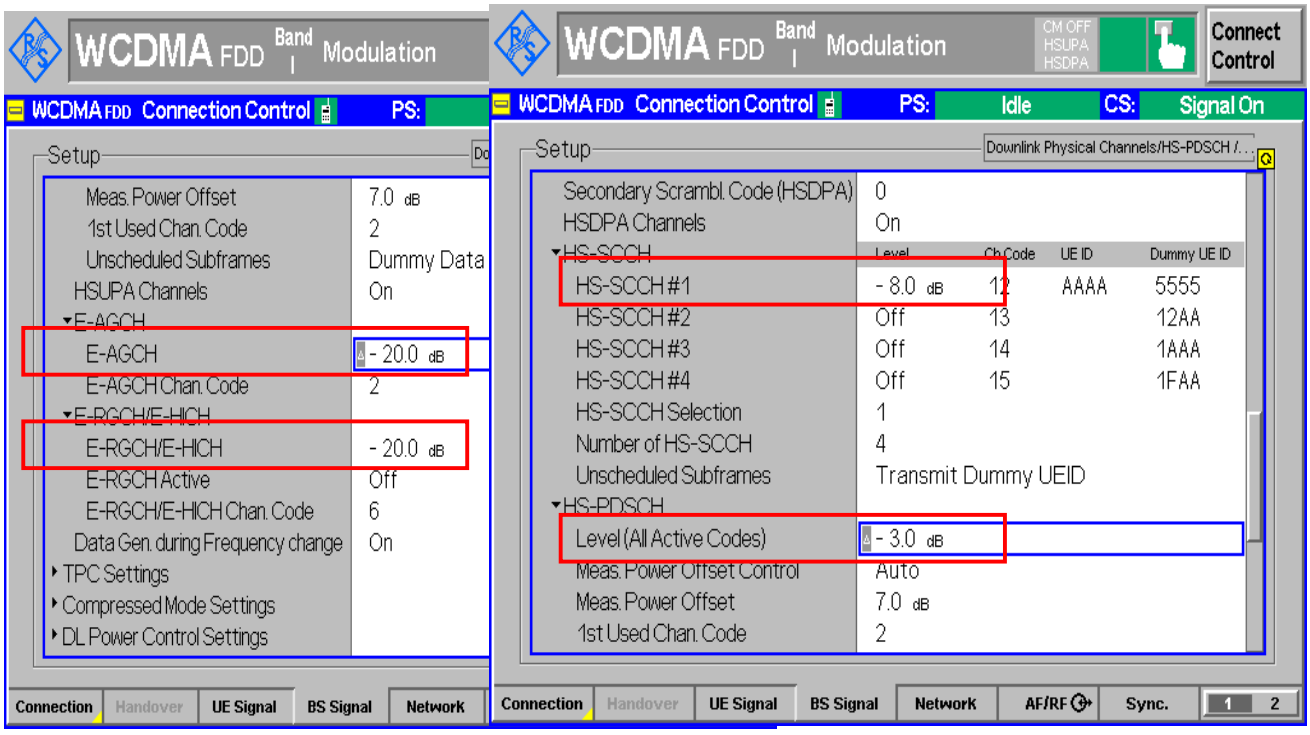

Figure 6: HSUPA power settings for Tx test

3.1.2 UE Target Power

The UE target power upon connection should be 6 dB less than the maximum power. It can be accessed via '**UE Signal > UE Power Control > UL Target Power > Power**' or set at connection control page. This setting is defined in TC 5.2B.4.2 and it is used for all other Tx test cases.

3.1.3 TPC Setting

Algorithm 2 is used as default setting (according to Contents of RADIO BEARER SETUP message defined in TC5.2B and 5.2D, which are used for 5.9B, 5.10B and 5.13.2B),

Change the pattern setting for Set 2, Set 3 and set 4 (used in 5.2D), which will be used in the test. '11111' means TPC = +1 in algorithm 2. '00000' means TPC = -1 in algorithm 2. '0101010101' means TPC = 0 in algorithm 2.

The setting can be found at **BS Signal > TPC Settings**

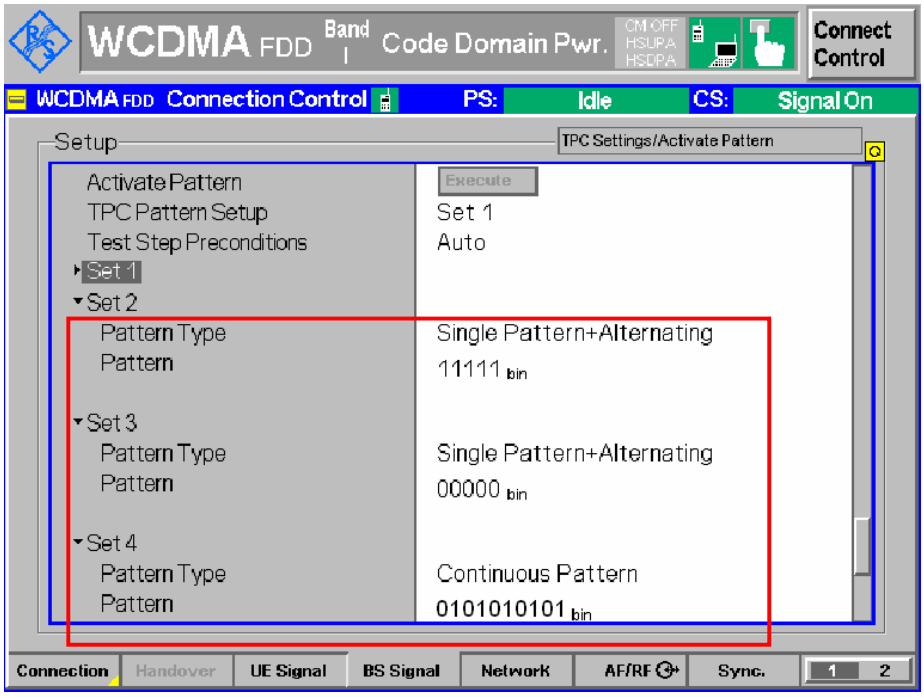

Figure 7: General TPC settings for Tx test

3.1.4 HSUPA-Specific Signalling Settings

Parameter	Value
E-TFCI table index	0
E-DCH minimum set E-TFCI	9
PLnon-max	0.84
Max. number channelization codes	2xSF4
Initial Serving Grant Value	Off

These settings are defined in TS 34.108 section 9.2.1, which is quoted by TS 34.121 Annex C.11.1.

Select **UE Signal > HSUPA** and change the related parameter accordingly.

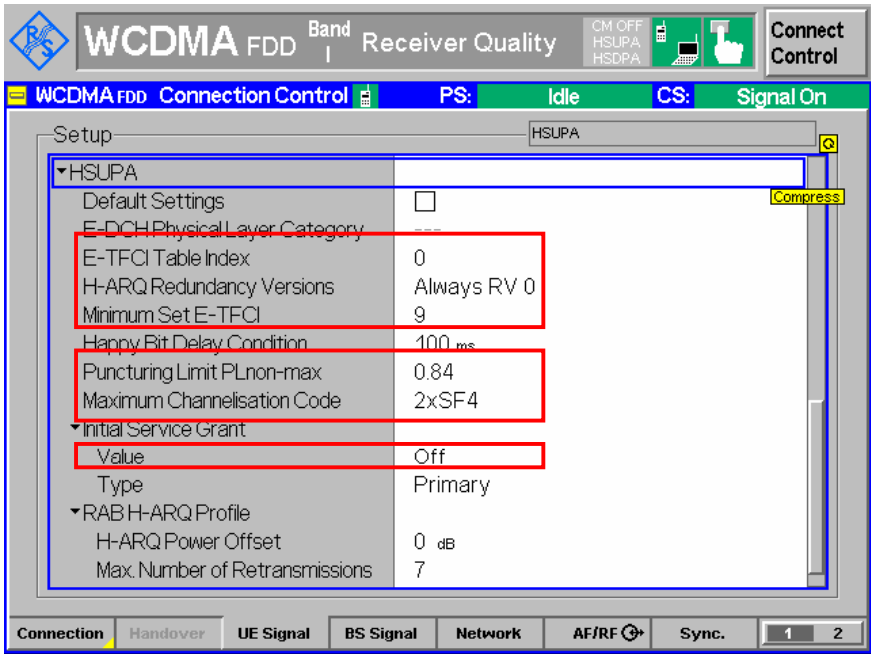

Figure 8: HSUPA signaling setting for Tx test

3.1.5 Subtest Settings

There are *five subtests* defined with different absolute grant (AG) values. Each sub-test has its own reference TFCI and gain setting. It is important to set the parameters correctly for different subsets. The following values are derived from TS 34.121 Annex C.11.1

Beta Values and Absolute Grant Values

Subtest	AG	β_c	β_d	β_{hs}/β_c
1	20	11	15	2
2	12	6	15	2
3	15	15	9	2
4	17	2	15	2
5	21	15	15	2

HSUPA Reference E-TFCIs

Subtest	**1,2,4,5**				
Number of Ref. ETFCIs	5				
Referece of E-TFCI	11	67	71	75	81
Ref. E-TFCI Power Offset	4	18	23	26	27

Subtest	**3**	
Number of Ref. ETFCIs	2	
Referece of E-TFCI	11	92
Ref. E-TFCI Power Offset	4	18

HSUPA Gain Factors

Subtest	ΔE-DPCCH
1	6
2	8
3	8
4	5
5	7

The settings for each subtest have to be done in three steps with the values according to the tables above. The following figures are given as example

Step 1. Absolute Grant index setting is defined in
BS Signal > HSUPA > E-AGCH >AG Pattern > AG Index

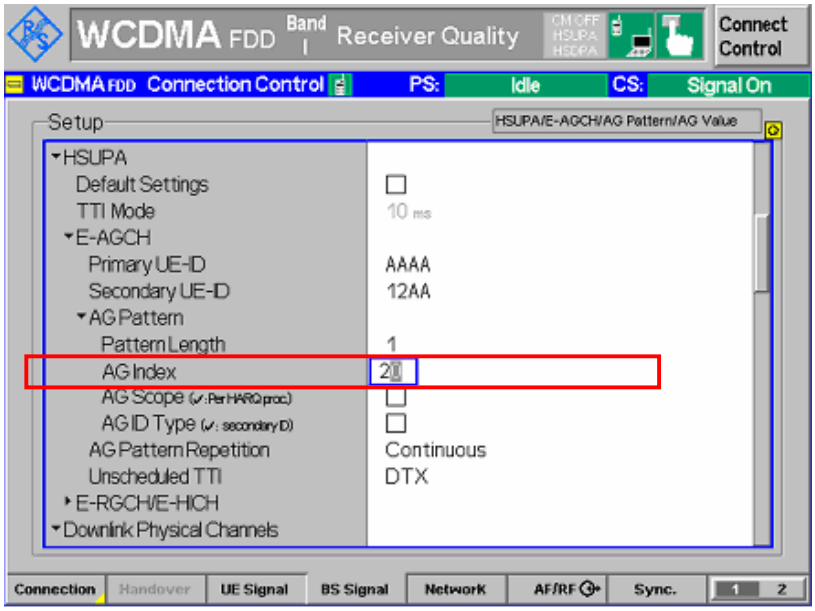

Figure 9: AG Index setting for Tx subtest 1

Step 2. Gain settings for RMC and HSDPA channels are defined in **UE Signal**:

The ΔACK, ΔNACK and ΔCQI values should be 8, which calculated from $ß_{hs}$ / $ß_c$.

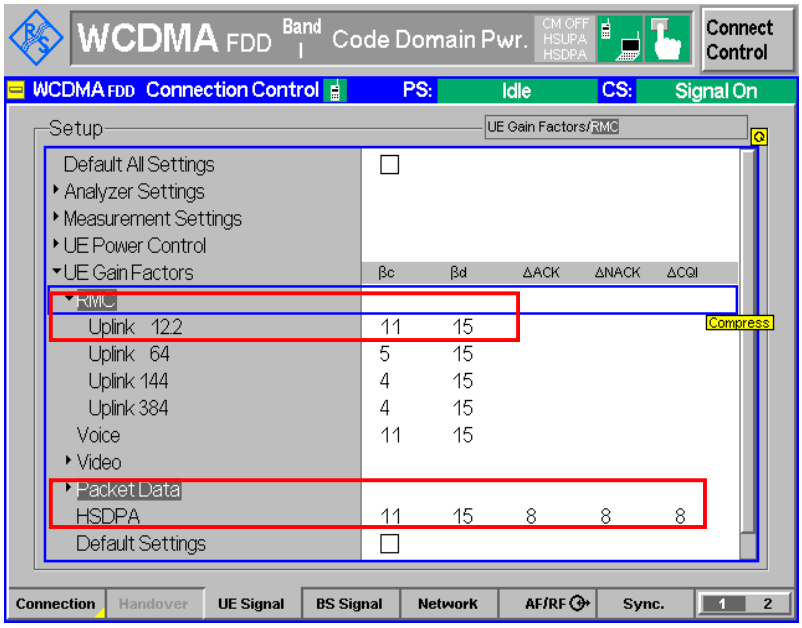

Figure 10: RMC and HSDPA channel gain settings for Tx subtest 1

Step 3. HSUPA gain settings are defined in **UE Signal > HSUPA >HSUPA Gain Factors**:

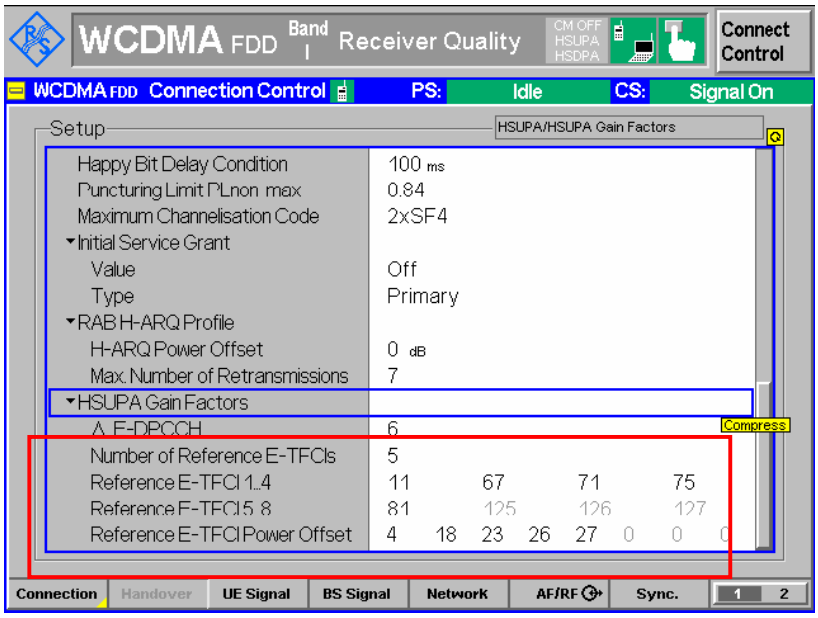

*Figure 11: HSUPA gain settings for Tx subtest **1,2,4,5***

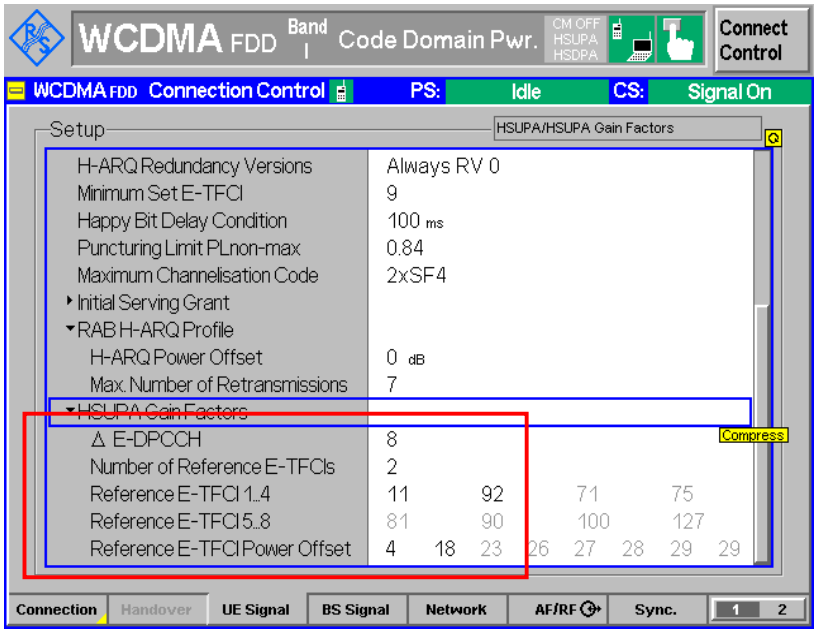

*Figure 12: HSUPA gain settings for Tx subtest **3***

After the setting, you can start your measurements by pressing '**Connect UE (CS)**'.

