W-CDMA Base Station Receiver Tests According to TS25.141 Rel. 10 Application Note

Products:

- I R&S[®]SMW200A I R&S[®]SMF100A
- I R&S®SMU200A I R&S®SMB100A
- I R&S®SMATE200A I R&S®SGS100A
 - I R&S®FSW
 - I R&S®FSV
 - I R&S[®]FSQ
 - R&S[®]FPS

3GPP TS25.141 [1] defines conformance tests for W-CDMA base stations (including HSPA+ features).

This application note describes how all required receiver (Rx) tests (TS25.141 Chapter 7) can be performed easily and quickly by using vector signal generators and CW sources from Rohde & Schwarz. One test additionally requires a spectrum analyzer from Rohde & Schwarz.

Example illustrates manual operation. A free software program enables and demonstrates remote operation.

The W-CDMA base station transmitter (Tx) tests (TS25.141 Chapter 6) are described in Application Note 1MA67.



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The following abbreviations are used in this Application Note for Rohde & Schwarz test equipment:

- The R&S[®]SMW200A vector signal generator is referred to as the SMW.
- The R&S[®]SMU200A vector signal generator is referred to as the SMU.
- The R&S[®]SMBV100A vector signal generator is referred to as the SMBV.
- The R&S[®]SMF100A signal generator is referred to as the SMF.
- The R&S[®]SMB100A signal generator is referred to as the SMB.
- The R&S[®]SGS100A signal generator is referred to as the SGS.
- The R&S[®]FSQ signal analyzer is referred to as the FSQ.
- The R&S[®]FSV spectrum analyzer is referred to as the FSV.
- The R&S[®]FSW spectrum analyzer is referred to as the FSW.
- The R&S[®]FPS spectrum analyzer is referred to as the FPS.
- The SMW, SMATE, SMBV and SMU are referred to as the SMx.
- The FSQ, FSV, FSW and FPS are referred to as the FSx.

1 Introduction

The Wide band code division multiple access (W-CDMA) was first introduced in 3GPP Release-99/4 considering the growing demand for higher capacity and improved data rate. Since then, it has gone through a long process of evolution to ensure high quality experience for customers and maintain market competition.

Evolution of W-CDMA			
3GPP Release	Main Features		
Rel-99/4	W-CDMA		
Rel-5	HSDPA		
Rel-6	HSUPA		
Rel-7	 Downlink MIMO 16 QAM for Uplink and 64 QAM for Downlink 		
Rel-8	Combination of MIMO and 64 QAM Dual cell HSDPA		
Rel-9	Dual cell HSUPA Dual band HSDPA Dual Cell HSDPA + MIMO		
Rel-10	Four carrier HSDPA		

Table 1-1 gives a brief overview of the evolution of W-CDMA with 3GPP releases.

Table 1-1: Evolution of W-CDMA from 3GPP release 99/4 to release 10

3GPP specification TS25.141 describes the conformance tests for W-CDMA base stations operating in FDD mode. It includes transmitter (Tx), receiver (Rx) and performance (Px) tests.

This application note describes the receiver tests for W-CDMA base station according to TS25.141 Release-10. All of these tests can be performed using Rohde & Schwarz test and measurement instruments.

Receiver Characteristics (Chapter 7)			
Chapter	Test name		
(TS 25.141)			
7.2	Reference sensitivity level		
7.3	Dynamic range		
7.4	Adjacent Channel Selectivity (ACS)		
7.5	Blocking characteristics		
7.6	Intermodulation characteristics		
7.7	Spurious Emissions		
7.8	Verification of the internal BER calculation		

Table 1-2: Covered Tests

2 General Receiver Tests

2.1 Note



Very high power occurs on base stations! Be sure to use suitable attenuators in order to prevent damage to the test equipment.

2.2 RX Test setup

Fig. 2-1 shows the general test setup for receiver tests. A SMx is used to perform the tests. An FSx is required for the receiver spurious emission test (3.7). A few tests require special setups; these are described in the respective sections.



Fig. 2-1: General test setup for Rx test. Additional settings are required for some tests.

To synchronize the SMx to the base station frame timing, the base station provides a trigger which starts the generator. Connect this signal to the BNC socket TRIGGER1 (SMU)/User 3 (SMW) of the SMx. As the signal generator offers a channel coded signal (required by all the Reference Measurements Channels (RMC)), set the BS to emit a 'SFN mod 4' periodic trigger.

2.3 Instrument and Options

Several different vector signal generators can be used for the tests described here:

- I SMW
- I SMU
- I SMJ
- SMATE

SMx-K42/-K83 software is required for W-CDMA signal generation (for both paths).

One of the tests (Spurious emissions (Clause 7.7)) requires a spectrum analyzer. The following instruments are available:

- I FSW
- ı FSQ
- I FSV
- I FPS

One test (Blocking characteristics (Clause 7.5)) requires a CW signal up to 12.75 GHz. An additional CW signal generator is used for the purpose. The following instruments are suitable:

- I SMF
- I SMB
- I SGS

Please note that the R&S[®]SMW-B120 (RF path A) and R&S[®]SMW-B220 (RF path B) options provide support up to 20 GHz and can be used instead of additional CW generator.

Please note that the SMBV is able to generate W-CDMA signals but does not support the test case wizard described in this application note.

3 Receiver Tests (Chapter 7)

TS25.141 specifies various frequency channels (bottom (B), Middle (M) and Top (T)) of the operation band for the BS Test. Most of the test should be performed in all of B, M and T frequencies unless mentioned otherwise in the test. The center frequency can be set to any frequency within the supported range using Rohde & Schwarz instruments.

Table 3.1 provides basic overview of the parameters used for individual tests.

Basic Parameter Overview					
Chapter	Chapter	Name	Channels		
TS25.141	AppNote				
7.2	3.2	Reference sensitivity level	B,M,T		
7.3	3.3	Dynamic range	B,M,T		
7.4	3.4	Adjacent Channel Selectivity (ACS)	B,M,T		
7.5	3.5	Blocking characteristics	М		
7.6	3.6	Intermodulation characteristics	B,M,T		
7.7	3.7	Spurious Emissions	М		
7.8	3.8	Verification of the internal BER calculation	B,M,T		

Table 3-1: Basic parameter overview

3.1 Basic Operation

3.1.1 Generating Uplink W-CDMA settings at SMx

The SMx generates the wanted uplink W-CDMA signal and also generates adjacent and co-channel interferences for some tests.

The basic settings for the generation of an uplink W-CDMA signal according to 3GPP standard are described here. For the generation of user defined signals and any further details, please refer to [2].

1. Go to the block Baseband A



Fig. 3-1: Select Baseband block A

2. Click **3GPP FDD** to generate W-CDMA Signal

CDMA Standards	
3GPP FDD	
CDMA2000	
TD-SCDMA	
1xEV-DO	
WLAN Standards	
IEEE 802.11	

Fig. 3-2: Select 3GPP FDD for W-CDMA signal

- 3. Go to **Trigger In** section. Select trigger **Mode** form the list. (Fig. 3-3)
- Select **Auto** for continuous signal generation without external trigger.
- Select Armed Auto for continuous signal generation with the external trigger event.
- 4. Select trigger Source. (Fig. 3-4)

SMW provides the option to configure the trigger connectors according to user preference. Select **Global Connector Settings** and change the connector setting according to preference. Use **find** function to display the location of the selected connector. Fig. 3-5 shows the default connector mapping.