3.2 Maximum Output Power with HS-DPCCH and E-DCH (TC 5.2B)

To verify that the error of the UE maximum output power with HS-DPCCH and E-DCH does not exceed the range prescribed by the maximum output power and tolerance defined in table 5.2B.5.

In this test case there are two parameters that need to be observed:

1. Maximum output power

2. E-TFCI.

To observe E-TFCI:

a) Go to measurement page, press '**Menus**'
b) Press '**Receiver Quality**' at bottom
c) Press Applic. 2 / Applic. 1 at the right side, until you see HSUPA E-AGCH at the bottom, then press HSUPA E-AGCH. You will see the following:

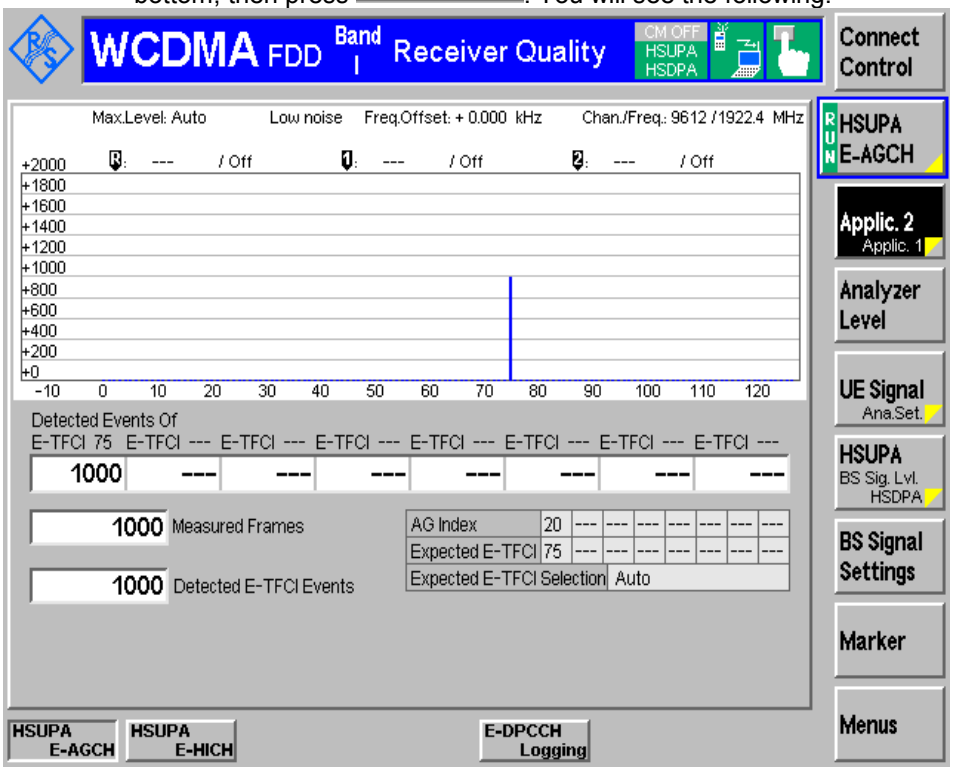

Figure 13: E-TFCI transmitted

The expected E-TFCI is shown in the following table

Subtest	**1**	**2**	**3**	**4**	**5**
Expected E-TFCI	75	67	92	71	81

The procedures described in the specifications are as follows[2].

1)-3) have been implemented through the general setting

4) Send power control bits to give one TPC_cmd=+1 command to the UE.

5) The SS checks the received E-TFCI for 150 ms. If UE does not send any decreased E-TFCI within the 150ms then go back to step 4) otherwise proceed to step 6).

6) Send power control bits to give one TPC_cmd = -1 command to the UE.

7) The SS checks the received E-TFCI for 150 ms. If UE sends any decreased E-TFCI within the 150 ms, then send new power control bits to give another TPC_cmd = -1 command to the UE and wait 150 ms.

8) Confirm that the E-TFCI transmitted by the UE is equal to the target E-TFCI in Table C.11.1.3. If the E-TFCI transmitted by the UE is not equal to the target E-TFCI, then fail the UE.

9) Measure the mean power of the UE. The mean power shall be averaged over at least one timeslot.

10) Repeat the measurement for the different combinations of beta values as given in table C.11.1.3.

In order to implement these steps in CMU200:

d) Press **'BS Signal Settings'** at right

e) Press '**TPC Pattern Setup'** at bottom and select '**Set 2**'

f) Press '**Activate Pattern'** once to send TPC_cmd = +1

g) Keep on pressing '**Activate Pattern**' until a E-TFCI drops, and then press '**TPC Pattern Setup'** at bottom and select **'Set 3'** and press **'Activate Pattern'** once to send TPC_cmd = -1 (step 6)**.**

h) If UE sends any decreased E-TFCI, press **'Activate Pattern'** button again (step 7).

i) If the E-TFCI is still a decreased value, fail the UE (step 8).

j) If not, measure the power by selecting '**Overview / WCDMA**' in '**Modulation**' measurement (step 9)[2].

k) Repeat the measurement for different subtest (step 10)

[2] NOTE: These steps fulfills the test condition for TC 5.2D, 5.9B, 5.10B, 5.13.2B.

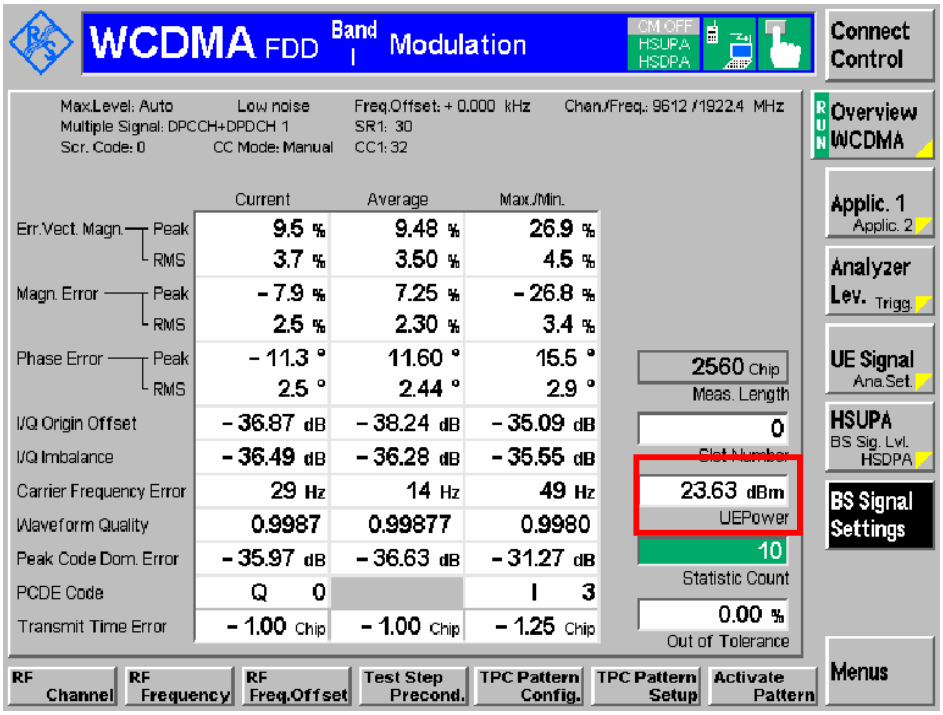

Figure 14: UE Maximum output power

The maximum power should be within the limits defined:

Table 5.2B.5: Maximum Output Powers with HS-DPCCH and E-DCH for test

Sub-test in table C.11.1.3	Power Class 3		Power Class 4	
	Power (dBm)	Tol (dB)	Power (dBm)	Tol (dB)
1	+24	+1.7/-5.2	+21	+2.7/-4.2
2	+22	+3.7/-5.2	+19	+4.7/-4.2
3	+23	+2.7/-5.2	+20	+3.7/-4.2
4	+22	+3.7/-5.2	+19	+4.7/-4.2
5	+24	+1.7/-5.2	+21	+2.7/-4.2

3.3 Spectrum Emission Mask with E-DCH (TC 5.9B)

The setting for this test is the same as the maximum output power setting described in *section 3.2 Maximum Output Power with HS-DPCCH and E-DCH*. After taking the maximum output power measurement, press '**Menus**' at the right side; '**Spectrum**' at the bottom; '**Application**' at the right side and '**Emission Mask**' at the bottom. You will see the measurement as below:

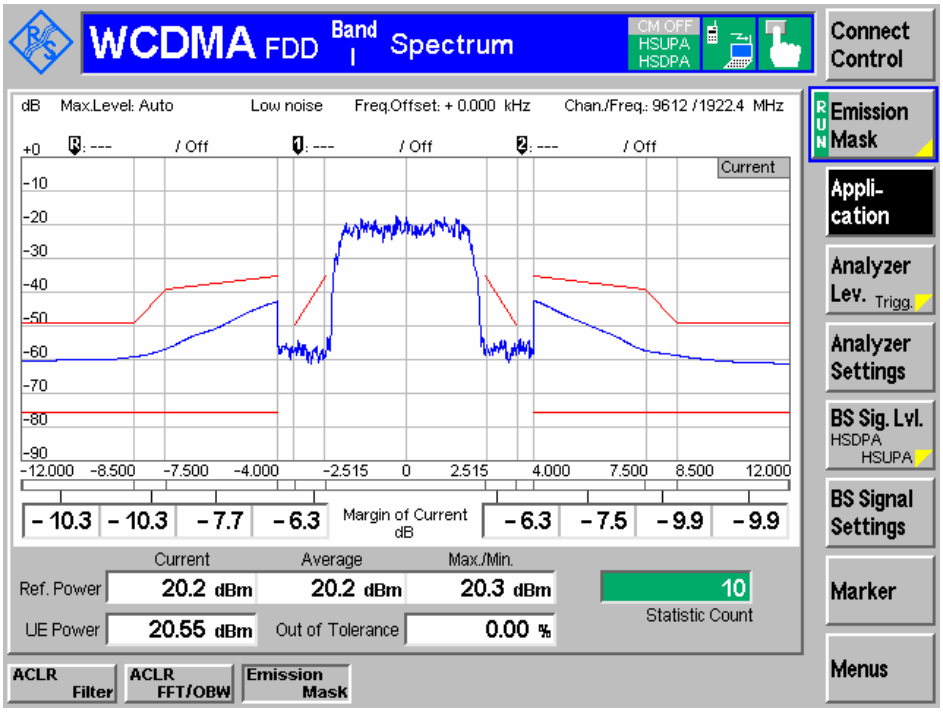

Figure 15: Spectrum emission mask with E-DCH

Table 5.9B.1: Spectrum Emission Mask requirements

Δf in MHz (Note 1)	*Minimum requirement (Note 2)*		*Additional requirements Band II, IV, V, X (Note 3)*	*Measurement bandwidth (Note 6)*
	Relative requirement	*Absolute requirement*		
2.5 to 3.5	$\left\{-35-15\cdot\left(\frac{\Delta f}{MHz}-2.5\right)\right\}dBc$	*-71.1 dBm*	*-15 dBm*	*30 kHz*
3.5 to 7.5	$\left\{-35-1\cdot\left(\frac{\Delta f}{MHz}-3.5\right)\right\}dBc$	*-55.8 dBm*	*-13 dBm*	*1 MHz*
7.5 to 8.5	$\left\{-39-10\cdot\left(\frac{\Delta f}{MHz}-7.5\right)\right\}dBc$	*-55.8 dBm*	*-13 dBm*	*1 MHz*
8.5 to 12.5 MHz	*-49 dBc*	*-55.8 dBm*	*-13 dBm*	*1 MHz*

The test should be repeated with different subtests.

3.4 Adjacent Channel Leakage Power Ratio (ACLR) with E-DCH (TC 5.10B)

The setting for this test is the same as the maximum output power setting described in *section 3.2 Maximum Output Power with HS-DPCCH and E-DCH*. After taking the maximum output power measurement, press '**Menus**' at the right side; '**Spectrum**' at the bottom; '**Application**' at the right side and '**ACLR FFT/OBW**' at the bottom. You will see the measurement as below:

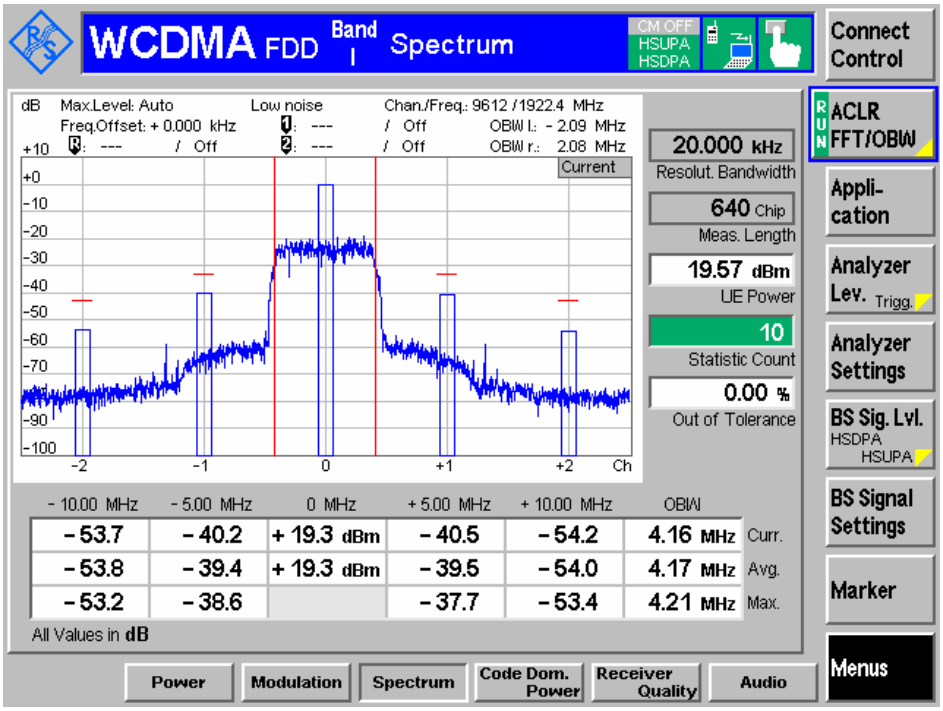

Figure 16: ACLR with E-DCH measurement

The requirements are given in Table 5.10B.1

Table 5.10B.1: UE ACLR limit

Power Class	UE channel	ACLR limit
3	+5 MHz or –5 MHz	33 dB
3	+10 MHz or –10 MHz	43 dB
4	+5 MHz or –5 MHz	33 dB
4	+10 MHz or –10 MHz	43 dB

The test should be repeated with different subtests.

3.5 UE relative Code Domain Power Accuracy for HS-DPCCH and E-DCH (TC 5.2D)

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

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

where

*Measured CDP ratio = 10*log((Measured code power) / (Measured total power of all active codes))*

*Nominal CDP ratio = 10*log((Nominal CDP) / (Sum of all nominal CDPs))*

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 (according to TS 25.101 section 6.2.3)

This test case setting can be based on TC 5.2B.

After taking the measurement result for TC 5.2B, TC 5.9B and TC 5.10B, do the following steps:

a) Press **'BS Signal Settings'** at right

b) Press '**TPC Pattern Setup'** at bottom and select '**Set 4**'

c) Press '**Menus**' at the right bottom and select '**Code Dom. Power**' at the bottom

d) Press '**Application**' at the right and select '**CDP Relative**' at the bottom to activate the measurement

e) Press ' 

' at the right and select '**Channel Settings**' and set the AG Pattern Len to be 2, and the first AG value should be '0', and the second should be the value defined in the corresponding subtest testing (please refer to table in section 3.1.5), shown as in *Figure 17* for subtest 1 as an example.

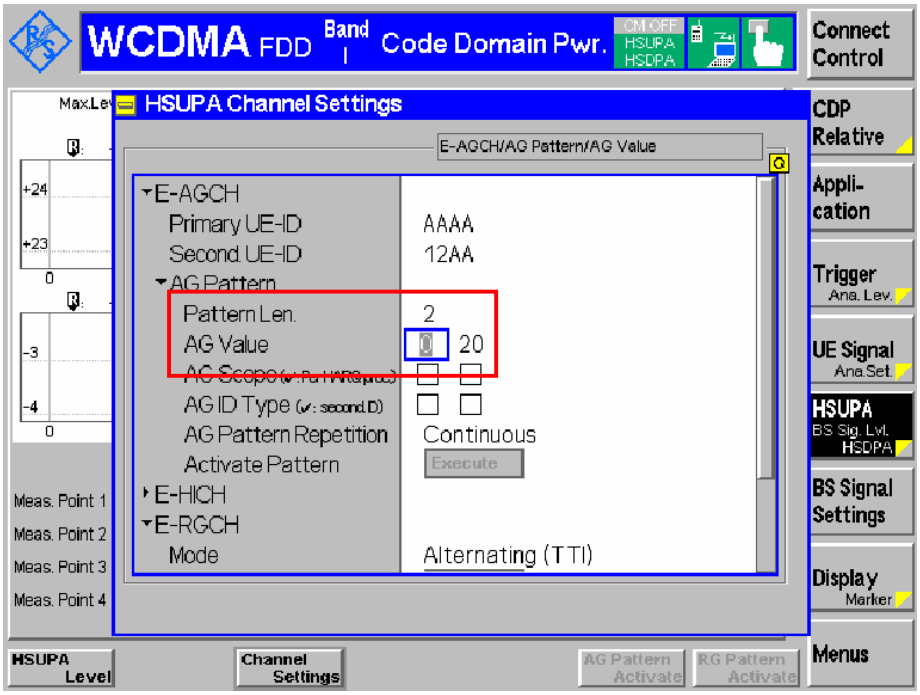

Figure 17: AG Pattern setting for TC 5.2D

f) Press '**Trigger Ana.Lev**' at the right and select '**Trigger Source**' at the bottom, and set it to be 'Frame'

g) Press '**CDP Relative'** at the right and '**Diagram Type**' at the bottom, select 'E-DPDCH1'. Select '**Measure Length**' and set it as '45'. Select '**Measure Points**' and set the points in accordance with what shown in *Figure 18*.

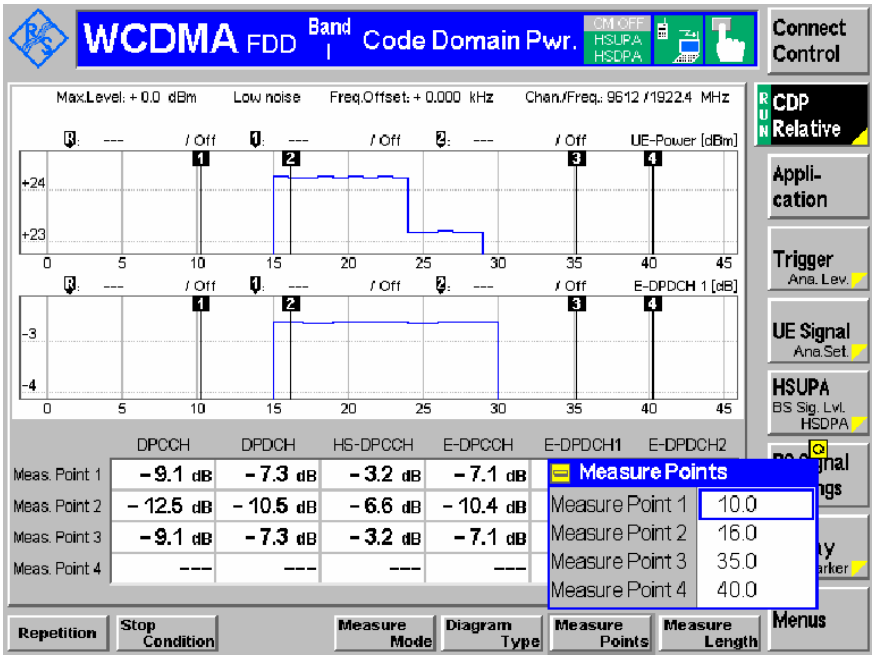

Figure 18: Mearsure points for relative CDP accuracy measurement.

The measured CDP ratio for each channel and each measurement point are shown as in *Figure 18*.

The UE relative code domain power nominal ratio and the test requirement is shown as in Table 5.2D.7 and Table 5.2D.8 respectively.

Table 5.2D.7: UE relative code domain power nominal ratios

Sub-Test in Table C.11.1.3	Measure-ment Point	Expected Relative Code Domain Power in dB					
		DPCCH	DPDCH	HS-DPCCH	E-DPCCH	E-DPDCH1	E-DPDCH2
1	1	-9.3	-6.6	-3.3	-7.3	-18.9	OFF
	2	-18.5	-15.8	-12.5	-16.5	-0.5	OFF
	3	-9.3	-6.6	-3.3	-7.3	-18.9	OFF
2	1	-11.9	-3.9	-5.8	-5.8	-21.4	OFF
	2	-14.0	-6.0	-8.0	-8.0	-4.1	OFF
	3	-11.9	-3.9	-5.8	-5.8	-21.4	OFF
3	1	-9.8	-14.2	-3.7	-3.7	-19.3	OFF
	2	-14.6	-19.1	-8.6	-8.6	-4.7	-4.7
	3	-9.8	-14.2	-3.7	-3.7	-19.3	OFF
4	1	-17.9	-0.4	-11.9	-17.9	-27.5	OFF
	2	-19.7	-2.2	-13.7	-19.7	-4.7	OFF
	3	-17.9	-0.4	-11.9	-17.9	-27.5	OFF

Table 5.2D.8: 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

The test should be repeated with different subtests.

3.6 Relative Code Domain Error with HS-DPCCH and E-DCH (TC 5.13.2B)

The Relative Code Domain Error for every non-zero beta code in the domain is defined as the ratio of the mean power of the projection onto that non-zero beta code, to the mean power of the non-zero beta code in the composite reference waveform.

The Effective Code Domain Power (ECDP) is defined as following:

$ECDP_k = (Nominal\ CDP\ ratio)_k + 10*log10(SF_k/256)$,

where the nominal CDP ratio is defined in section 3.5 UE relative Code Domain Power Accuracy for HS-DPCCH and E-DCH (TC 5.2D).

The requirements for Relative Code Domain Error are not applicable when either or both of the following channel combinations occur:

- when the ECDP of any code channel is < -30dB.

- when the nominal code domain power of any code channel is < -20 dB

The calculated ECDP value for different subtest is shown as in Table 5.13.2B.8 and the minimum requirement is shown as in Table 5.13.2B.9.

Table 5.13.2B.8: Nominal ECDP ratios

Sub-Test in Table C.11.1.3	Code	Nominal Code Domain Power	Spreading Factor	Nominal ECDP
1	DPCCH	-18.5	256	-18.5
	DPDCH	-15.8	64	-21.8
	HS-DPCCH	-12.5	256	-12.5
	E-DPCCH	-16.5	256	-16.8
	E-DPDCH	-0.5	4	-18.6
2	DPCCH	-14.0	256	-13.9
	DPDCH	-6.0	64	-11.9
	HS-DPCCH	-8.0	256	-7.8
	E-DPCCH	-8.0	256	-8.8
	E-DPDCH	-4.1	4	-22.0
3	DPCCH	-14.6	256	-15.2
	DPDCH	-19.1	64	-25.6
	HS-DPCCH	-8.6	256	-9.2
	E-DPCCH	-8.6	256	-6.2
	E-DPDCH1	-4.7	4	-23.4
	E-DPDCH2	-4.7	4	-23.4
4	DPCCH	-19.7	256	-19.7
	DPDCH	-2.2	64	-8.2
	HS-DPCCH	-13.7	256	-13.7
	E-DPCCH	-19.7	256	-19.4
	E-DPDCH	-4.7	4	-22.9

Table 5.13.2B.9: 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

The test procedure defined from the standard is shown as following:

1) Set UE to maximum output power according to 5.2.B.4.2 steps 1 to 8.

2) Measure the Relative Code Domain Error of the DPCCH, DPDCH, HS-DPCCH, E-DPCCH and E-DPDCH(s).

3) Repeat steps 1 through 2 for the other combinations of beta values as given in Table C.11.1.3.

4) Set the power level of UE to –18 dBm or send Down power control commands (1 dB step size should be used) to the UE until UE output power shall be –18 dBm with ± 2 dB tolerance.

5) Measure the Relative Code Domain Error of the DPCCH, DPDCH, HS-DPCCH, E-DPCCH and E-DPDCH(s).

6) Repeat steps 4 and 5 for all the combinations of beta values for sub-tests 1, 2, 3, and 4 as given in Table C.11.1.3.

After taking the measurement result for TC 5.2B, TC 5.9B and TC 5.10B, do the following steps:

a) Press '**Menus**' at the right bottom and select '**Code Dom. Power**' at the bottom

b) Press '**Application**' at the right and select '**CDE Relative**' at the bottom to activate the measurement (*step 2*). The test result is shown as in *Figure 19*.

c) Press '**UE Signal**' at the right and select '**UL Target Power**' at the bottom and set it to be -18dBm

d) Repeat the measurement.

e) Repeat a)-d) for subtest 1-4.

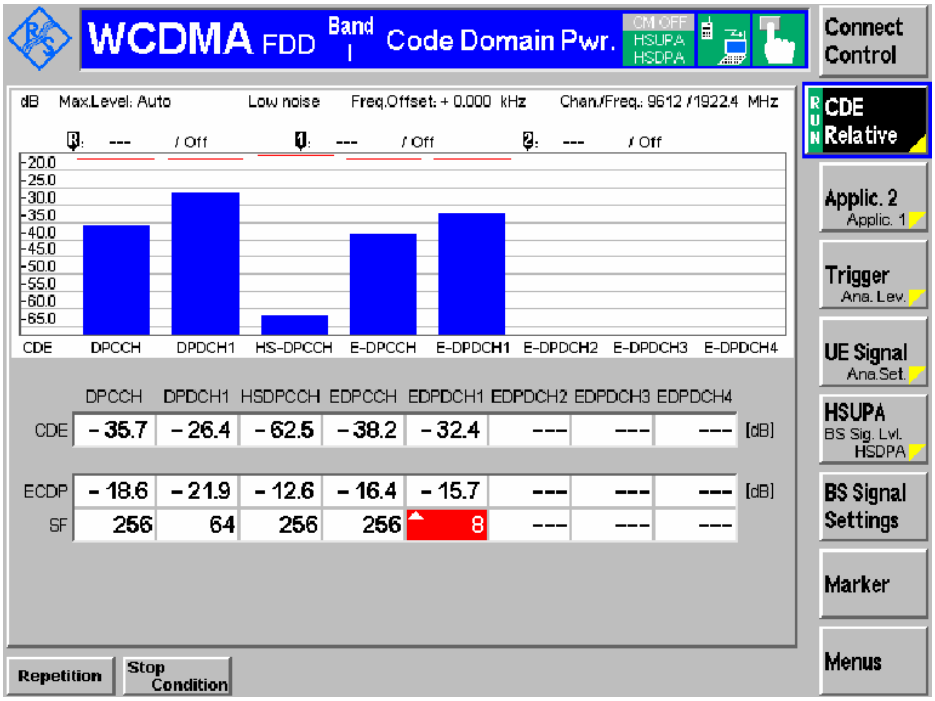

Figure 19: Code Domain Error measurement for TC 5.13B.2

4 Performance Tests

4.1 General Settings for Performance Tests

All receiver performance measurements should be carried out in multi-path fading environments (VA30), and AWGN should be activated. The hardware connection is shown as below, with a fading simulator, R&S SMU or R&S AMU with fading option, to provide VA30 fading profile and AWGN.