8

3	IGPP FDD A								×
	General	Stop	Marker	Cloc Interr	:k nal	O Basestations			
ſ		Trigg	ger Setting	gs Co	mm	on to all Baseband	ds ———		
	Mode				Arm	ned Auto			
	Exe	cute Trigger			Auto	D			
					Retrigger				
	Source				Arm	ned Auto	R		J
	Delay				Arm	ned Retrigger			
					Sing	jle			- 1
	Local Connector Settings				_				
	Global Connector Settings								

Fig. 3-3: SMW: Select trigger mode. Select armed auto for external trigger

Source			Internal
Delay			Internal
			Internal (Baseband B)
Local Connector Settings			External Global Trigger 1 💦 😽
Globa	al Connector Se	ettings	External Global Trigger 2
			External Global Clock 1
(in the second sec			External Global Clock 2
System Config.	VNC	Spatial Spatial 0 minimum 0 minimum 0 minimum 0 minimum 0 minimum 0 minimum	External Local Trigger

Fig. 3-4: SMW: Select trigger source. Example: "External Global Trigger 1"

Glo	obal Coni	nectors			_	×
oc R	Routing	Charact	eristics			
	onnecto	or	Direction	Signal		
U	ser 1	9	Output -	Baseband	I A Marke	er 1 -
U	ser 2	<i>P</i>	Output -	Baseband	l A Marke	er 2 -
U	ser 3	<i>P</i>	Input -	Global Tri	gger 1	ħ.
U	ser 4	<u> </u>	Input	Global Tri	gger 2	•
-	ser 5		Output	Signal Val	id A	•
U	ser 6	9	Not Used -	None		•
		Global Connector Connector User 1 User 2 User 3 User 4 User 5 User 6	Global Connectors Routing Charact Connector User 1 User 2 User 3 User 4 User 5 User 6 User	Global Connectors Routing Characteristics Connector Direction User 1 2 Output User 2 2 Output User 3 2 Input User 4 2 Input User 5 2 Output User 6 2 Not Used -	Global Connectors Routing Characteristics Connector Direction Signal User 1 2 Output Basebanc User 2 2 Output Basebanc User 3 2 Input Global Tri User 4 2 Input Global Tri User 5 2 Output Signal Val User 6 2 Not Used None	Global Connectors Connector Direction Signal Co User 1 Output Direction Signal User 1 Output • Baseband A Market User 2 Output • Baseband A Market User 3 Output • Baseband A Market User 3 Output • Global Trigger 1 User 4 Output • Global Trigger 2 User 5 Output • Signal Valid A User 6 Output • None

Fig. 3-5: SMW: Configure the connector settings. Example: for the current configuration, Trigger 1 has to be supplied at the input connector USER 3.

5. The SMx offers **Test Case Wizard** for quick and easy generation of signal according to standard. It opens a configuration menu with a selection of predefined settings according to test cases in TS25.141. The default settings are set according to the standard.

It is also possible to generate user defined signals by selecting **User defined** under the "General Setting" menu of the test case.

Select Test Case Wizard (see Fig. 3-6).

3GPP FDD A		_ ×
General Stop Trigger In Marker	Clock Internal User Equipments	
Off On On Defa	To Recall Save	Generate Waveform
Test Case Wizard		
3GPP Version		Release 1
Chip Rate		3.84 Мср
Link Direction	Uplink / Reverse	
Filter/Clipping/ARB Settings	Root	Cosine / Clip Of

Fig. 3-6: Open Test case wizard for easy and convenient generation of signal according to standard

6. Go to **Test Case 7 Receiver Characteristics** and select the appropriate test from the set of "Test Case"

GPP FDD: Test Cases According to TS 25.141: 7.2 Reference Sensitivity Level 🛛 🚬 🗙						
Test Case 7.2 Reference Sensitivity Level						
Gener	al Settings ———)				
Edit Mode	According to Standard -		7.2 Reference Sensitivity Level			
Trigger Configuration	Auto (Ext. Trigger 1)		7.3 Dynamic Range			
Marker Configuration	Auto	-1 E	1 7.4 Adjacent Channel Selectivity (ACS)			
Baseband A Signal Routi	ng To Path and RF Port A	Power / dB	7.5 Blocking Characteristics 7.6 Intermodulation Characteristics			
Basestatio	n Configuration	(-1				
Scrambling Code (hex)	0000 00	-1	7.8 Verification of Internal BER			
Scrambling Mode	Long Scrambling Code		1.948 1.949 1.95 1.951 1.952 Frequency / GHz			
Power Class	Local Area BS -					

Fig. 3-7: Select the desired test to be performed. Example: "7.2 Reference sensitivity level"

- Select According to Standard in the Edit Mode under the "General Settings" section (Fig. 3-8)
- 8. Select Unchanged under "Trigger Configuration" menu.

General Settings					
Edit Mode	According to Standard				
Trigger Configuration	Unchanged -				
Marker Configuration	Auto				
Baseband A Signal Routing	To Path and RF Port A				

Fig. 3-8: Select "According to Standard" to generate uplink signal according to 3GPP standard.

9. Enter the uplink **Scrambling Code** and select **Scrambling Mode** in the "Baseband Configuration" section

Basestation Configuration				
Scrambling Code (hex)	FFF0 00			
Scrambling Mode	Long Scrambling Code			

Fig. 3-9: Enter the scrambling code and select the mode

10. Select the **Power class**. This automatically sets the power level of the wanted signal according to standard

Power Class	Medium Range BS	
	Wide Area BS	ed Signal
State	Medium Range BS	n Reference Measurement Channel RMC 12.2 kbps -
RF Frequency	Local Area BS	Power Level -110.3 dBm

Fig. 3-10: Select the BS power class to set the power level. Example: Medium range BS results in a power level of -110.3 dBm.

11. Set **RF Frequency** of the wanted signal

	Wanted Signal	
State	Off On Reference Measurement Channel	RMC 12.2 kbps -
RF Frequency	2.140 000 000 00 GHz - Power Level	-110.3 dBm -

Fig. 3-11: Set the RF frequency

3.1.2 Demo Program R&S RUN

This Application Note comes with a demonstration program module called **W-CDMA BS Rx Test** for the software R&S RUN which is free of charge. The module covers all required tests.

The **W-CDMA BS Rx Test** module represents a so called test for the R&S RUN software.

See Section 4.1 for some important points on the basic operation of R&S RUN.

Each test described in this application note can be executed quickly and easily using the module. Additional individual settings can be applied.

The program offers a straightforward user interface, and SCPI remote command sequence export functions for integrating the necessary SCPI commands into any user-specific test environment. A measurement report is generated on each run. It can be saved to a file in different formats including PDF and HTML.

Following SCPI resources are needed:

- I SMx
- ı CWx
- r FSx

Getting Started

This section describes only the module for the W-CDMA BS Rx tests. Double-click the test to open the window for entering parameters.

The test consists of two independent testcases:



- I The testcase **ResetAll** resets all instruments (SMx, CWx and FSx). All instruments must be connected to use this feature.
- I The testcase Measurement is the main part

CDMA_BS_Rx_Tests	and they the street	×
ROHDE&SCHWARZ		Help
Receiver Test: 7.2 Reference Sensitivity	_evel	Trigger Auto (Ext. Trigger 1)
Wanted Signal Parameters	Test Specific Parameters	General Settings
BS class Wide Area BS -	Interferer Level 0.00 dBn	n Default Values
Mean Power -120.30 dBm	CW Interferer Level 0.00 dBn	n Comments:
000000 (box)	Interfering Signal allocation :	Reference Sensitivity Level:
Scrambling Code (nex)	Higher Frequencies -	Note: All default parameters are set according to the test specification, based on the base station class
Scr. Code Mode	Intermodulation Settings	BER at BS receiver port shall not exceed 0.001.
Center Frequency 1950.00 MHz	Narrowband Modulation	Click 'Help' for further details.
RMC RMC 12.2 kbps •	Blocking Settings	
	Interferer Modulation WCDMA	
Generator Attenuation		
Wanted Signal (Path A) 0.00 dB	Interferer Start 1960.00 MH	z
Interfering Signal (Path B) 0.00 dB	Frequency Stop 1980.00 MH	Z Consul Tart Octors
		General Test Setup.
	Wait Time 300 ms	BS Wanted W-CDMA Signal
	BER Settings	
	BER 0.01	
		J J J J
		OK Cancel

Fig. 3-12: Full overview: setting parameters for the W-CDMA BS Rx test

General settings

The basic parameters are set at the top right:

- Ext. CW generator: uses an additional CW generator
- Ext. Reference: Turns on external reference mode of the instruments
- Reset Device: Sends a reset command to all connected instruments
- Default Values: Sets default values according to standard

General Settings Ext. CW generato		Ext. Reference	
Default Values	V	Reset Device	✓

Fig. 3-13: General settings

The **Generator Attenuation** section is used to enter compensations for external path attenuations.



Fig. 3-14: Attenuation Settings

Test Cases

This is the main parameter. Select the wanted test case here. All other remaining parameters in the window are grayed out or set active based on the requirements for the selected test case. These parameters are described in detail in the individual sections below.

7.2 Reference Sensitivity Level
7.2 Reference Sensitivity Level
7.3 Dynamic Range
7.4 Adjacent Channel Selectivity
7.5 Blocking Characteristics
7.6 Intermodulation Characteristics
7.7 Spurious Emissions
7.8 Verification of the internal BER calculation

Fig. 3-15: Available test cases

Based on the selected test case, helpful hints are provided in the **Comments** section and an illustration of the basic test setup is displayed.



Fig. 3-16: Brief notes are provided in the Comments section based on the selected test case.



Fig. 3-17: The Test Setup section (bottom right) displays a basic setup for the selected test case along with the location of the signals in the spectrum.