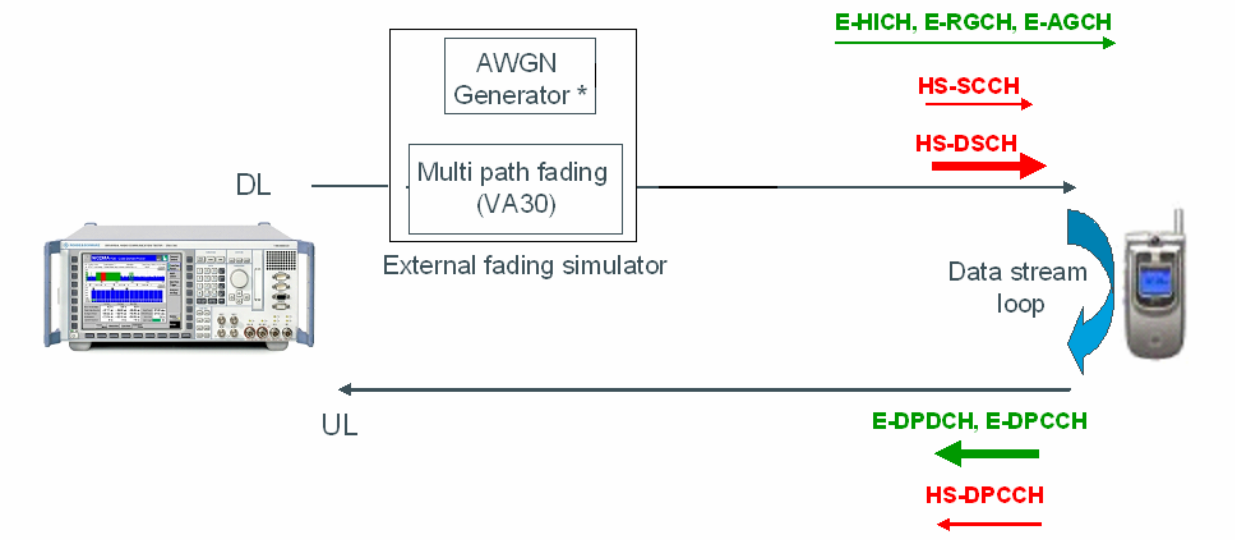

Figure 20: Px test setup

The AWGN and fading profile can be set in R&S SMU200. The detail description can be found in application note 1MA 130[4].

To configure the output channel power $\hat{I}_o$ and level reference:

Select **BS Signal> Node-B Settings >Output Channel Power > '-60dbm'**

BS Signal> Node-B Settings >Level Reference > 'Output Channel Power Ior)'

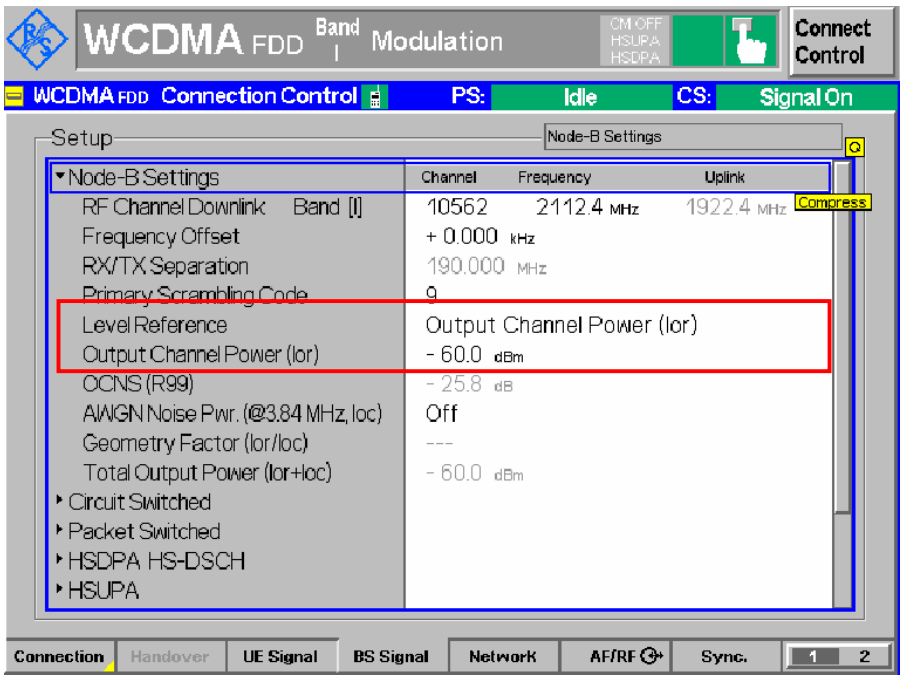

Figure 21: Output channel power for Px test

The HSDPA setting is the same as for Tx testing. There is no subtest definition for Px tests.

The following table is the DL power requirement:

Table E.5A.2: Downlink Physical Channel parameters for E-DCH singlelink performance tests

Parameter During Measurement	Unit	Value	Remark
P-CPICH_Ec/Ior	dB	-10	
P-CCPCH and SCH_Ec/Ior	dB	-12	
PICH _Ec/Ior	dB	-15	
HS-PDSCH	dB	-3	During TTIs, in which the HS-PDSCH is not allocated to the UE via HS-SCCH signalling, the HS-PDSCH shall be transmitted continuously with constant power
HS-SCCH_1	dB	-7.5	During TTIs, in which the HS-SCCH is not allocated to the UE the HS-SCCH shall be transmitted continuously with constant power.
DPCH_Ec/Ior	dB	-10	
E-AGCH	dB	Test specific	Test-specific value or –20dB is used
E-HICH	dB	Test specific	Test-specific value or DTX'd is used
E-RGCH	dB	Test specific	Test-specific value or DTX'd is used
OCNS_Ec/Ior	dB	Necessary power so that total transmit power spectral density of Node B (Ior) adds to one	OCNS interference consists of 6 dedicated data channels as specified in table E.5A.4
NOTE 1: For dynamic power correction required to compensate for the presence of transient channels, e.g. control channels, a subset of the OCNS DPCH channels may be used.			

Compared to Tx tests, the HS-SCCH1 power needs to be changed, but please be alerted that in order to set it at '-7.5 dB', the E-HICH power may

need to be set at lower level initially as the total power should not exceed -60 dBm.

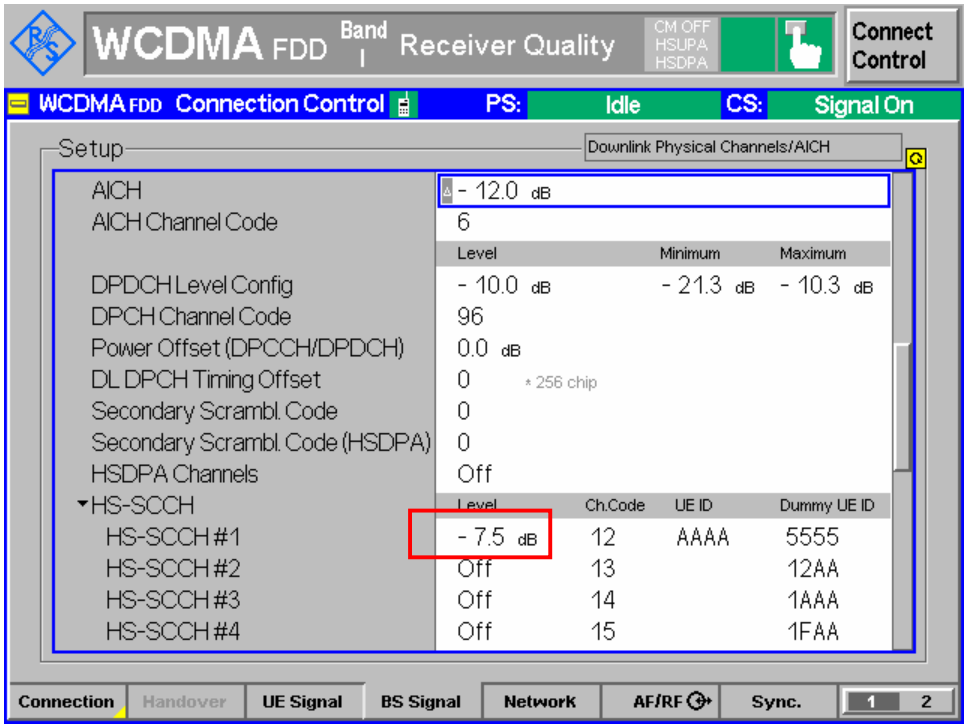

Figure 22: HS-SCCH channel power setting for Px test

In the test cases described in this application notes, the AGCH power should be -20dBm.

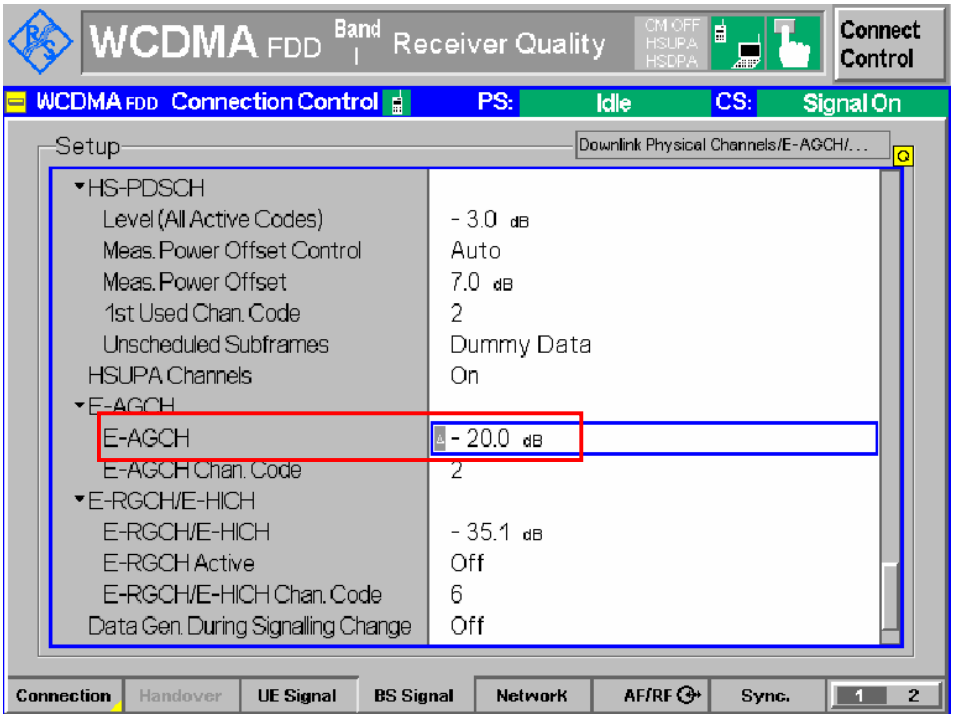

Figure 23: E-AGCH power setting for Px test

The value for **UL RLC SDU size** should be '2936 bits' for TTI = 10ms and '5872 bits' for TTI = 2ms (according to Annex C.11.3) for the test cases described in this application note. The setting can be found at **BS Signal > Circuit Switched > RMC Settings > HSPA > HSUPA UL RLC SDU Size**.

'Connect CS' should be used to setup a connection in Px test.

4.2 Detection of E-DCH HARQ ACK Indicator Channel (EHICH)

4.2.1 Single Link Performance – 10ms TTI (TC 10.2.1.1)

Evaluation of the receive characteristics of the E-DCH HARQ ACK Indicator Channel (E-HICH based on the determination of missed ACK and false ACK probability.

Two tests are defined:

- Missed ACK for 10 ms TTI
- False ACK for 10 ms TTI

Table 10.2.1.1.2.1: Parameters for E-HICH – Serving E-DCH cell

Parameter	Unit	Missed ACK	False ACK
I_{oc}	dBm/ 3.84 MHz	-60	
Phase reference	-	P-CPICH	
P-CPICH E_c / I_{or}	dB	-10	
E-HICH signalling pattern	-	100% ACK	100% DTX

Step 1. Set E-HICH power:

Select **BS Signal> Downlink Physical Channels > E-RGCH/E-HICH> E-RGCH/E-HICH > '-35.1 dB'** (according to Table 10.2.1.1.2.2)

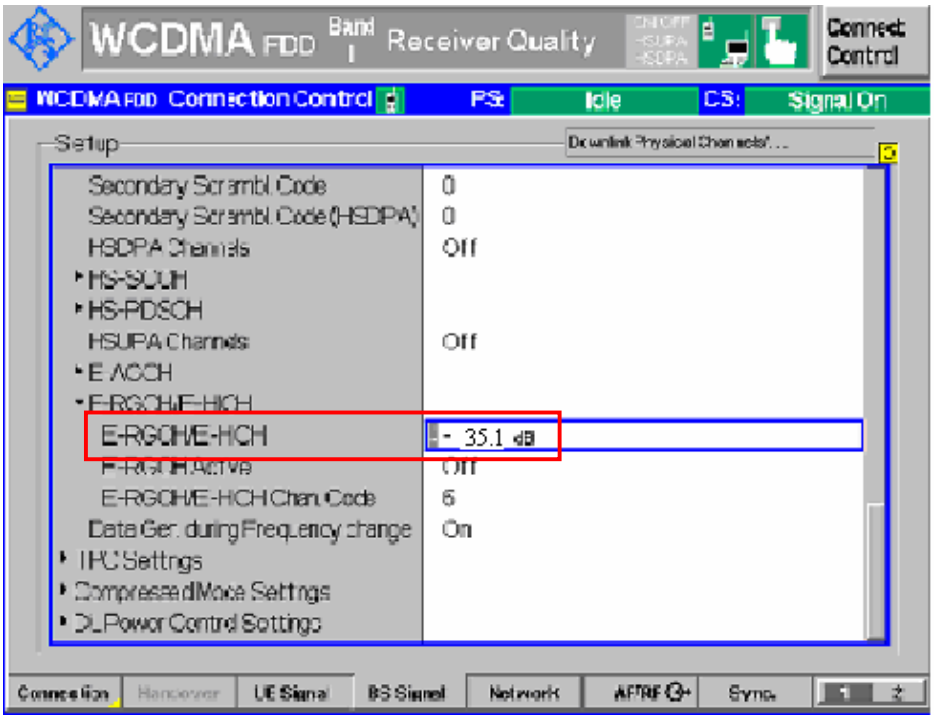

Figure 24: E-RGCH/E-HICH power level setting for TC 10.2.1.1

Step 2. Set the TTI Mode to '10ms', the AG Index to '5' and RLC PDU Size to '112' (according to the radio bearer setup message defined in section 10.2.1.1.4.2)