Settings for wanted signal

Use this section to define the basic parameters for the wanted W-CDMA signal:

- BS Class
- Mean Power
- Scrambling code
- Scrambling Mode
- Center Frequency
- Reference Measurement Channel (RMC)

Wanted Signal Parameters					
BS class Wide Area BS -					
Mean Power	-120.30	dBm			
Scrambling Code	000000	(hex)			
Scr. Code Mode	Long •				
Center Frequency	1950.00	MHz			
RMC	RMC 12.2 kbps 🔻				

Fig. 3-18: Main settings for wanted signal

More advanced settings for specific tests cases are described in the corresponding sections below.

3.2 Reference sensitivity level (Clause 7.2)

The reference sensitivity level is the minimum mean power received at the antenna connector at which the BER shall not exceed the specific value indicated by the minimum requirement. [1]

This test verifies that the BER remains within the limits specified in Table 3-2 at the BS reference sensitivity level.

BS reference sensitivity levels						
BS class	BS class Reference BS reference sensitivity level (dBm)					
	measurement	$f \le 3.0 \text{ GHz}$				
	channel data rate (kbps)					
Wide Area BS		-120.3	-120.0			
Medium Range BS	12.2	-110.3	-110.0	≤ 0.001		
Local Area BS / Home BS		-106.3	-106.0			

Table 3-2: Requirements for BS reference sensitivity levels

Test Setup



Fig. 3-19: Test setup for reference sensitivity level. The SMx generates the wanted W-CDMA uplink reference measurement channel with data rate 12.2 kbps.

Settings:

- The SMx generates the wanted W-CDMA signal with reference measurement channel data rate 12.2 kbps and level settings according to Table 3-2 which is applied to the BS receiver port
- Disable TPC (Transmit power control) function
- Set BS to transmit a "SFN mod 4" periodic trigger.
- Set the base station to transmit W-CDMA signal with maximum power and use TM1 for channel setting

Test Procedure

Setup at SMx

- 1. Use standard procedure (see 3.1.1) to generate the wanted W-CDMA uplink signal
- 2. Press Apply settings
- 3. Measure the BER at the BS receiver ports

Demo Program

No further special settings are needed for this test. The settings are reported.

*********** 7.2 Reference Sensitivity Level **********					
Generator Settings: - BS Class : Wide Area BS - Scrambling Code: FFFFF - Scrambling Mode: Long - Signal attenuation (Path A) : 0.00 dB			-		
Test Item	Frequency (MHz)	Power (dBm)			Status
7.2 Receiver Sensitivity Level					
Wanted Signal	1950.00	-120.30			

Time: 8/14/2014 4:19:31 PM

Fig. 3-20: Example report for test case 7.2

3.3 Dynamic range (Clause 7.3)

Receiver dynamic range is the ability of the base station receiver to handle a rise of interference in the reception frequency channel. BER should not be greater than 0.001 for a specified sensitivity degradation of the wanted signal in the presence of an interfering AWGN signal in the same reception frequency channel. [1]

This test verifies the ability of the BS to receive the wanted signal with a BER not higher than 0.001 using the parameters specified in Table 3-3.

Dynamic Range					
Parameter		Level	I	Unit	
	Wide Area BS	Medium Range BS	Local Area / Home BS	Home BS ¹	
Reference measurement channel data rate		12.2			
Wanted signal mean power	-89.8	-79.8	-75.8	-55.8	dBm
Interfering AWGN signal	-73	-63	-59	-39	dBm/3.84 MHz
BER		≤ 0.00	1		

Note 1: For Home BS, this additional requirement ensures the performance is met over a large dynamic range.

Table 3-3: Parameters for Dynamic range test



Fig. 3-21: Receiver dynamic range. W-CDMA carrier with AWGN interferer

Test Setup



Fig. 3-22: Test Setup for Dynamic range. The SMx generates the wanted W-CDMA uplink reference measurement channel and the AWGN interferer.

Settings:

- The SMx generates the wanted W-CDMA signal with reference measurement channel data rate 12.2 kbps and level settings according to Table 3-3 which is applied to the BS receiver port.
- The SMx also generates the AWGN interferer according to Table 3-3
- Set BS to transmit a "SFN mod 4" periodic trigger.

Test Procedure

- 1. Use standard procedure (see 3.1.1) to generate the wanted W-CDMA signal. This generates the interfering AWGN signal as well.
- AWGN power level is set automatically based on the BS class according to Table 3-3

Power Class	Medium Range BS		
	Want	ed Signal	
State	Off Off C	n Reference Measurement Channel	RMC 12.2 kbps -
RF Frequency	1.950 000 000 00 GHz	• Power Level	-79.80 dBm •
	AWGN	Configuration	
State	Off Off C	n	
C/N	-16.80 dB	 Power Level (within 3.84 MHz BW) 	-63.00 dBm

Fig. 3-23: Select power class to set wanted signal power and AWGN power level. Example: for medium range BS, wanted signal power is set as -79.8 dBm and AWGN is set as -63 dBm (according to standard)

- 3. Press Apply settings
- 4. Measure the BER at the BS receiver ports

Demo Program

For this test, one additional parameter must be defined. The settings are reported.

Test Specific Parameters		
AWGN Level	-73.00	dBm

Fig. 3-24: Special settings for Dynamic Range

The level for AWGN can be entered directly. Please note the settings from the specification listed in Table 3-3.

***************** 7.3 Dynamic Range **********					
Generator Settings: - BS Class : Wide Area BS - Scrambling Code: FFFFFF - Scrambling Mode: Long - C/N : -16.8 - Wanted Signal attenuation (Path A) : 0.00 dB			-		
Test item	Frequency (MHz)	Power (dBm)	AWGN Power (dBm)	Status	
7.3 Dynamic Range					
Generated Signal	1950.00	-89.80	-73.00		
Time: 8/14/2014 4:26:10 PM					

Fig. 3-25: Example report for test case 7.3

3.4 Adjacent Channel Selectivity (ACS) (Clause 7.4)

Adjacent Channel Selectivity (ACS) is a measure of the receiver ability to receive a wanted signal at its assigned channel frequency in the presence of an adjacent channel signal at a given frequency offset from the center frequency of the assigned channel. ACS is the ratio of the receiver filter attenuation on the assigned channel frequency to the receive filter attenuation on the adjacent channel(s). [1]

The interference signal shall have an ACLR of at least 63 dB in order to eliminate the impact of interference signal adjacent channel leakage power on the ACS measurement [1]. The SMx provides an excellent ACLR performance of +70 dB (typ.) with 3GPP FDD signal, hence the impact of interfering W-CDMA signal ACLR can be neglected.





This test verifies the ability of the BS receiver filter to suppress interfering signals in the channels adjacent to the wanted channel following the parameters specified in Table 3-4.

Adjacent Channel Selectivity					
Parameter	Level				Unit
	Wide Area BS	Medium Range BS	Local Area / Home BS	Home BS ¹	
Reference measurement channel data rate		12.2	2		kbps
Wanted signal mean power	-115	-105	-101	-91	dBm
Interfering signal mean power	-52	-42	-38	-28	dBm
Frequency Offset (Interferer)		±5			MHz
BER	≤ 0.001				
Note 1: For Home BS, this additiona	I requirement ens	ures the perform	ance is met ove	r a large dyna	mic range.

Table 3-4: Parameters for Adjacent channel selectivity test

Test Setup



Fig. 3-27: Test Setup for ACS Test. The SMx generates the wanted W-CDMA uplink signal and the interfering W-CDMA signal at ±5 MHz offset frequency with two paths.

Settings:

- The SMx generates the wanted W-CDMA signal with reference measurement channel data rate 12.2 kbps and level settings according to Table 3-4 which is applied to the BS receiver port.
- The SMx also generates the adjacent channel W-CDMA interfering signal according to Table 3-4
- Use a hybrid combiner to sum two signals
- Set BS to transmit a "SFN mod 4" periodic trigger.

Test Procedure

Setup at SMx

- 1. Use standard procedure (see 3.1.1) to generate the uplink signal
- Power level of the wanted W-CDMA signal and the interfering W-CDMA signal is set automatically according to selected BS power class
- **3.** Set the **Frequency Offset** of the interfering W-CDMA signal in the "Interferer Configuration" section

State	Off On	
Frequency Offset	+5 MHz • C/I	-63.00 dB -
Modulation	W-CDMA (3GPP FDD)	

Fig. 3-28: Frequency offset = 5 MHz is applied

- 4. Press Apply settings
- 5. Measure the BER at the BS receiver ports

Demo Program

For this test, additional parameters (**W-CDMA Interferer** and **Interfering Signal Allocation**) must be defined. The settings are reported.

Test Specific Parameters		
W-CDMA Interferer	-52.00	dBm
CW Interferer Level	-48.00	dBm
Interfering Signal allocation :		
Higher Frequencies		-



The level for the W-CDMA interferer can be entered directly. Select the position of the interferer. Please note the settings from the specification listed in Table 3-4.

*********** 7.4 Adjacent Channel Selectivity *******	***		_	
Generator Settings: - BS Class : Wide Area BS - Scrambling Code : FFFFFF - Scrambling Mode : Long - Interfering Signal: W-CDMA - Wanted Signal attenuation (Path A) : 0.00 dB - Interfering Signal attenuation (Path B) : 0.00 dB			-	
Test Item	Frequency (MHz)	Power (dBm)		 Status
7.4 Adjacent Channel Selectivity				
Wanted Signal	1950	-115.00		
W-CDMA Interferer Signal	1955	-52.00		

Time: 8/14/2014 4:30:35 PM

Fig. 3-30: Example report for test case 7.4

3.5 Blocking characteristics (Clause 7.5)

The blocking characteristics are measures of the receiver ability to receive a wanted signal at its assigned channel frequency in the presence of an unwanted interferer on frequencies other than those of the adjacent channels. [1]

The test stresses the ability of the BS receiver to withstand high-level interference from unwanted signals at frequency offsets of 10 MHz or more, without undue degradation of its sensitivity. The BER for wanted signal shall not exceed 0.001 for the parameters specified in Table 3-5, Table 3-6 and Table 3-7.

Blocking can be divided into the three following scenarios:

Wideband blocking- This kind of blocking occurs if there is an interfering W-CDMA signal within the "operating band ± 20 MHz" range, known as in-band blocking or if there is a CW carrier signal out of the "operating band ± 20 MHz" range, known as out-of-band blocking.

The minimum frequency offset, Fuw between the wanted signal and interferer shall be ± 10 MHz and it shall be increased by 1 MHz steps so that the interfering signal covers the range from 1 MHz to 12750 MHz.

 Table 3-5 describes the requirements for wideband blocking based on the BS

 class depending on the frequency band.



Fig. 3-31: Wideband blocking example. Fig a) shows in-band blocking with W-CDMA interferer where the center frequency of the interfering signal is within the operating band \pm 20 MHz range. Fig b) shows out-of-band blocking with CW interferer where the center frequency of the interfering signal is out of the operating band \pm 20 MHz range.

Co-located blocking: This test maybe applied if a BS is co- located with another BS using different wireless standards and another frequency band. For the test, blocking is done by a CW carrier signal within the operating band of wanted W-CDMA signal. This test is optional.

Requirements for co-located blocking are mentioned in in Table 3-6.

 Narrowband Blocking- This test is applied if a BS is located in one of the frequency bands specified for GSM. For the test, blocking is done by a narrowband GMSK signal within the operating band.

The GMSK modulated interfering signal shall have an ACLR of at least 72 dB in order to eliminate the impact of interference signal adjacent channel leakage power on the blocking characteristics measurement [1]. Use a notch filter to eliminate the impact.

Requirements for co-located blocking are mentioned in in Table 3-7.

Blocking characteristics for Wideband blocking					
BS class	Operating	Interfering Signal mean power (dBm)			
	Band	F_{high} – 20 MHz \leftrightarrow F_{low} + 20 MHz Min. offset = ±10 MHz	1 MHz↔ F _{high} - 20 MHz and F _{low} + 20 MHz↔12750 MHz	(dBm)	
Wide Area BS	I - XXV	-40		-115	
Medium Range BS	I - XXV	-35	-15	-105	
Local Area/ Home BS	I - XXV	-30		-101	
Type of Interferer	I - XXV	WCDMA interferer	CW carrier		
Note: Check	TS 25.141 ta	able 7.4K \leftrightarrow 7.4M for further detail	s		

Table 3-5: Blocking characteristics for wideband blocking for different BS

Blocking characteristics for Co-located blocking				
BS class	Operating Band	Interfering Signal mean power (dBm)	Wanted signal mean power (dBm)	
Wide Area BS	Macro GSM900, Macro DCS1800, Macro PCS1900, Macro GSM850 or CDMA850; WA E-UTRA 1 \leftrightarrow 25, 33,34,38 \leftrightarrow 43; WA UTRA-FDD I \leftrightarrow XIV , XIX \leftrightarrow XXII, XXV	+16	-115	
	Macro GSM900, Macro GSM850	-3	-105	
Medium	Macro DCS1800, Macro PCS1900	+5		
Range BS	$MR\;UTRA\text{-}FDD\;I\leftrightarrowXIV,XIX\leftrightarrowXXII,\!XXV$	+8		
	Pico GSM900, Pico GSM850	-7		
Local Area/ Home BS	Pico DCS1800, Pico PCS1900	-4	-101	
	LA E-UTRA 1 \leftrightarrow 25, 33,34,38 \leftrightarrow 43; LA UTRA-FDD I \leftrightarrow XIV , XIX \leftrightarrow XXII, XXV	-6		
Type of Interferer	CW carrier			
Note 1: Cheo	ck TS 25.141 table 7.4N \leftrightarrow 7.4 Q for further details			

Table 3-6: Blocking characteristics for co-located blocking for different BS

Blocking characteristics for Narrow band blocking					
BS class	Operating Band	Min. Offset of Interfering Signal (MHz)	Interfering Signal mean power (dBm)	Wanted signal mean power (dBm)	
Wide Area	$II,IV,V,X,XII\leftrightarrowXIV,XXV$	±2.7	-47	-115	
BS	III, VIII	±2.8	-47	-110	
Medium	$II,IV,V,X,XII\leftrightarrowXIV,XXV$	±2.7	10	405	
Range BS	III, VIII	±2.8	-42	-105	
Local Area/	$II,IV,V,X,XII\leftrightarrowXIV,XXV$	±2.7	-37	-101	
	III, VIII	±2.8	-57		
Type of Interferer	GMSK modulated				

Note 1: Use a notch filter to eliminate the impact of interfering GMSK signal adjacent channel leakage power on the blocking characteristics measurement.

Note 2: Check TS 25.141 table 7.4NR ↔ 7.4T for further details

Table 3-7: Blocking characteristics for narrowband blocking for different BS

Test Setup



Fig. 3-32: Test setup for blocking characteristics. The SMx generates the wanted W-CDMA signal and the interfering signal with two paths. The CW generator provides the CW interferer up to 12.75 GHz

RF channel to be tested: Middle (M)

Settings

- The BS transmits a W-CDMA signal at Pmax using channel setup according to TM1
- The SMx generates the wanted W-CDMA signal with reference measurement channel data rate 12.2 kbps and level settings according to the level specified in Table 3-5, Table 3-6 and Table 3-7 which is applied to the BS receiver port
- The SMx also generates a W-CDMA, CW or GMSK modulated interferer according to the level specified in Table 3-5, Table 3-6 and Table 3-7. For the narrowband blocking (Interferer GMSK modulated) use a notch filter to fulfil the ACLR requirement
- For out-of-band blocking, use an additional CW generator to generate the CW interferer up to 12.75 GHz. Use a filter to suppress harmonics in the receive band.
- Use a hybrid combiner to sum all signals

Set BS to transmit a "SFN mod 4" periodic trigger.

Procedure

SMx "Test Case Wizard" offers three blocking scenarios: Wideband blocking, Co located blocking and Narrowband blocking. Modulation of the interfering signal is done based on the blocking scenario.

Wideband Blocking (In-Band)

- 1. Use standard procedure (see 3.1.1) to generate the uplink W-CDMA signal
- Select Wideband Blocking as Blocking Scenario in the "Wanted Signal" menu. (Fig. 3-33).
- 3. Select the **Operating band** of the wanted signal (Fig. 3-33).
- 4. Set **RF frequency** of the wanted signal within the operating band. (Fig. 3-33)
- 5. **Power level** for the wanted signal is set automatically according to specification.

State	Off On Blocking Scenario	Wideband Blocking -
Reference Measurement Cha	nel RMC 12.2 kbps - Operating Band	I: (1920 - 1980 MHz)
RF Frequency	1.950 000 000 00 GHz - Power Level	-115.0 dBm -

Fig. 3-33: Set parameters for wideband blocking

- Set Frequency offset of the interfering signal from the wanted signal such that the center frequency of the interfering signal is within "operating band ± 20 MHz" range. Maintain minimum offset of ± 10 MHz. (Fig. 3-34)
- 7. Modulation of the interfering signal is set as **W-CDMA (3GPP FDD)** and **Power level** is set automatically according to specification.