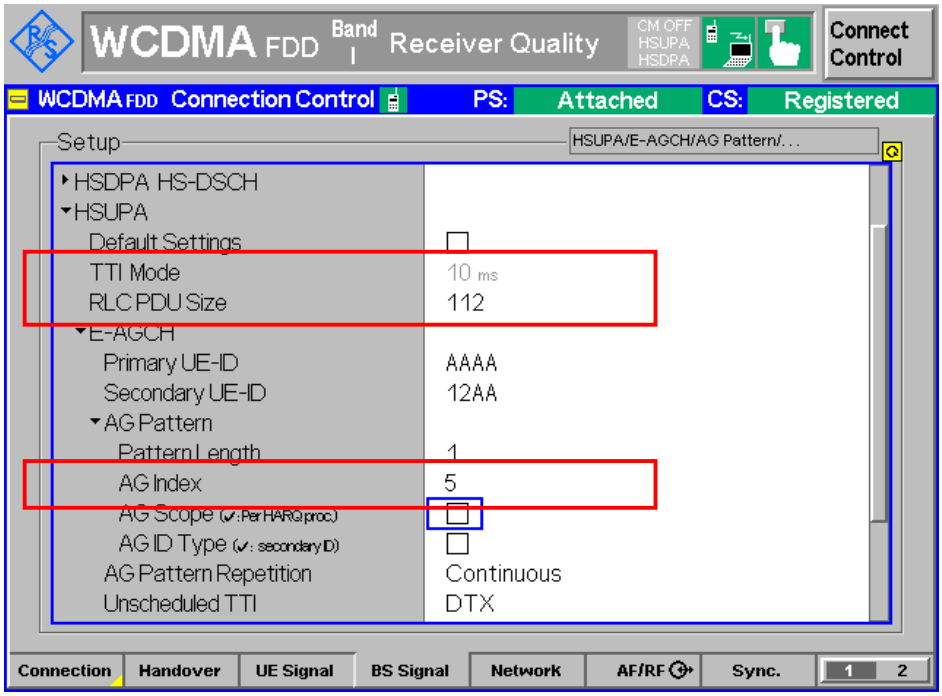

Figure 25: AG Index and RLC PDU Size setting for TC 10.2.1.1

Step 3. Set Maximum re-transmission to '15' and Happy bit delay condition to '10ms' (according to the radio bearer setup message defined in section 10.2.1.1.4.2)

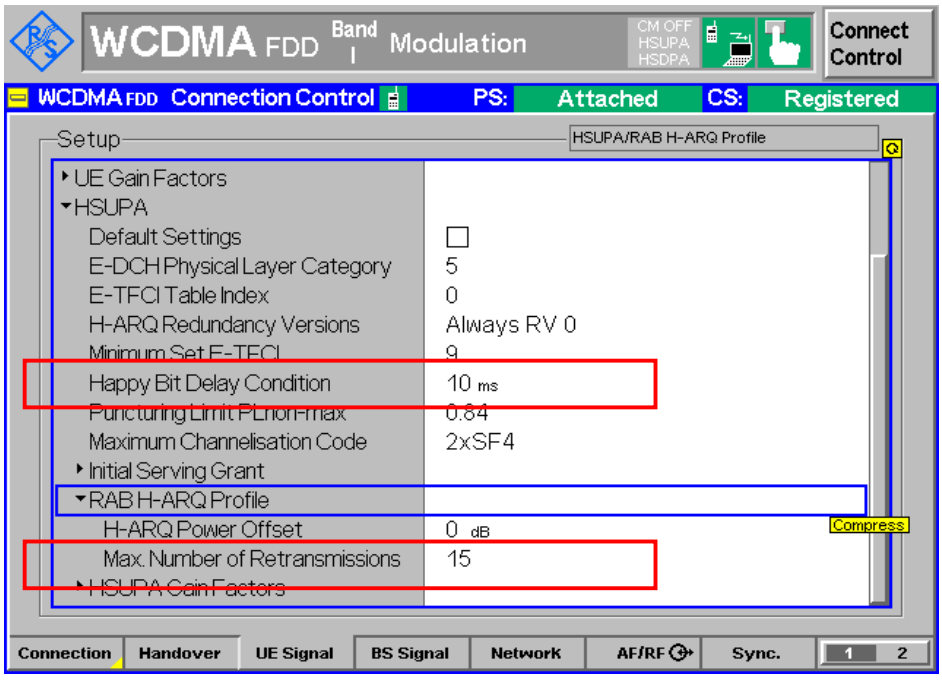

Figure 26: Happy Bit and Retransmissions setting for TC 10.2.1.1

Now you can press '**Connect UE (CS)'** to start the measurement.

The measurement item is '**HSUPA E-HICH**'.

Go to measurement page, press '**Menus**', press '**Receiver Quality**' at bottom.

press 

at the right side one or two times, until you see '**HSUPA E-HICH**' at the bottom, press it and you will see the following:

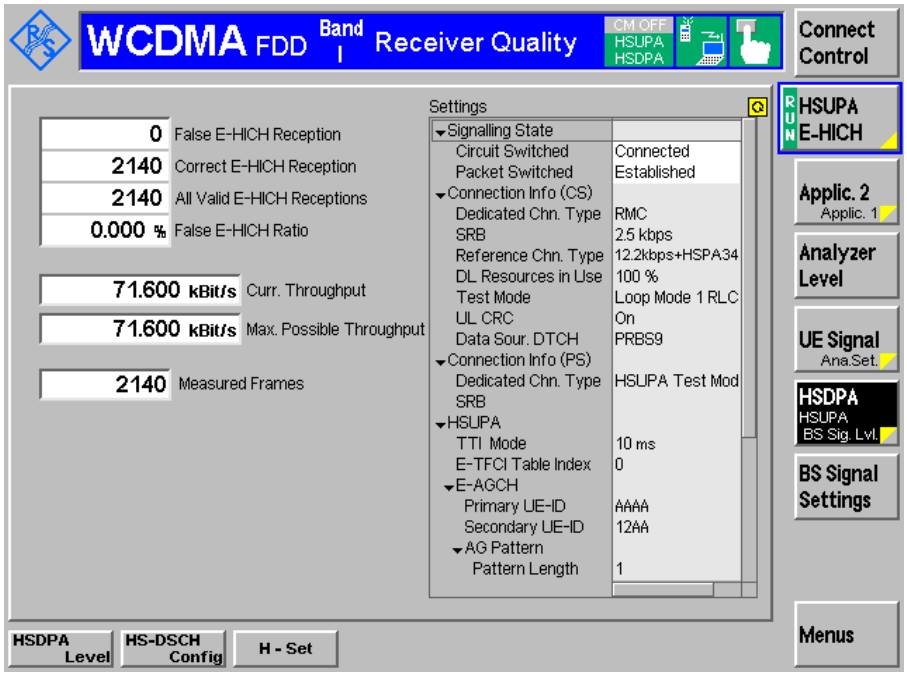

Figure 27: Test page for TC10.2.1.1

Step 4. Set E-HICH for 'Missed Ack' testing. The E-HICH mode should be 'All Ack'

Select **BS Signal> HSUPA > E-RGCH/E-HICH > HARQ Feedback (E-HICH) > Mode > 'All Ack'**

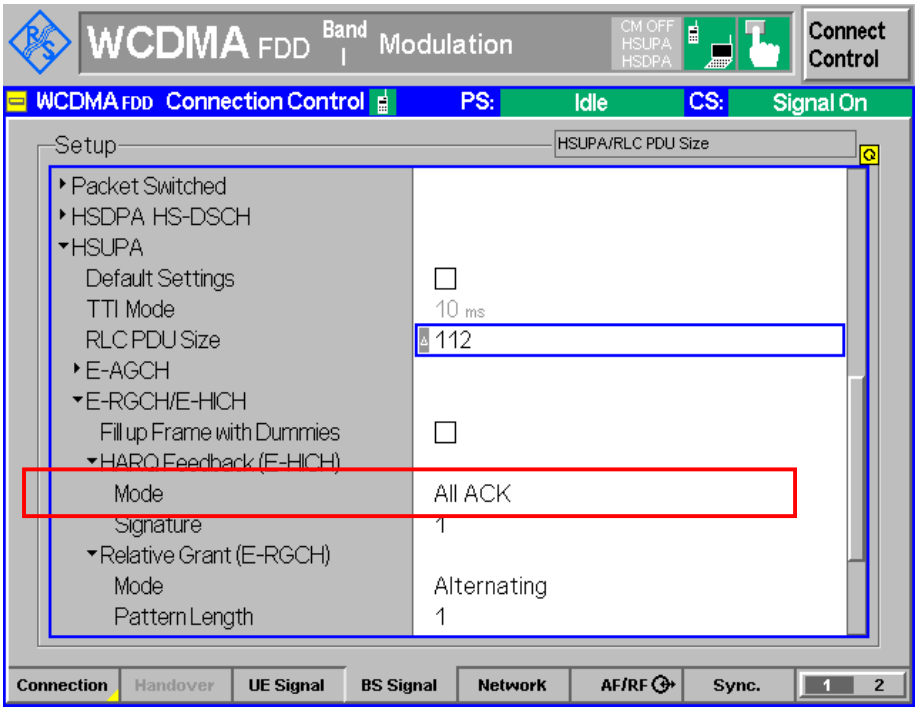

Figure 28: Missed Ack test setting for TC 10.2.1.1

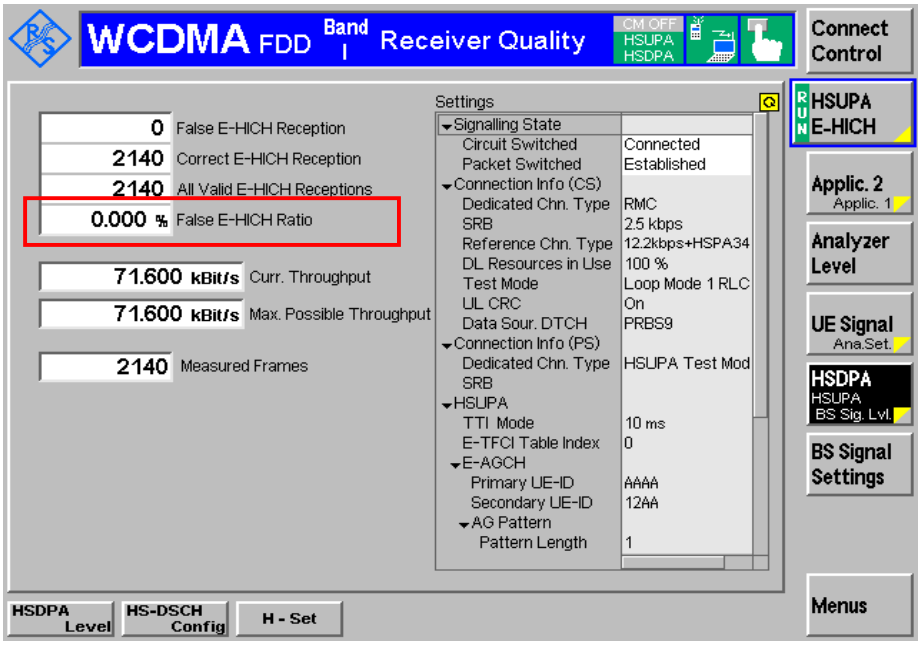

Figure 29: Missed Ack test result for TC 10.2.1.1

The expected UL datarate is 71.6 kbps corresponding to E-TFC Index 45.

The test requirement is shown as the following table:

Table 10.2.1.1.2.2: Minimum requirement for Missed ACK when hybrid ARQ acknowledgement indicator is transmitted using 12 consecutive slots – Serving E-DCH cell

Test Number	Propagation Conditions	Reference value		
		E-HICH E_c / I_{or} (dB)	$\hat{I}_{or} / I_{oc}$ (dB)	Missed ACK probability
2	VA30	-35.1	0	0.01

Step 5. Set E-HICH for 'False Ack' testing. The E-HICH mode should be 'All DTX'

Select **BS Signal> HSUPA > E-RGCH/E-HICH > HARQ Feedback (E-HICH) > Mode > 'All DTX'**

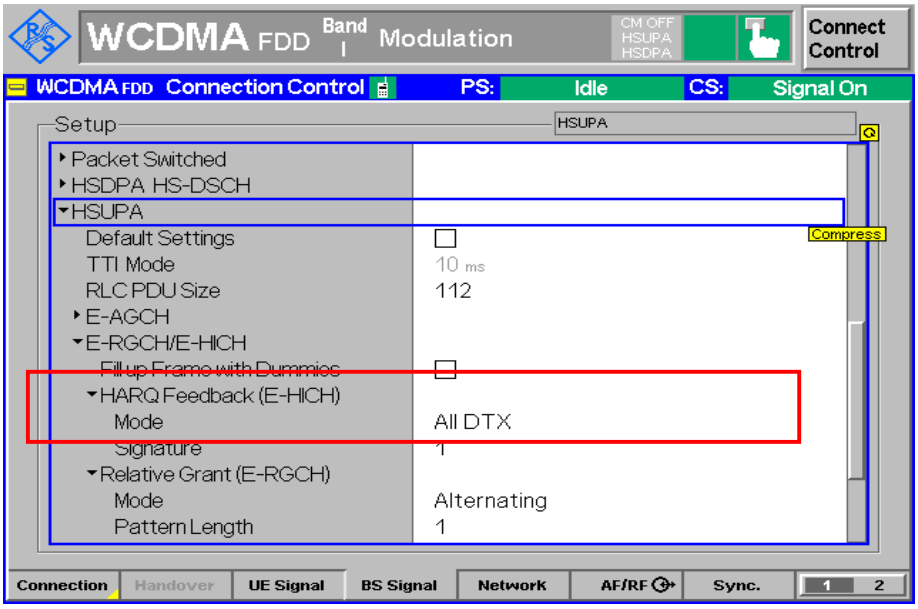

Figure 30: False Ack test setting for TC 10.2.1.1

The test requirement is shown as the following table:

Table 10.2.1.1.2.3: Minimum requirement for False ACK when hybrid ARQ acknowledgement indicator is transmitted using 12 consecutive slots – single link

Test Number	Propagation Conditions	Reference value	
		$\hat{I}_{or} / I_{oc}$ (dB)	False ACK probability
4	VA30	0	0.5

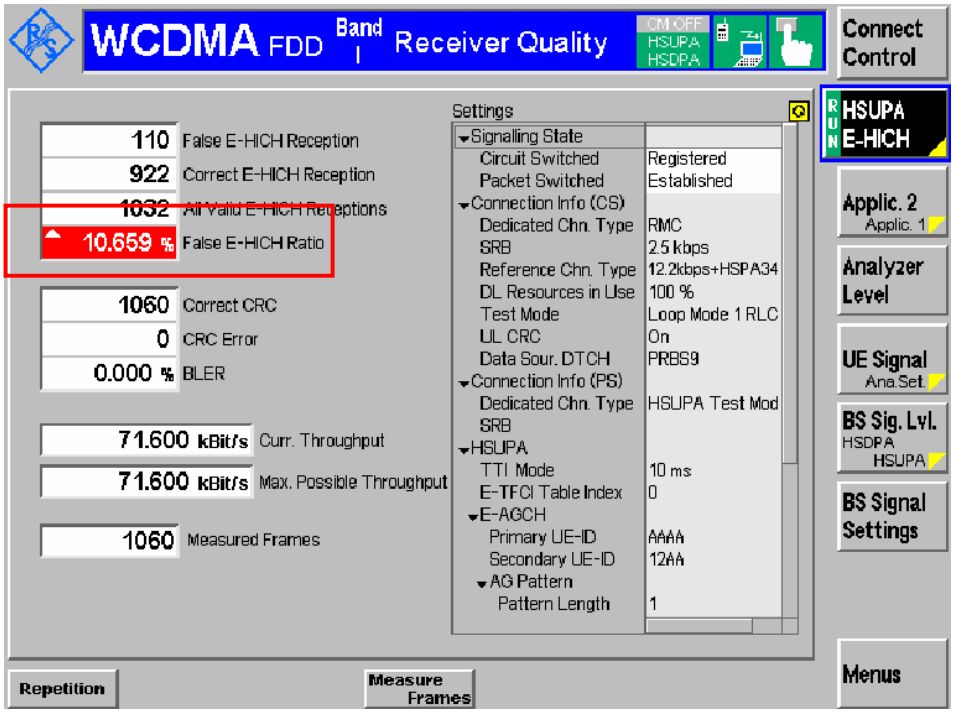

Figure 31: False Ack test result for TC 10.2.1.1

4.2.2 Single Link Performance – 2ms TTI (TC 10.2.1.2)

Compared to TC 10.2.1.1, this test case is for devices that support 2ms TTI with E-HICH power -28.3 dB, absolute grant 4 and the UL RLC SDU size should be 5872 bits (2*DL RLC SDU). Here are the few settings that should be changed based on the settings for TC 10.2.1.1.