State	Off On	
Frequency Offset	20 MHz · Power Level	-40.00 dBm ·
Modulation	W-CDMA (3GPP FDD)	

Fig. 3-34: Frequency offset is selected as 20 MHz which is within \pm 20 MHz of the highest and lowest edge of the operating band. So, a -40 dBm W-CDMA interferer is used for wideband blocking scenario of a wide area BS.

- 8. Press Apply Setting
- 9. Measure the BER at the BS receiver ports
- **10.** Shift the interferer in 1 MHz steps up in the range (operating band \pm 20 MHz) by changing the frequency offset and press **Apply Settings**
- 11. Repeat the measurement at BS receiver port

Wideband Blocking (Out-of-Band)

An additional CW signal generator is needed for out-of-band blocking. Follow the steps below to generate a CW interferer in addition to the wanted W-CDMA signal.

SMx settings:

- 1. Use step 1-5 of the standard procedure (see 3.1.1) to generate the uplink W-CDMA signal
- Select User Definable in the Edit Mode under the General settings section of Test case "7.5 Blocking characteristics"
- 3. Select Unchanged under "Trigger Configuration" menu.
- 4. Enter uplink **Scrambling Code** and select **Scrambling Mode** in the "Baseband Configuration" section

Basestation Configuration				
Scrambling Code (hex)	FFDE DE			
Scrambling Mode	Short Scrambling Code			
	Off			
State	Long Scrambling Code			

Fig. 3-35: Set scrambling code and scrambling code mode of the wanted W-CDMA signal

- 5. Select Reference Measurement Channel of the wanted signal (Fig. 3-36)
- 6. Set **RF Frequency** and **Power Level** of the wanted signal

	State Off On Reference Measurement Channel RMC 12.2 kbps -				
RF Frequency 1.950 000 000 00 GHz Power Level -115.0 dBm	RF Frequency	1.950 000 000 00 GHz	Power Level	-115.0 dBm	

Fig. 3-36: Set reference measurement channel, RF frequency and Power level of the wanted signal

6. Turn off the interfering signal.

	Interferer Configuration		
State	Off On		

Fig. 3-37: Turn off interfering signal.

7. Press Apply Settings

CW generator settings:

8. Set RF Frequency and level in the CW generator and start measurement. (start frequency 1 MHz, level -15 dBm)



Fig. 3-38: CWx: set RF frequency and Power level of CW signal

- Shift the interferer in 1 MHz steps up in the range and repeat the measurement up to 12750 MHz. Skip the operating band plus additional range (example: skip 1900 to 2000 MHz range for operating band I (1920-1980 MHz)
- 10. Measure the BER at the BS receiver ports for each frequency step

Co-located blocking:

- 1. Use the standard procedure (see 3.1.1) to generate the uplink W-CDMA signal
- Select Co-located BS blocking as Blocking Scenario in the "Wanted Signal" menu. (Fig. 3-39)
- 3. Set RF frequency of the wanted signal. (Fig. 3-39)
- 4. **Power level** for the wanted signal is set automatically based on the power class and blocking scenario. (Fig. 3-39)

	VVanted	I Signal	
State	Off On	Blocking Scenario	Colocated BS Blocking
Reference Measurement Cha	nnel RMC 12.2 kbps -		
RF Frequency	1.950 000 000 00 GHz -	Power Level	-105.0 dBm 🔸

Fig. 3-39: Set blocking scenario as Colocated BS Blocking. Set Frequency

- Set Frequency offset of the interfering signal from the wanted signal such that the center frequency of the interfering signal is within the operating band. (Fig. 3-40)
- 6. Modulation of the interfering signal is set as CW Carrier and **Power level** is set automatically according to standard. (Fig. 3-40)

State	Off On On	ation	
Frequency Offset	10 MHz · Power	Level	16.00 dBm 🔸
Modulation	CW Carrier		

Fig. 3-40: Set frequency offset

- 7. Press Apply Setting
- 8. Measure the BER at the BS receiver ports
- **9.** Shift the interferer in 1 MHz steps up in the range by increasing the frequency offset and press **Apply Settings**
- 10. Repeat the measurement at BS receiver port

Narrowband Blocking:

- 1. Use step 1-10 of the standard procedure (see 3.1.1) to generate the uplink W-CDMA signal
- Select Narrowband BS blocking as Blocking Scenario in the "Wanted Signal" menu. (Fig. 3-41)
- 3. Set **RF frequency** of the wanted signal. (Fig. 3-41)
- 4. **Power level** for the wanted signal is set automatically based on the power class and blocking scenario. (Fig. 3-41)

	Wanted	d Signal	
State	Off On	Blocking Scenario	Narrowband Blocking 🗸
Reference Measurement Cha	nnel RMC 12.2 kbps -	₽	
RF Frequency	1.950 000 000 00 GHz ·	Power Level	-115.0 dBm 🕞

Fig. 3-41: Select Narrowband Blocking. Set RF Frequency

- 5. Set **Frequency offset** of the interfering signal from the wanted signal such that the center frequency of the interfering signal is within the operating band. Maintain minimum offset between the signals according to Table 3-7.
- 6. Modulation of the interfering signal is set as **GMSK (270.833 kHz)** and **Power level** is set automatically according to specification.

State	Off On	
Frequency Offset	9 MHz Power Level	-47.00 dBm -
Modulation	GMSK (270.833 kHz)	
	Apply Settings	

Fig. 3-42: Set Frequency Offset. GMSK modulation is set automatically.

- 7. Press Apply Setting
- 8. Measure the BER at the BS receiver ports
- **9.** Shift the interferer in 1 MHz steps up in the range by changing the frequency offset and press **Apply Settings**
- 10. Repeat the measurement at BS receiver port

Demo Program

For this test, additional parameters must be defined. The settings are reported.

Test Specific Parameters						
Interferer level			-40.00	dBm		
CW Interferer L	.evel		-48.00	dBm		
Interfering Signa	al allocatio	n:				
Higher Frequent	cies			-		
Intermodulation Settings						
Blocking Settings						
Blocking Setting	gs					
Blocking Setting	gs lation [1	WCI	DMA	•		
Blocking Setting	gs lation	WCI	DMA	•		
Blocking Setting Interferer Modul	gs lation (Start	WCI	DMA 2500	• MHz		
Blocking Setting Interferer Modul Interferer Frequency	gs lation Start Stop	WCI	DMA 2500 2510	▼ MHz MHz		
Blocking Setting Interferer Modul Interferer Frequency	gs lation Start Stop	WCI	DMA 2500 2510	• MHz MHz		
Blocking Setting Interferer Modul Interferer Frequency Wait Time	gs lation Start Stop	WCI	DMA 2500 2510 500	 MHz MHz ms 		

Fig. 3-43: Special settings for blocking

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Choose the modulation of the interferer and set the level for the interferer. Set the start and stop frequency of the interferer. Set the wait time between two steps. Please note, that the entered frequencies are not checked for validity. Please note the settings from the specification listed in Table 3-5, Table 3-6 and Table 3-7.

*********** 7.5 Blocking Characteristics **********				
Generator Settings: - BS Class : Wide Area BS - Scrambling Code : 000000 - Scrambling Mode : Long - Interfering Signal : WCDMA - Measurment Frequency range : (2500 to 2510 MHz) - Wanted Signal attenuation (Path A) : 0.00 dB - Interfering Signal attenuation (Path B) : 0.00 dB				
Test Item	Frequency (MHz)	Power (dBm)		Status
7.5 Blocking Characteristics				
Wanted Signal	1950	-115.00		
Blocking Signal	2500	-40.00		
Blocking Signal	2501	-40.00		
Blocking Signal	2502	-40.00	-	
Blocking Signal	2503	-40.00		
Blocking Signal	2504	-40.00	-	
Blocking Signal	2505	-40.00		
Blocking Signal	2506	-40.00	—	
Blocking Signal	2507	-40.00		
Blocking Signal	2508	-40.00	-	
Blocking Signal	2509	-40.00		
Blocking Signal	2510	-40.00		

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Fig. 3-44: Example report for test case 7.5

3.6 Intermodulation characteristics (Clause 7.6)

Intermodulation response rejection is a measure of the capability of the receiver to receive a wanted signal on its assigned channel frequency in the presence of two or more interfering signals which have a specific frequency relationship to the wanted signal. Third and higher order mixing of the two interfering RF signals can produce an interfering signal in the band of the desired channel. [1]

The following figure shows the wanted signal along with a CW interfering signal at 10MHz offset from the wanted signal and a W-CDMA interfering signal at 20 MHz offset.

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Fig. 3-45: Intermodulation performance. W-CDMA and CW interfering signals cause interference in the wanted signal frequency band.

The test purpose is to verify the ability of the BS receiver to inhibit the generation of intermodulation products in its non-linear elements caused by the presence of two high -level interfering signals at frequencies with a specific relationship to the frequency of the wanted signal. [1]

The BER for wanted signal shall not be greater than 0.001 for the parameters specified in Table 3-8 and Table 3-9

Intermodulation parameter requirement						
Operating Band	Type of Signal	Offset	Signal mean power (dBm)			
			Wide Area BS	Medium Range BS	Local Area / Home BS	
	Wanted signal		-115	-105	-101	
All bands	CW signal	±10 MHz	-48	-44	-38	
	WCDMA signal	±20 MHz	-48	-44	-38	

Table 3-8: Interferer signals for intermodulation performance requirement

Narrowband intermodulation parameter requirement						
Operating Band	Type of Signal	Offset	Signal mean power (dBm)			
			Wide Area BS	Medium Range BS	Local Area / Home BS	
II, III, IV, V,	Wanted signal		-115	-105	-101	
VIII, X, XII,	CW signal	±3.5 MHz	-47	-43	-37	
XIII, XIV, XXV	GMSK modulated	±5.9 MHz	-47	-43	-37	

Use a notch filter to fulfil the ACLR requirement

Table 3-9: Narrowband intermodulation performance requirement

Test Setup



Fig. 3-46: Test setup for Intermodulation characteristics. The SMx generates the wanted W-CDMA signal and the interfering signal with two paths.

Settings:

- The SMx generates the wanted W-CDMA signal with reference measurement channel data rate 12.2 kbps and level settings according to the level specified in Table 3-8 and Table 3-9 which is applied to the BS receiver port
- The SMx also generates two interferers (CW and W-CDMA/GMSK) based on the modulation bandwidth and according level specified in Table 3-8 and Table 3-9. For the narrowband intermodulation (Interferer GMSK modulated) use a notch filter to fulfil the ACLR requirement
- Use a hybrid combiner to sum all signals
- Set BS to transmit a "SFN mod 4" periodic trigger.

Test Procedure

- 1. Use the standard procedure (see 3.1.1) to generate the uplink signal
- 2. Select Bandwidth type in the "Interferer Configuration settings"

Interferen			
Bandwidth Type		Narrowband	
		Wideband	
State	Off	Narrowband	

Fig. 3-47: Set bandwidth type of the interferer (Example: narrowband is chosen here).

3. All the settings (frequency offset, Modulation type and power level) for CW interferer (interferer 1) and Modulated Signal (interferer 2) are set automatically based on the power class and interferer bandwidth type according to standard.

(Interferer Configuration	
Bandwidth Type	Narrowband -	
	Interferer 1: CW Carrier	
State	Off On	
Frequency Offset	3.500 000 00 MHz · Power Level	-37.00 dBm -
	Interferer 2: Modulated Signal	
State	Off On Modulation GMSK (27	′0.833 kHz)
Frequency Offset	5.900 000 00 MHz · Power Level	-37.00 dBm -

Fig. 3-48: Power levels (marked red), frequency offsets (marked green) and modulation type (marked blue) for the interferers are set automatically according to standard.

- 4. Press Apply Settings
- 5. Measure the BER at the BS Receiver ports

Demo Program

For this test, additional parameters must be defined. The settings are reported.

Test Specific Parameters		Test Specific Parameters	
W-CDMA Interferer Level	IA Interferer Level -48.00 dBm		GMSK Interferer Level -47.00 dBm
CW Interferer Level	-48.00	dBm	CW Interferer Level -47.00 dBm
Interfering Signal allocation :			Interfering Signal allocation :
Higher Frequencies			Lower Frequencies
Intermodulation Settings Narrowband Modulation			Intermodulation Settings Narrowband Modulation

Fig. 3-49: Special settings for Intermodulation characteristics. Change modulation setting to change between W-CDMA and GMSK interferer.

Check **Narrowband Modulation** to switch to "Narrowband Intermodulation". The level for the W-CDMA/GMSK interferer and CW interferer can be entered directly. Select the Interfering signal allocation. Please note the settings from the specification listed in Table 3-8 and Table 3-9

*********** 7.6 Intermodulation Characteristics **********			
Generator Settings: - BS Class : Wide Area BS - Scrambling Code : 000000 - Scrambling Mode : Long - Interferer 1 : CW - Interferer 2: W-CDMA - Wanted Signal attenuation (Path A) : 0.00 dB - Interfering Signal attenuation (Path B) : 0.00 dB			
Test Item	Frequency (MHz)	Power (dBm)	Status
7.6 Intermodulation characteristics			
Generated signal	1950.00	-115.00	
CW Interferer	1960	-48.00	
W-CDMA Interferer	1970	-48.00	

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Fig. 3-50: Example report for test case 7.6.

3.7 Spurious emissions (Clause 7.7)

The spurious emission power is the power of the emissions generated or amplified in a receiver that appears at the BS antenna connector. The requirements apply to all BS with separate RX and TX antenna port. The test shall be performed when both TX and RX are on with the TX port terminated. [1]

The transmitter spurious emission limits apply from 30 MHz to 12.75 GHz. The frequencies between 12.5 MHz below the first carrier frequency and 12.5 MHz above the last carrier frequency used by the BS is excluded. [1]

The test purpose is to verify the ability of the BS to limit the interference caused by receiver spurious emissions to other systems. All the measured spurious emissions shall be within the limits specified in Table 3-10

Spurious emission minimum requirement				
Band	Maximum level	Measurement Bandwidth		
30 MHz - 1 GHz	-57 dBm	100 kHz		
1 GHz - 12.75 GHz	-47 dBm	1 MHz		
Applies only for Band XXII:	47 dBm	1 MHz		
12.75 GHz - 5" narmonic of the upper frequency edge of the UL operating band in GHz	-47 UDIII			

Table 3-10: Limits for Spurious emissions

Test Setup



Fig. 3-51: Receiver spurious emission test setup. A notch filter suppresses the Tx signal

RF channels to be tested: M

Setting

 The base station transmits a W-CDMA signal at Pmax with channel configuration according to TM1

- The FSx analyzes the emissions on the Rx port via a notch filter and performs measurement
- Tx and unused Rx ports are terminated

Test Procedure

Measurement at FSx

1. In the Spectrum mode, press hardkey MEAS and select Spurious Emission

V Select Measurement Mode Auto Sv		
Power Measurements	Statistics Measurements	Basic Measurements
Channel Power ACLR	APD	Frequency Sweep
C/N	CCDF	Zero Span
C/N0	Further Measurements	EMI Measurements
OBW	Time Domain Power	EMI
Emission Measurements	Harmonic Distortion	ang th _{appe} r and served straight relating and phylocomers and
Spectrum Emission Mask	Third Order Intercept	Marker Functions
Sol 4 Sun Spurious Emissions	AM Modulation Depth	All Functions Off
.000 kHz 150.000 kHz	1.000 kHz 136.4229 10.000 kHz 25.99737	7 kHz -98.55 dBm 7 MHz -91.65 dBm

Fig. 3-52: Select spurious emissions via hardkey MEAS

- In the Sweep list, delete ranges 1 and 2. Exclude frequencies between 12.5 MHz below the first carrier frequency and 12.5 MHz above the last carrier frequency. Example: for operating band I (1920-1980 MHz), frequency range "1907.5 MHz to 1992.5" MHz is excluded. (Fig. 3-53)
- Adjust the limit settings in the remaining two ranges to -57 dBm and -47 dBm. Check the other settings. (Fig. 3-53)
- 4. Press Adjust X-Axis. This applies the settings.

Spurious Emissions				
aval 0 00 dBm	Range 1	Range 2	Range 3	
Range Start	30 MHz	1 GHz	1.9925 GHz	
Range Stop	1 GHz	1.9075 GHz	12.75 GHz	
Filter Type	Normal(3	Normal(3	Normal(3	
RBW	100 kHz	1 MHz	1 MHz	
VBW	300 kHz	3 MHz	3 MHz	
Sweep Time Mode	Auto	Auto	Auto	
Sweep Time	32.1 ms	32.1 ms	43.1 ms	
Detector	RMS	RMS	RMS	
Ref Level	0 dBm	0 dBm	0 dBm	
RF Att Mode	Auto	Auto	Auto	
RF Attenuation	10 dB	10 dB	10 dB	
Preamp	Off	Off	Off	
Sweep Points	32001	32001	32001	
Stop After Sweep	Off	Off	Off	
Transducer	None	None	None	
Limit Check	Absolute	Absolute	Absolute	
Abs Limit Start	-57 dBm	-47 dBm	-47 dBm	
Abs Limit Stop	-57 dBm	-47 dBm	-47 dBm	

Fig. 3-53: Sweep list settings for spurious emission test. Sweep range is set 30 MHz to 12.75 GHz and RMS detector is selected. 1907.5 to 1992.5 MHz is excluded (example: Operating band I)

Limit check line shows the result of the test.