1. Set E-DCH TTI to be '2ms'

   Select **BS Signal> HSUPA > TTI Mode > '2ms'**

2. Set the absolute grant to be '4'. The parameter can be found as shown in *Figure 25*.

   Select **BS Signal>HSUPA>E-AGCH>AG Pattern>AG Index>'4'**

3. Set the Happy bit delay condition to '2ms'. The parameter can be found as shown in *Figure 26*.

   Select **UE Signal> HSUPA > Happy Bit Delay > '2ms'**

4. Set the E-HICH power to be '-28.3 dB'. The parameter can be found as shown in *Figure 24*.

   Select **BS Signal> Downlink Physical Channels > E-RGCH/E-HICH> E-RGCH/E-HICH > '-28.3 dB'**

5. Set the UL RLC SDU size to be '5872 bits' (According to TS 34.121 Annex C.11.3).

   Select **BS Signal > Circuit Switched > RMC Settings > HSPA > HSUPA UL RLC SDU Size > '5872 Bit'**

Table 10.2.1.2.2.1: Parameters for E-HICH – Serving E-DCH cell

Parameter	Unit	Missed ACK	False ACK
I_{oc}	dBm/3.84 MHz	-60	
Phase reference	-	P-CPICH	
P-CPICH E_c / I_{or}	dB	-10	
E-HICH signalling pattern	-	100% ACK	100% DTX

Table 10.2.1.2.2.2: Minimum requirement for Missed ACK when hybrid ARQ acknowledgement indicator is transmitted using 3 consecutive slots – Serving E-DCH cell

Test Number	Propagation Conditions	Reference value		
		E-HICH E_c / I_{or} (dB)	$\hat{I}_{or} / I_{oc}$ (dB)	Missed ACK probability
1	VA30	-28.3	0	0.01

Table 10.2.1.2.2.3: Minimum requirement for False ACK when hybrid ARQ acknowledgement indicator is transmitted using 3 consecutive slots – Serving E-DCH cell

Test Number	Propagation Conditions	Reference value	
		$\hat{I}_{or} / I_{oc}$ (dB)	False ACK probability
2	VA30	0	0.5

4.3 Detection of E-DCH Relative Grant Channel (E-RGCH)

The receive characteristics of the E-DCH Relative Grant Channel (E-RGCH) in multi-path fading environment is determined by the 'missed UP/DOWN' and 'missed HOLD' measurement, the detail is described in the test procedure.

4.3.1 Single link performance (10ms TTI) (TC 10.3.1.1)

The test requirement and power setting for this test case is shown as following:

Table 10.3.1.1.2.1: Parameters for E-RGCH – Serving E-DCH cell

Parameter	Unit	Missed UP/DOWN	Missed HOLD
I_{oc}	dBm/3.84 MHz	-60	
Phase reference	-	P-CPICH	
P-CPICH E_c / I_{or}	dB	-10	
E-RGCH signalling pattern	-	50% UP 50% DOWN	100% HOLD

Table 10.3.1.1.2.2: Minimum requirement for Missed UP/DOWN when relative scheduling grant is transmitted using 12 consecutive slots – Serving E-DCH cell

Test Number	Propagation Conditions	Reference value		
		E-RGCH E_c / I_{or} (dB)	$\hat{I}_{or} / I_{oc}$ (dB)	Missed UP/DOWN probability
1	VA30	-31	0	0.05/0.05

Table 10.3.1.1.2.3: Minimum requirement for Missed HOLD when relative scheduling grant is transmitted using 12 consecutive slots – Serving E-DCH cell

Test Number	Propagation Conditions	Reference value	
		$\hat{I}_{or} / I_{oc}$ (dB)	Missed HOLD probability
2	VA30	0	0.1

Step 1: The power setting and E-RGCH channel activation is shown as in *Figure 32*.

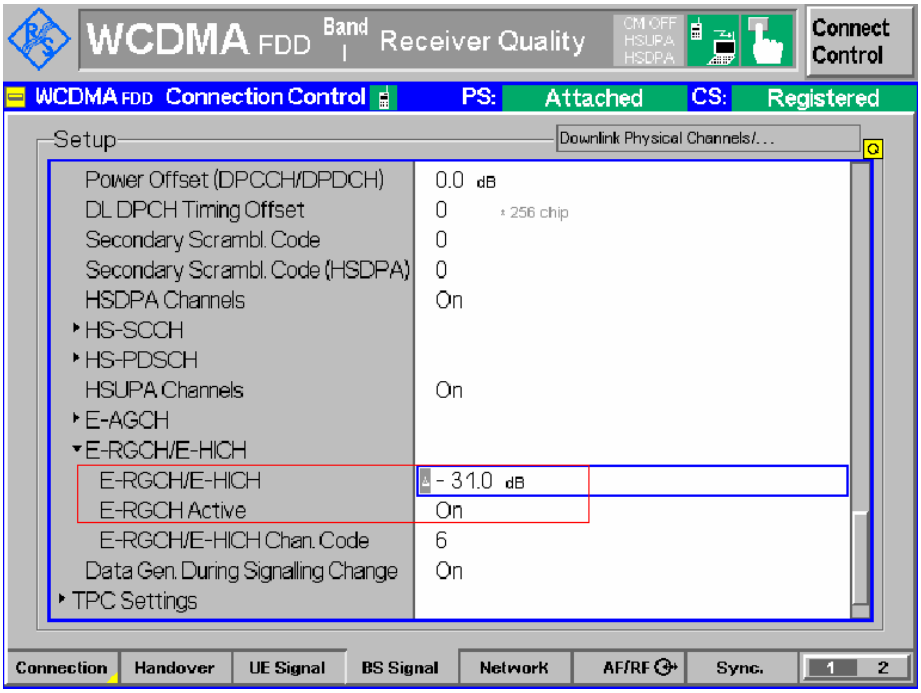

Figure 32: Activate E-RGCH channel and E-RGCH power setting

Step 2: Set the TTI Mode to be '10ms'. The **RLC PDU Size** for single link performance test should be 112 (according the the RAB message defined in the test cases), which is the same as TC 10.2.1, shown as in *Figure 25*.

Select BS **Signal > HSUPA > TTI Mode > '10ms'**

> RLC PDU Size > '112'

Step 3: The 'Missed UP/DOWN' is configured as 4 consecutive "down" and 4 consecutive "up" on the E-RGCH. In CMU200, this is configured as '**per H-ARQ process**' for E-RGCH test mode, shown as in *Figure 33*.

Set the **Absolute Grant** to **5** and **E-HICH** Feedback to '**ALL DTX'**.

Select BS **Signal > HSUPA** to find all the settings.

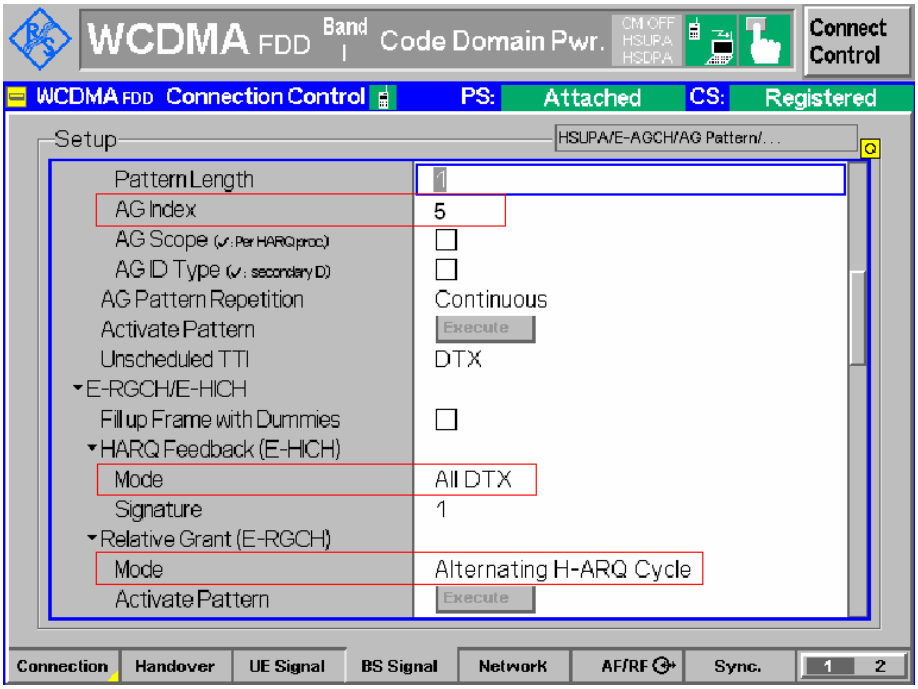

Figure 33: Absolute grant and HARQ feedback settings for TC 10.3.1.1

Step 4: The UE shall not retransmit any data and the happy bit delay condition is 10 ms, the setting is shown as in *Figure 34*.

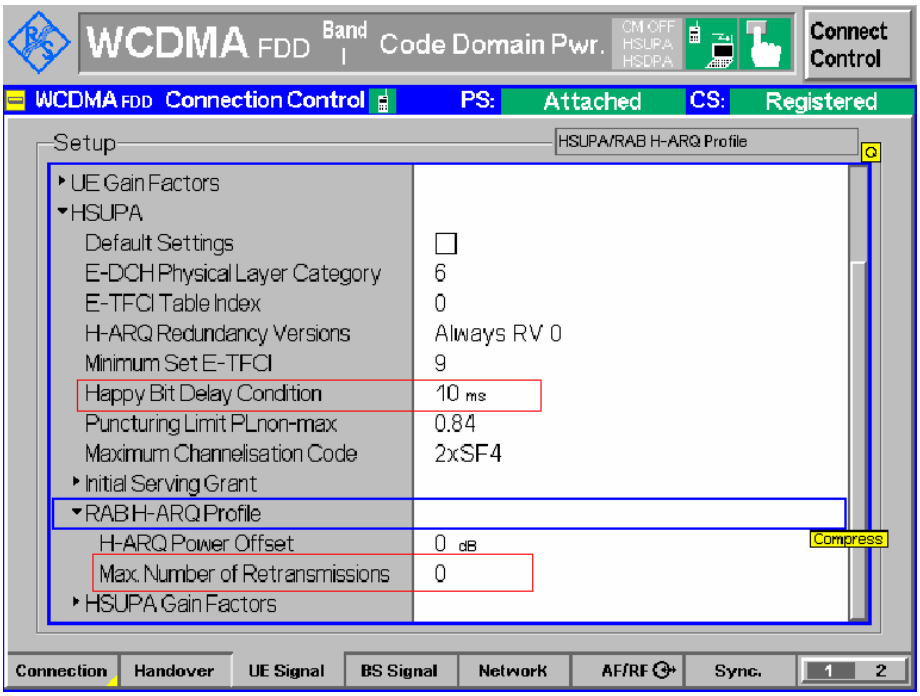

Figure 34: UE signal settings for TC 10.3.1.1

Step 5: This measurement page can be accessed by pressing 'Menus' at the right and followed by '**Receiver Quality**' at the bottom, then press

'**Applic.2/Applic.1**' once or twice at the right and select **'HSUPA E-RGCH'** at bottom. The measurement page is shown as in *Figure 35*.

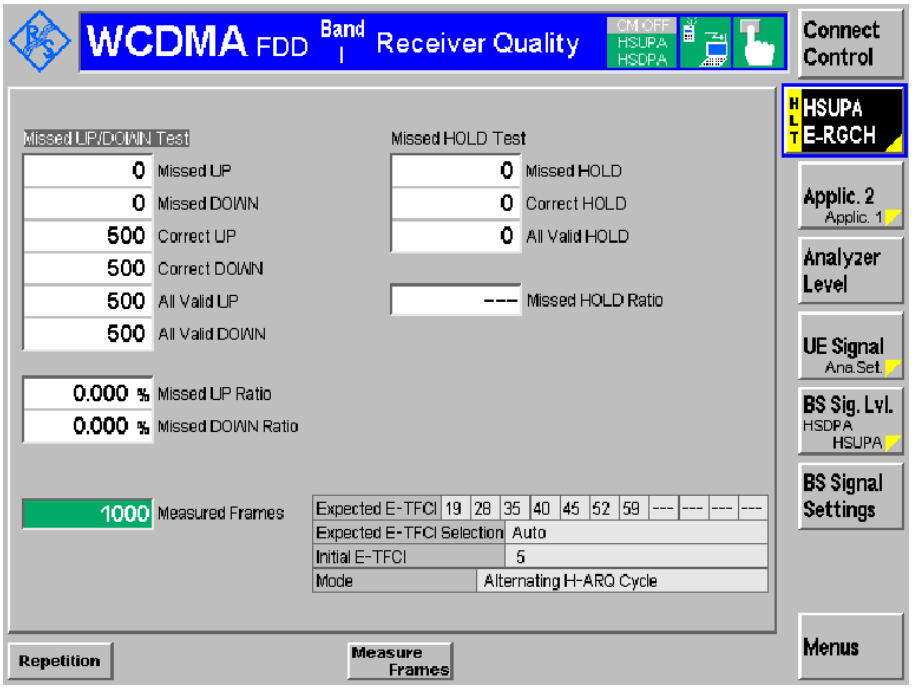

Figure 35: E-RGCH measurement for TC 10.3.1.1

Step 6: It is recommended to do a single shot for this test case. This can be configured by pressing **HSUPA E-RGCH** at the right twice to get the page shown as below. Set the **Repetition** to be '**Single Shot**' and the number of measure frames can be configured as well.