1 Spurious Emissions					o1 Clrw
Limit Check		PASS			
Line _SPURIOUS	_LINE_ABS_001	PASS			
-10 dBm					
-20 dBm					
-20 abiii					
-30 dBm					
-40 dBm					
-50 aBm					
_SPURIOUS_LINE_ABS_001					
-60 dBm					
-70 dBm					n Janka taikha lasa
, o aom			talia da anti-	المؤدولة والمرابع بالمناوليا أجروني أرقوا والمراجع والمع	A CONTRACTOR AND A CONTRACT OF
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al		alla de la construcción de la const	and the second		Le de la de la la la ser la
100.1.1	المرازلية بالمراجع بالمالية المتعادية المتعادية	فالقارب والشريب ويسترج وترجي والمنطقة المراجع المقتوع والطوا			· 1 · · · ·
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الرائلة للله بالشقال					
CF 6.39 GHz		96003 pts	1.27 GHz/		Span 12.72 GHz
2 Result Summary					
Range Low	Range Up	RBW	Frequency	Power Abs	ΔLimit
30.000 MHz	1.000 GHz	100.000 kHz	681.13762 MHz	-84.55 dBm	-27.55 dB
1.000 GHz	1.907 GHz	1.000 MHz	1.17924 GHz	-76.24 dBm	-29.24 dB
1.992 GHz	12.750 GHz	1.000 MHz	12.52427 GHz	-68.18 dBm	-21.18 dB

Fig. 3-54: Result for spurious emission. Limit check shows "Pass" if spurious emission remains below the limit. Measurements for individual range are shown in the result summary section

Additional Co-existing requirements

Additional requirements may apply for:

- Protection of the BS receiver of own or different BS (see subclause 6.5.3.7.3)
- Co-existence with other systems in the same geographical area (see subclause 6.5.3.7.4 and 6.5.3.7.8.2) [1]
- Co-existence requirements for co-located BS (see subclause 6.5.3.7.5 and 6.5.3.7.8.2) [1]

Demo Program

For this test, additional parameters must be defined. The settings are reported. A spectrum analyzer is used.

Test Specific Parameters		
Limit: 30 MHz - 1 GHz	-57.00	dBm
Limit: 1 GHz - 12.75 GHz	-47.00	dBm

FSx Attenuation		
Attenuation	0.00	dB
Interfering Signal (Path B)	0.00	dB

Fig. 3-55: Special settings receiver spurious emissions.

The limits for the spectrum measurement can be entered directly. Set the FSx attenuation. Please note the settings from the specification listed in Table 3-10.

********** 7.7 Receiver Spurious Emissions **********

FSx Attenuation Level: 0.00 dB					
Test Frequency Range			Power (dBm)	Limit (dBm)	Status
7.7 Receiver Spurious Emissions					
30 MHz - 1 GHz			-87.07	-57.00	Passed
1 GHz - 12.75 GHz		_	-76.92	-47.00	Passed

Fig. 3-56: Example report for test case 7.7

3.8 Verification of the internal BER calculation (Clause 7.8)

Base station System with internal BER calculation can synchronize it's receiver to known pseudo-random data sequence and calculates bit error ratio from the received data. This test is performed only if base station System has this kind of feature. This test is performed by feeding measurement signal with known BER to the input of the receiver. Locations of the erroneous bits shall be randomly distributed within a frame. Erroneous bits shall be inserted to the data bit stream as shown in Fig. 3-57.



Fig. 3-57: BER insertion into the information data [1]

The aim of this test is to verify that the internal BER calculation accuracy shall meet requirements for conformance testing. BER indicated by the base station System shall be within $\pm 10\%$ of the BER generated by the RF signal source for the measurement signals specified in Table 3-11.

Measurement signal requirements				
Transport channel combination	Data rate	BER		
DPCH	12.2 kbps	0.01		

Table 3-11: Measurement signals requirements for internal BER calculation

Signal source parameters should be set according Table 3-12

Signal sour	ce parameters			
Parameters		Level/status		Unit
	BS Class	$f \le 3.0 \text{ GHz}$	3.0 GHz < f \leq 4.2 GHz	
UL signal	Wide Area BS	-110.3 dBm	-110 dBm	dBm/3.84 MHz
level	Medium Range BS	-100.3 dBm	-100 dBm	
	Local Area BS / Home BS	-96.3 dBm	-96 dBm	
Data sequence		PN9 or longer		

Table 3-12: Parameters for signal source

Test Setup



Fig. 3-58: Verification of the internal BER calculation test setup. The SMx generates the W-CDMA uplink reference measurement channel with data rate 12.2 kbps.

Settings

- The SMx generates a W-CDMA signal with reference measurement channel data rate 12.2 kbps, a known BER and level settings according to Table 3-11 and Table 3-12 which is applied to the BS receiver port.
- Set BS to transmit a "SFN mod 4" periodic trigger.

Test procedure

1. Use standard procedure (see 3.1.1) to generate the uplink signal.

State	Off Or	d Signal Reference Measurement Channel	RMC 12.2 kbps
RF Frequency	2.140 000 000 00 GHz	Power Level	-110.3 dBm ·
Bit Error Rate	0.01		

Fig. 3-59: Set Bit error rate of the wanted signal

- 2. Set **Bit Error Rate** = 0.01 in the Wanted Signal section
- 3. Press Apply Settings

4. Measure the BER at the BS receiver ports. Calculation shall be done at least over 50,000 bits.

Demo Program

For this test, additional parameters must be defined. The settings are reported.

BER Settings		
BER	0.01	

Fig. 3-60: Special settings for Verification of BER calculation

BER can be entered directly. Please note the settings from the specification listed in Table 3-11.

********** 7.8 Verification of the internal BER calculation **********

Generator Settings: - BS Class: Wide Area BS - Scrambling Code: 000000 - Scrambling Mode: Long - Signal attenuation (Path A) : 0.00 dB				
Test Item	Frequency (MHz)	Power (dBm)	BER	Status
7.8 Verification of the internal BER calculation				
Generated Signal	1950.00	-110.30	0.01	

Time: 8/14/2014 5:27:55 PM

Fig. 3-61: Example report for test case 7.8

4 Appendix

4.1 R&S RUN Program

The R&S RUN software application makes it possible to combine tests (modules) provided by Rohde & Schwarz into test plans to allow rapid and easy remote control of test instruments. This program is available free of charge from our website.

Requirements

Operating system:

- Microsoft Windows XP / Vista / Windows 7 / Windows 8
- NET framework V2.0 or higher

General PC requirements:

- Pentium 1 GHz or faster
- 1 Gbyte RAM
- 100 Mbyte space harddisk
- XGA monitor (1024x768)

Remote control interface:

- National Instruments VISA
- GPIB card

Or

LAN connection After R&S RUN is launched, the following splash screen appears:

🎭 R&S RUN	
File View Resources Options 1	estplan Favorites Help
Rile Browsers	🞦 New 🗃 Open 🥥 Save All 💷 Abort All
Test Plans Tests Reports	No Testplan Loaded
Salar Remove Revorite	2
i ⊕ CMW-KT059 Developer Kit	
Session: AKTER License Server: CMW	==

Fig. 4-1: Overview R&S RUN

Tests and test plans

Tests are separate, closed modules for R&S RUN. A test plan can consist of one or more tests.

WCDMA_BS_Rx_Tests ×	WCDMA_BS_Tx_Test ×		
🕨 Run 🔲 Abort 🕅 Step	Idle	🚽 🤪 Parameters 📑 Resources	🝷 📝 Edit 🔡 Save As 👳
TC 😭 🖗 🗈 🔍 🗈	🗈 × 🛅 🗟 🖦 🔁		
Steps	Desc	iption	
WCDMA BS Rx Tests	insta		
	ests		
Testplan Details Yield Mea	asurement Report SCPI Report	Progress Log	

Fig. 4-2: Overview of a test plan in R&S RUN. The test plan in the example contains only one test (WCDMA_BS_Rx_Tests). After the test is completed, the bar along the bottom can be used to display the measurement and SCPI reports.

The WCDMA BS tests can be found under Tests/ApplicationNotes.

Click **RUN** to start the current test plan.

SCPI connections

Under **Resources**|**SCPI Connections**, you can add all required instruments for remote control.

🔅 R&S RUN - WCDMA_BS_Tx_Test				
File View	Resources Options Testplan			
Rile Browsers Bar Code Reader				
Test Plans Tes Measurement Report				
🔁 Add 📄 Re	SCPI Connections			
	SCPI Report			
📗 🗄 🕠 🌆 Applicat	Serial Port			

Fig. 4-3: Setting the SCPI connections.

Use **Configure...** to open a wizard for entering the VISA parameters (Fig. 4-4).Use the **Test Connection** button to test the connection to the instrument. When the **Demo Mode** button is enabled, no instruments need to be connected because R&S RUN will run in demo mode and output a fictitious test report.

SCPI Con	nections			×
Globals				
D	Alias	Resource Name	Timeout	*
SMx2		TCPIP0::10.85.0.170::INSTR	10000	
SMx		TCPIP0::10.85.0.117::INSTR	10000	
				Ŧ
Reporti	ng	Break test after 10	successive time	outs
📃 Demo I	Mode			
Add	Delete	Configure	Test Connec	ction
			ок	Cancel



Resource Name Composer		×
Alias SMx	Remote Interface Assistant VISA: National Instruments; V5.4.0f0	
Resource Name	Interface Type:	VXI11 (Network) 👻
TCPIP0::10.85.0.117::INSTR	Board No.	0
< Assistant Timeout (ms)	TCPIP IP Address IP Address 10	 Host Name 85 0 117
OK Cancel		

Fig. 4-5: Wizard for entering VISA parameters. Both the IP address and a host name can be entered directly.

Reports: Measurement and SCPI

After the test is completed, R&S RUN automatically generates both a **Measurement Report** and a **SCPI Report**.

The measurement report shows the actual results and the selected settings.

The **SCPI Report** returns a LOG file of all transmitted SCPI commands. These can then be copied and easily used in separate applications.

Protocol

Test Case 1: Measurement

0:00:00.375.296: Initializing testcase!
0:00:00.406.224: Opening new remote channel: FSx
0:00:00.415.433: Connection to FSx(TCPIP0::10.85.0.53::INSTR) established!
0:00:00.416.433: Session handle: 1
0:00:00.417.797: Resource Name: TCPIP0::10.85.0.53::INSTR
0:00:00.418.760: VISA Manufacturer: National Instruments
0:00:00.420.853: [>TCPIP0::10.85.0.53::INSTR] *IDN?
0:00:00.506.689: <pre>[<tcpip0::10.85.0.53::instr] 101157,2.10<="" pre="" rohde&schwarz,fsw-13,1312.8000k13=""></tcpip0::10.85.0.53::instr]></pre>
0:00:00.508.290: [>TCPIP0::10.85.0.53::INSTR] *RST;*CLS;*OPC?
0:00:00.645.087: <pre>[<tcpip0::10.85.0.53::instr] 1<="" pre=""></tcpip0::10.85.0.53::instr]></pre>
0:00:00.647.203: [>TCPIP0::10.85.0.53::INSTR] ROSC:SOUR INT
0:00:00.648.763: [>TCPIP0::10.85.0.53::INSTR] DISP:TRAC:Y:RLEV:OFFS 0.00
0:00:00.650.252: [>TCPIP0::10.85.0.53::INSTR] DISP:TRAC:Y:RLEV 0.00dBm
0:00:00.653.030: [>TCPIP0::10.85.0.53::INSTR] INST:SEL BWCD
0:00:00.656.442: [>TCPIP0::10.85.0.53::INSTR] SENS:FREQ:CENT 2000MHz
0:00:00.657.892: [->TCPIP0::10.85.0.53::INSTR] SENS:CDP:LCOD #H0
0:00:01.133.068: [>TCPIP0::10.85.0.53::INSTR] SENS:CDP:PREF TOT
0:00:01.140.435: [>TCPIP0::10.85.0.53::INSTR] INIT:CONT OFF
0:00:01.144.236: [>TCPIP0::10.85.0.53::INSTR] INIT:IMM;*OPC
0:00:02.149.043: [>TCPIP0::10.85.0.53::INSTR] *ESR?
0:00:02.151.031: [<tcpip0::10.85.0.53::instr] 1<="" td=""></tcpip0::10.85.0.53::instr]>
0:00:02.151.746: [->TCPIP0::10.85.0.53::INSTR] CALC:MARK:FUNC:WCDP:RES? PTOT
0:00:02.161.245: [<tcpip0::10.85.0.53::instr] -30.7061824799<="" td=""></tcpip0::10.85.0.53::instr]>
0:00:02.162.119: [->TCPIP0::10.85.0.53::INSTR] CALC:MARK:FUNC:WCDP:RES? FERRor
0:00:02.164.324: [<-TCPIP0::10.85.0.53::INSTR] 577.945495605
0:00:02.165.064: [>TCPIP0::10.85.0.53::INSTR] CALC:MARK:FUNC:WCDP:RES? EVMPeak
0:00:02.167.922: [<tcpip0::10.85.0.53::instr] 82.5495986938<="" td=""></tcpip0::10.85.0.53::instr]>
Testplan Details Yield Measurement Report SCPI Report Progress Log

Fig. 4-6: SCPI report

4.2 References

[1] Technical Specification Group Radio Access Network; **Base Station (BS)** conformance testing (FDD) (Release 10), 3GPP TS 25.141 V10.10.0 (2014-03)

[2] Rohde & Schwarz: **3GPP FDD incl. enhanced MS/BS tests, HSPA, HSPA+, Digital Standard for R&S®SMW200A**, User Manual

4.3 Additional Information

Please send your comments and suggestions regarding this application note to

TM-Applications@rohde-schwarz.com

4.4 Ordering Information

Ordering Information for Signal Generators			
Vector Signal Generator			
Product Description	Туре	Ordering No.	
Vector Signal Generator	SMW200A	1412.0000.02	
Baseband Generator	SMW-B10	1413.1200.02	
SMU-B11 Baseband Generator	SMW-B11	1159.8411.02	
Baseband Main Module	SMW-B13	1141.8003.04	
1st RF path up to 6 GHz	SMW-B10x		
2nd RF path up to 6 GHz	SMW-B20x		
1st RF path up to 20 GHz	SMW-B120	1413.0404.02	
2nd RF path up to 20 GHz	SMW-B220	1413.1100.02	
AWGN	SMW-K-62	1413.3484.02	
Digital Standard 3GPP FDD	SMW-K42	1413.3784.02	

Ordering Information for Signal Generators			
Vector Signal Generator			
Product Description	Туре	Ordering No.	
Vector Signal Generator	SMU200A	1141.2005.02	
Baseband Generator	SMU-B9	1161.0766.02	
Baseband Generator	SMU-B10	1141.7007.02	
SMU-B11 Baseband Generator	SMU-B11	1159.8411.02	
Baseband Main Module	SMU-B13	1141.8003.04	
1st RF path	SMU-B10x		
2nd RF path	SMU-B20x		
AWGN	SMU-K62	1159.8511.02	
Digital Standard 3GPP FDD	SMU-K42	1160.7909.02	
3GPP FDD Enhanced MS/BS Tests, incl. HSDPA	SMU-K43	1160.9660.02	
Digital Standard 3GPP FDD HSUPA	SMU-K45	1161.0666.02	
Digital Standard HSPA+	SMU-K59	1415.0001.02	

Ordering Information for Signal Generators			
Vector Signal Generator			
Product Description	Туре	Ordering No.	
Vector Signal Generator	SMBV100A	1407.6004.02	
RF 9 kHz – 6 GHz	SMBV-B106	1407.9703.02	
Baseband Generator with Digital Modulation (Realtime) and ARB (32 Msample), 120-MHz RF BW	SMBV-B10	407.8907.02	
AWGN	SMBV-K62	1415.8419.02	
Digital Standard 3GPP FDD	SMBV-K42	1415.8048.02	
3GPP FDD Enhanced MS/BS Tests, incl. HSDPA	SMBV-K43	1415.8054.02	
Digital Standard HSPA+	SMBV-K59	1415.8219.02	

Ordering Information for Signal Generators			
Signal Generator			
Product Description	Туре	Ordering No.	
Microwave Signal Generator	SMF100A	1167.0000.02	
RF and Microwave Signal Generator	SMB100A	1406.6000.02	
SGMA RF Source	SGS100A	1416.0505.02	

Ordering Information for Analyzers			
Signal and Spectrum Analyzers			
Product Description	Туре	Ordering No.	
Up to 13, 26, 43, 50 or 67 GHz	FSW	1312.8000Kxx	
Up to 26, 43, 46, 50 or 67 GHz	FSQ	1313.9000.xx	
Up to 13, 30, or 40 GHz	FSV	1307.9002Kxx	
Up to 13, 30, or 40 GHz	FPS	1319.2008.xx	

About Rohde & Schwarz

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Environmental commitment

- Energy-efficient products
- Continuous improvement in environmental sustainability
- ISO 14001-certified environmental management system



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