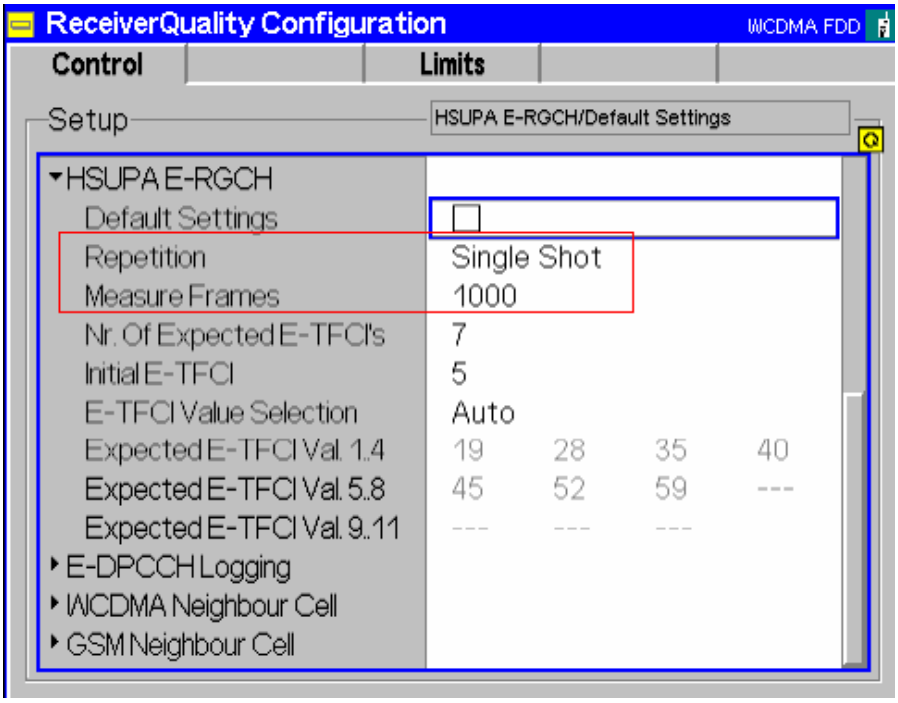

Figure 36: Configure the single shot test for TC 10.3.1.1

After UE connected for 3 second, start the fading simulator, and then activate the measurement. The '**Missed UP/DOWN**' measurement will be done automatically, shown as in *Figure 35*.

Step 7: To test the **'Missed HOLD'** condition, the E-RGCH Mode needs to be changed to 'All DTX'. This can be done by pressing 

once or twice to get the HSUPA setting show at the bottom. Press **Channel Settings** and change the **Mode** to '**All DTX**', shown as in *Figure 37*.

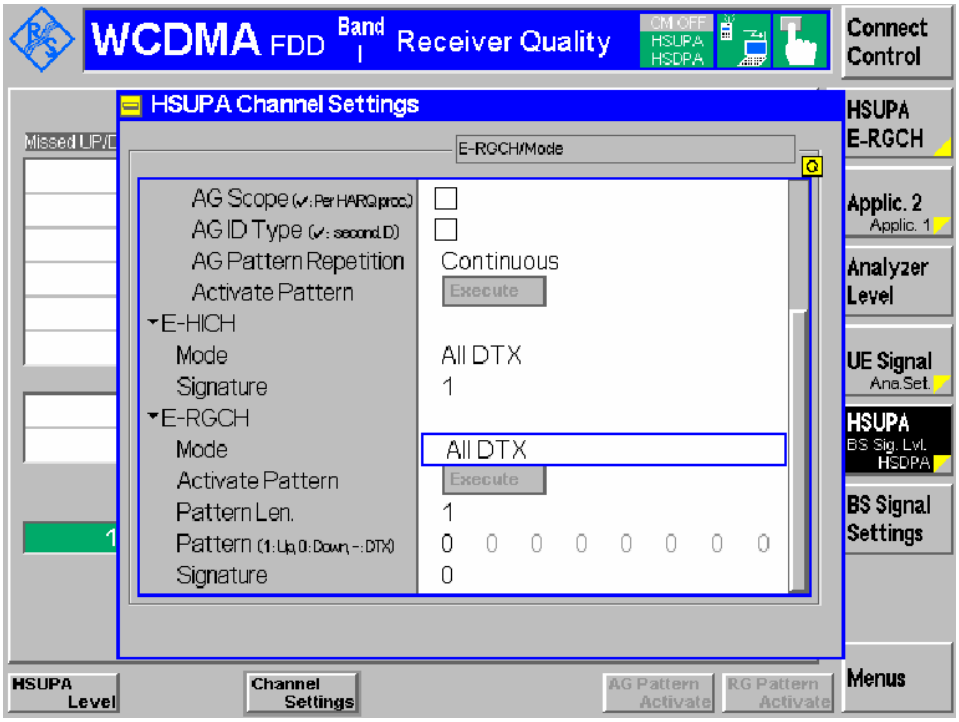

Figure 37: 'Missed HOLD' test setting for TC 10.3.1.1

Activate the **HSUPA E-RGCH** test again and the '**Missed HOLD**' test will be done automatically.

4.3.2 Single link performance 2ms TTI (TC 10.3.1.2)

Compared to TC 10.3.1.1, this test case is for devices that support 2ms TTI with E-HICH power -24.4 dB, absolute grant 4 and the UL RLC SDU size should be 5872 bits (2*DL RLC SDU). The test limits are the same as well.

Table 10.3.1.2.2.2: Minimum requirement for Missed UP/DOWN when relative scheduling grant is transmitted using 3 consecutive slots – Serving E-DCH cell

Test Number	Propagation Conditions	Reference value		
		E-RGCH E_c / I_{or} (dB)	$\hat{I}_{or} / I_{oc}$ (dB)	Missed UP/DOWN probability
1	VA30	-24.4	0	0.05/0.05

Here are the few settings that should be changed based on the settings for TC 10.3.1.1.

1. Set E-DCH transmission time to be ‘2ms’

   Select **BS Signal> HSUPA > TTI Mode > ‘2ms’**

2. Set the Happy bit delay condition to ‘2ms’. The parameter can be found as shown in *Figure 26*.

   Select **UE Signal> HSUPA > Happy Bit Delay > ‘2ms’**

3. Set the E-RGCH power to be -24.4 dB. The parameter can be found as shown in *Figure 24*.

   Select **BS Signal> Downlink Physical Channels > E-RGCH/E-HICH> E-RGCH/E-HICH > ‘-24.4 dB’**

4. Set the absolute grant to be ‘4’. The parameter can be found as shown in *Figure 25*.

   Select **BS Signal>HSUPA>E-AGCH>AG Pattern>AG Index>’4’**

5. Set the UL RLC SDU size to be ‘5872 bits’ (According to TS 34.121 Annex C.11.3).

   Select **BS Signal > Circuit Switched > RMC Settings > HSPA > HSUPA UL RLC SDU Size > ‘5872 Bit’**

The test procedure is the same as TC 10.3.1.1 except the “Miss UP/DOWN” is configured as 8 consecutive “down” and 8 consecutive “up” on the E-RGCH. This setting is automatically done when ‘2ms’ TTI is selected.

4.6 Demodulation of E-DCH Absolute Grant Channel (E-AGCH) (TC 10.4.1)

This test case is defined to verify the demodulation of the E-AGCH channel.

Step 1. The E-HICH should be set as ‘**All ACK**’.

Step 2. The AGCH value should be a sequence of **‘4, 8, 10’**. (according to Table 10.4.1.3 of TS 34.121)

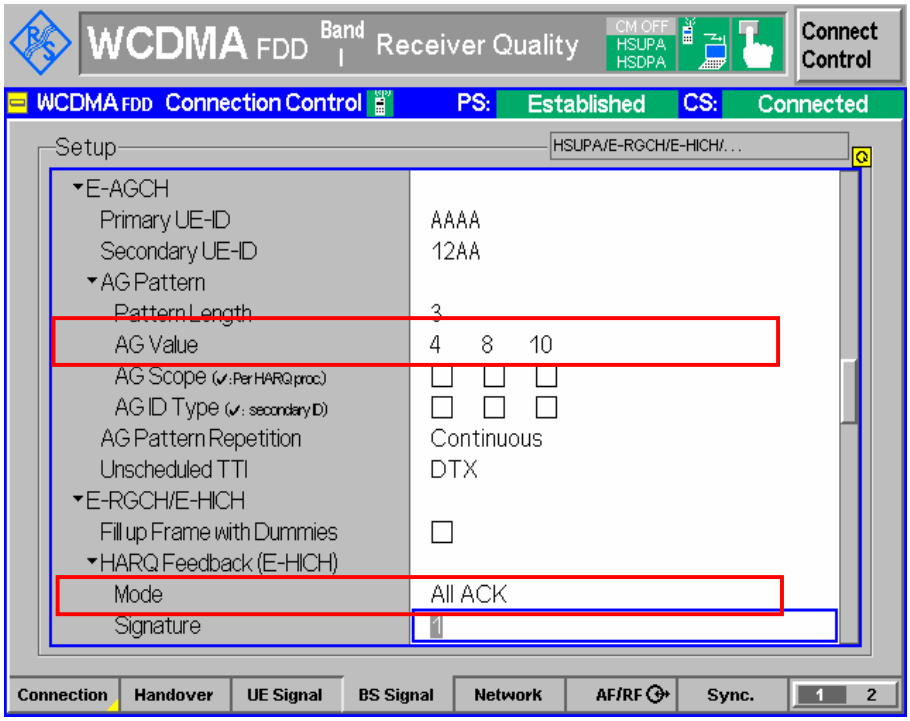

Figure 38: E-AGCH settings for TC 10.4.1

Step 3. Power setting

a. Set the Output Channel Power (Ior) to '-59.4 dBm'

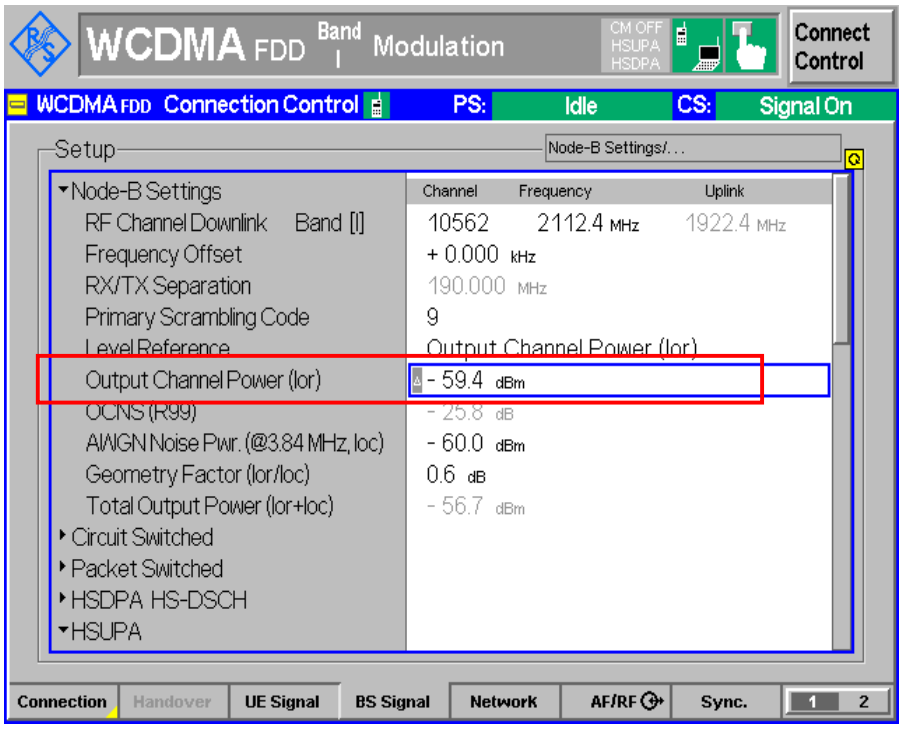

Figure 39: Output Channel Power for TC 10.4.1

b. Set the HSUPA downlink physical channel settings (according to Table 10.4.1.3a and Table 10.4.1.4 of TS 34.121):

E-AGCH = -23.1 dB
E-RGCH/E-HICH = -20 dB
E-RGCH Active = OFF

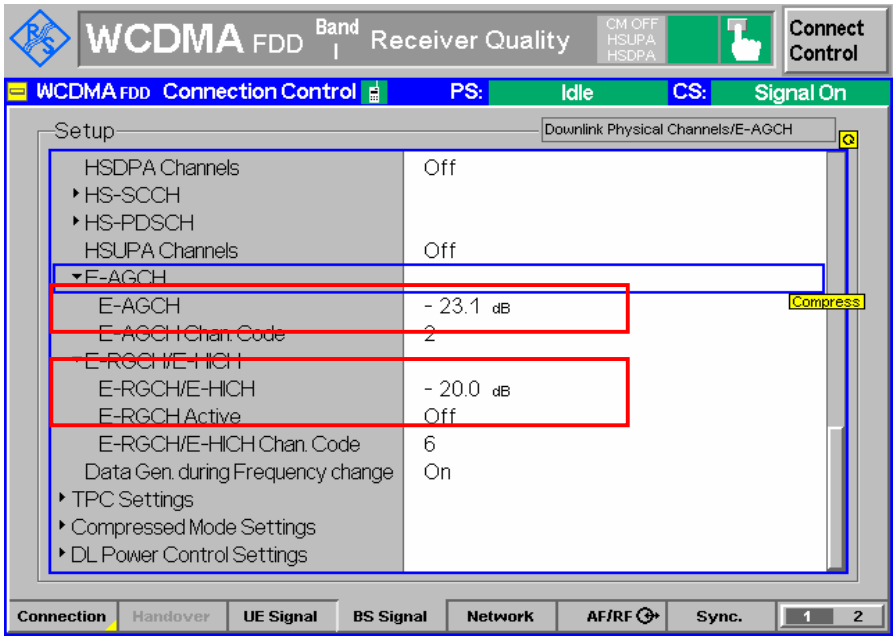

Figure 40: HSUPA channel power level setting for TC 10.4.1

Step 4. UE Channel type and Gain Factors (according to Table 10.4.1.3 of TS 34.121):

RMC Uplink 12,2 kbps: βc = 15; βd = 5

HSDPA gain factors: ΔACK = 5; ΔNACK = 5; ΔCQI = 5 (β_{hs} = 15)

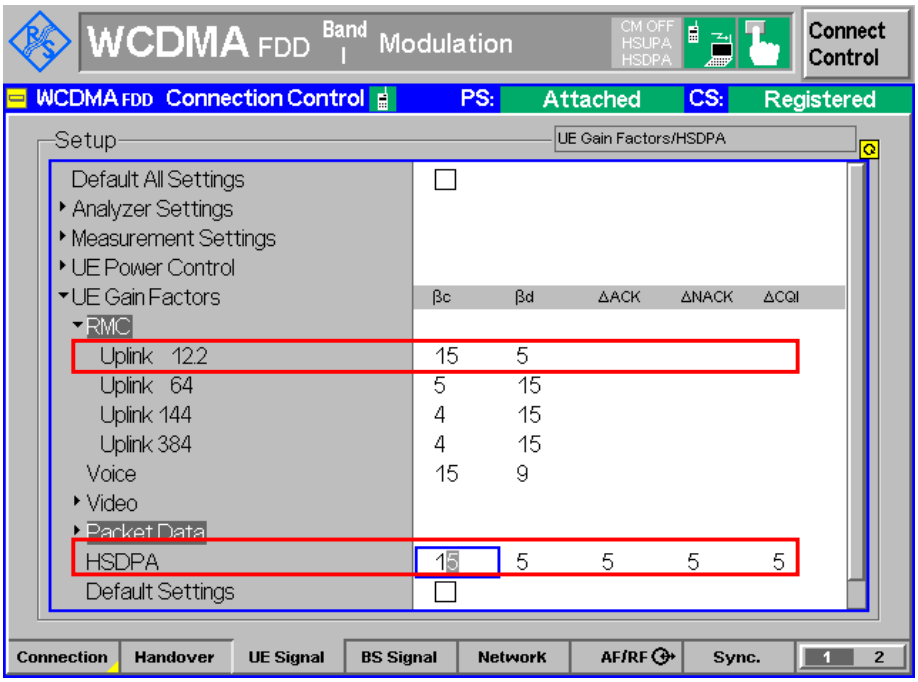

Figure 41: RMC and HSDPA gain setting for TC 10.4.1

Step 5. Set maximum number of retransmissions to '0' (according to the radio bearer setup message defined in section 10.4.1.4.2)

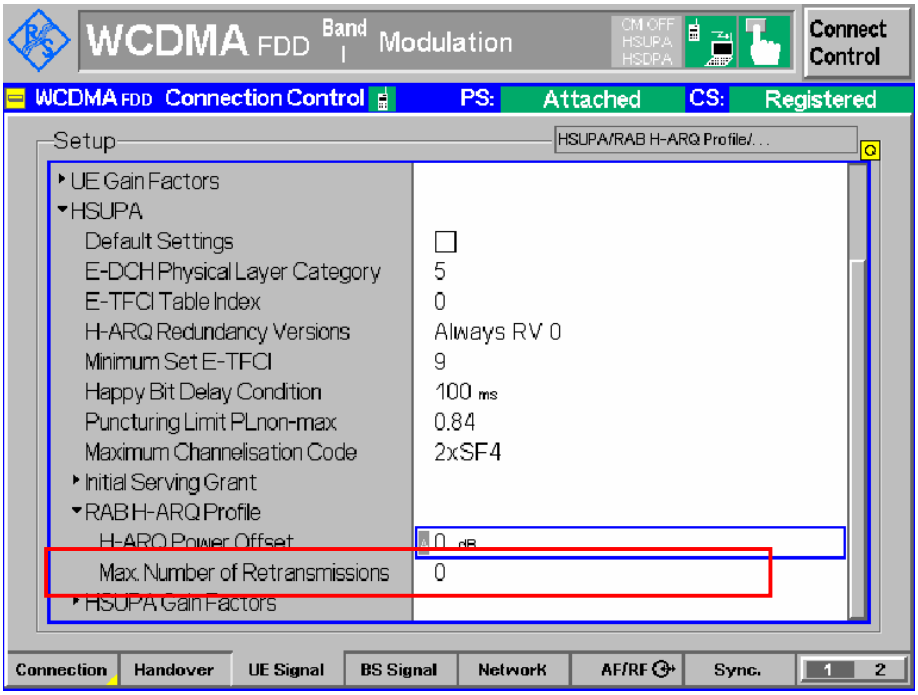

Figure 42: Maximum number of retransmissions setting for TC 10.4.1

Step 6. Set HSUPA UL RLC SDU Size to '8808' (according to Table C.11.3.1 of TS 34.121)

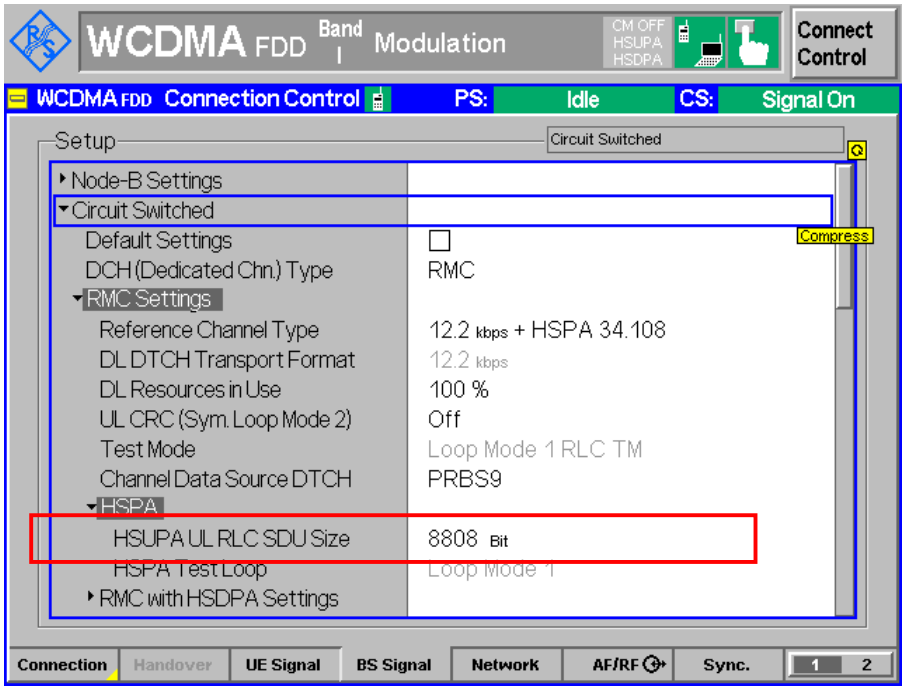

Figure 43: HSUPA UL RLC SDU Size setting for TC10.4.1

Step 7. Set HSUPA UL RLC PDU Size to '336' (default setup for all HSUPA test)

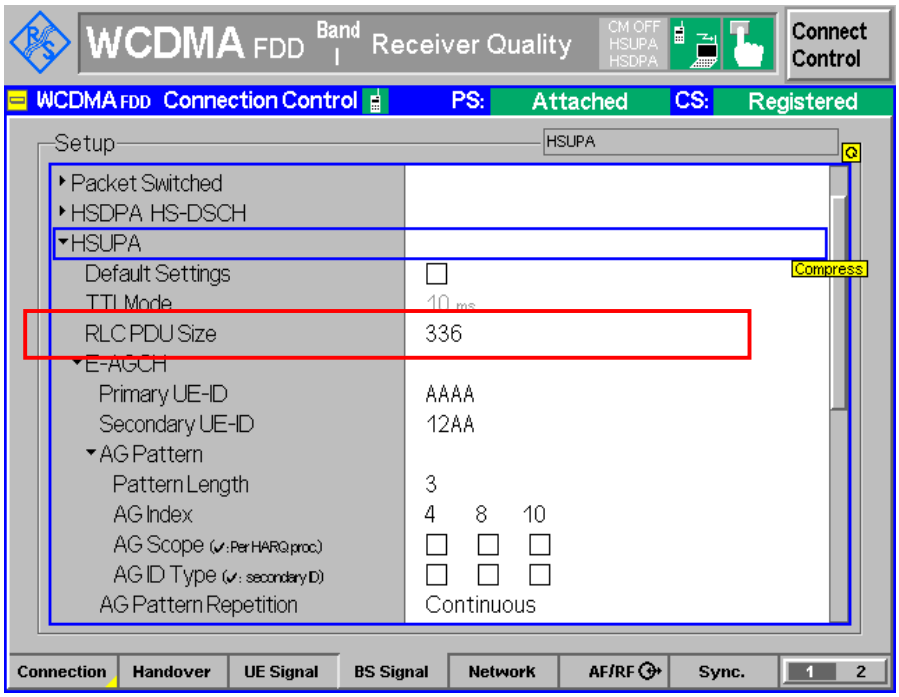

Figure 44: HSUPA UL RLC PDU Size setting for TC 10.4.1

Step 8. Set number of Reference E-TFCIs to '1' (according to section 9.2.1 of TS 34.108, Contents of RADIO BEARER SETUP message: AM or UM (E-DCH and HSDPA), which is called in Annex C.11.1 of TS 34.121)

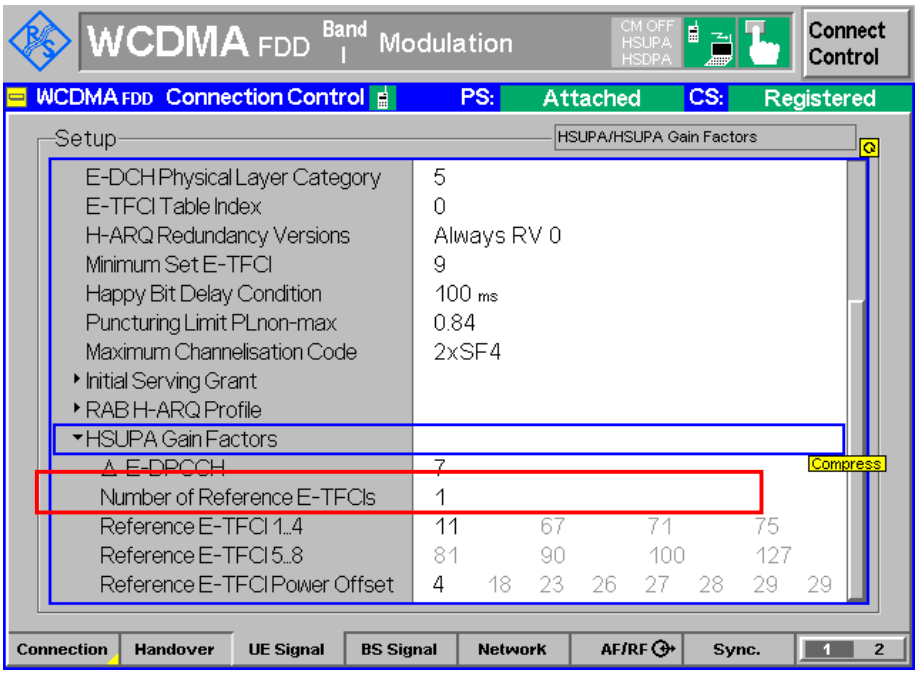

Figure 45: HSUPA Gain Factors setting for TC 10.4.1

Now you can press '**Connect UE (CS)'** to start the measurement.

Go to measurement page, press '**Menus**', then '**Receiver Quality**' at bottom, followed by 

at the right side until you see '**HSUPA E-AGCH**' at the bottom, press it to activate the measurement. Press '**HSUPA E-AGCH**' at the right side, you will see '**Measure Type**' button at the bottom, press it and select '**Missed Detection**' and you will see the following:

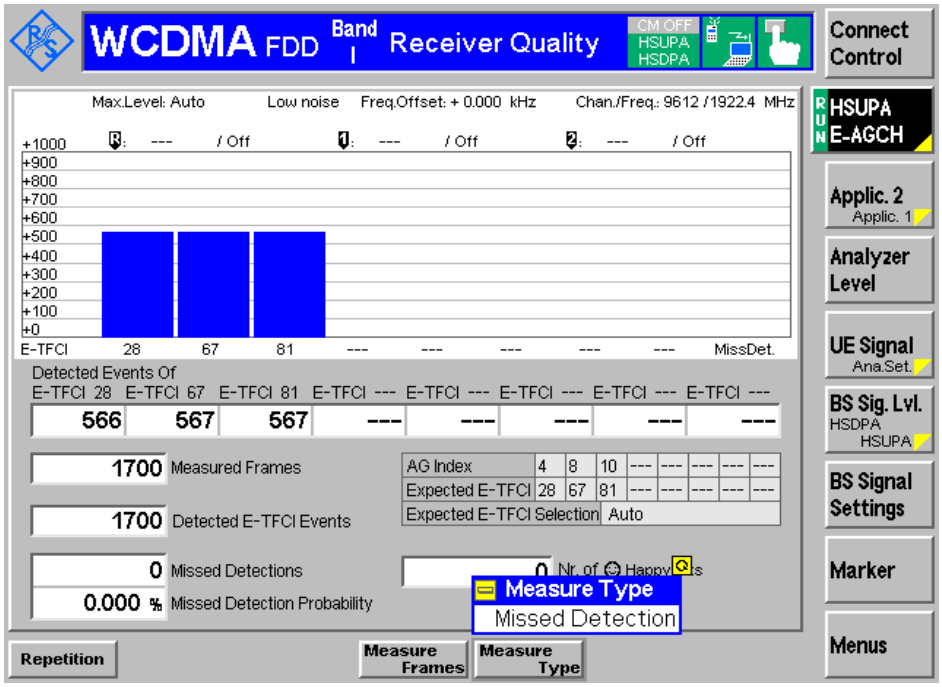

Figure 46: Test result for TC 10.4.1

The test requirement is shown as following table:

Table 10.4.1.3a: Test requirement for E-AGCH detection – single link

Test Number	Propagation Conditions	Reference value		
		E-AGCH E_c / I_{or} (dB)	$\hat{I}_{or} / I_{oc}$ (dB)	Miss detection probability
1	VA30	-23.1	0.6	0.01

5 Literature

1. Reiner Stuhlfauth, “High Speed Uplink Packet Access, HSUPA – RF measurements with CMU200 radio communication tester”
2. 3GPP TS 34.121-1 version 8.0.0 Release 8
3. 3GPP TS 34.108 version 8.0.0 Release 8
4. 1MA130, “Measurements on 3GPP UE's according to TS34.121 with additional Instruments and CMUgo”

For comments and suggestions regarding this operation guide, please contact

customersupport.asia@rohde-schwarz.com.

6 Ordering information

Type of instrument		
R&S®CMU200	Universal radio communication tester for MS/UE test	1100.0008.02
R&S®CMU-B11	HW-option for CMU200: Reference oscillator OXCO, aging 2x10E-7/year	1100.5000.02
R&S®CMU-B12	HW-option for CMU200: Reference oscillator OXCO, aging 2x10E-8/year	1100.5100.02
R&S®CMU-B17	HW-option for CMU200: IQ/IF interface, analog, one channel	1100.6906.02
R&S®CMU-B21	HW-option for CMU200: Universal signaling unit, CMU-B21 V14 incl CMU-B54	1100.5200.54
R&S®CMU-B56	HW-option for CMU200: 3GPP signaling module for HSPA application test (for CMU-B21 V14 or V54)	1150.1850.54
R&S®CMU-B68	HW-option for CMU200 layer 1 – board (3GPP/FDD, DL+UL)	1149.9809.02
R&S®CMU-PK60	SW option for CMU200: WCDMA-Sig: 3GPP/FDD/UE, Tx-Test, Generator, Band 1-11	1159.3355.08
R&S®CMU-PK100	SW option for CMU200: GSM/GPRS/EGPRS+ WCDMA + C2K + 1xEV-DO + AMPS+ IS136	1159.3455.10

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R&S® CMU-K60	SW option for CMU200: HSDPA 14Mbps ext. 3GPP/FDD/UE, Rel.5 (CMU-K64 necessary)	1200.8200.02
R&S® CMU-K64	SW option for CMU200: HSDPA 3.6Mb/s 3GPP/FDD/UE, REL.5 (CMU-B68, B21V14, B56 necassary)	1157.3970.02
R&S® CMU-K56	SW option for CMU200: HSUPA 5.7Mbps 3GPP/FDD/UE, Rel.6 (CMU-B68,B21V14 or V54,B56 necessary)	1200.7803.02

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