



Version
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R&S® AMU200A Baseband Signal Generator and Fading Simulator

Specifications



ROHDE & SCHWARZ

Specifications apply under the following conditions: 30 minutes warm-up time at ambient temperature, specified environmental conditions met, calibration cycle adhered to, and all internal adjustments performed. Data designated "overrange" or "underrange" and data without tolerance limits is not binding.

EMC specifications are tested with sufficiently shielded cables and accessories (e.g. mouse and keypad). To prevent degradation of these specifications, the user is responsible for using appropriate equipment.

In compliance with the 3GPP standard, chip rates are specified in Mcps (million chips per second), whereas bit rates and symbol rates are specified in kbps (thousand bits per second) or ksps (thousand symbols per second). Mcps, kbps, and ksps are not SI units.

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Introduction

The R&S®AMU200A baseband signal generator and fading simulator has been designed to meet all requirements encountered in the research and development of modern communications systems as well as in their production. The R&S®AMU200A not only combines up to two independent baseband signal generators in one cabinet of only four height units, but also offers unrivaled channel simulation capabilities.

Due to its modular design, the R&S®AMU200A can be optimally adapted to the requirements of different applications. Up to two generators can be installed. They generate complex signals in realtime and are equipped with an arbitrary waveform generator with 16 Msample, 64 Msample, or 128 Msample memory for I and Q and four marker bits per sample. The signals generated in the different basebands can be added, even with frequency, phase, and level offset.

The modern, intuitive concept of the R&S®AMU200A ensures fast and easy operation.

Key features

Scalable platform

- Up to two complete baseband paths
- Configuration as a fading simulator, I/Q source, or all-in-one instrument with fading and signal generation
- Baseband generators with universal coder for realtime signal generation
- Arbitrary waveform generators with 16 Msample, 64 Msample, or 128 Msample memory
- Analog single-ended, analog differential, and digital baseband outputs
- Up to two baseband inputs (analog/digital)
- Lossless combination of up to four baseband signals in the digital domain (e.g. for testing multistandard base stations)

High signal quality

- 40 MHz I/Q bandwidth with flat frequency response of typ. 0.03 dB
- Excellent ACLR performance of typ. +78 dB with 3GPP FDD (test model 1, 64 DPCH)
- Wideband noise of typ. -155 dBc
- Low inherent EVM

Unmatched flexibility

- Support of a multitude of digital standards, including GSM/EDGE, 3GPP FDD, HSPA, CDMA2000®¹, TD-SCDMA, WLAN, WiMAX, DVB-H, GPS, EUTRA/LTE
- Four code channels in realtime for 3GPP FDD
- Change of modulation from slot to slot for GSM/EDGE
- Multisegment waveform mode for fast signal switching
- Arbitrary waveform generator supported by R&S®WinIQSIM2™ simulation software
- Pulse generation with the pulse sequencer option from Rohde & Schwarz
- Direct waveform transmission via MATLAB®
- Internal 40 Gbyte hard disk as standard for storing waveforms and modulation data

Fading and interference simulation

- Dual-channel realtime fading simulator
- Up to 20 taps per channel
- Time resolution down to 0.01 ns
- Profiles for static and dynamic fading scenarios
- Additional noise simulation
- Optimal suitability for diversity tests

Intuitive operation

- Color display with 800 × 600 pixels (SVGA format)
- Intuitive user interface with graphical display of signal flow (block diagram)
- Graphical display of baseband signals through built-in transient recorder
- Context-sensitive help system

¹ CDMA2000® is a registered trademark of the Telecommunications Industry Association (TIA – USA).

Connectivity

- Remote control via GPIB and LAN
- USB connectors for keyboard, mouse, and memory stick
- VGA connector
- User-selectable trigger and marker signals

Baseband and enhancement options

One-path unit

R&S®AMU-B13	Baseband Main Module (mandatory)
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Two-path unit

2 × R&S®AMU-B13	Baseband Main Module (mandatory)
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Additionally, one of the following baseband source options must be installed in path A (one-path unit) or path A and B (two-path unit).

R&S®AMU-B9	Baseband Generator with ARB (128 Msample) and Digital Modulation (realtime)
R&S®AMU-B10	Baseband Generator with ARB (64 Msample) and Digital Modulation (realtime)
R&S®AMU-B11	Baseband Generator with ARB (16 Msample) and Digital Modulation (realtime)
R&S®AMU-B17	Baseband Input (digital/analog)

The following options can be installed in path A or B.

R&S®AMU-B9	Baseband Generator with ARB (128 Msample) and Digital Modulation (realtime)
R&S®AMU-B10	Baseband Generator with ARB (64 Msample) and Digital Modulation (realtime)
R&S®AMU-B11	Baseband Generator with ARB (16 Msample) and Digital Modulation (realtime)
R&S®AMU-B16	Differential I/Q Output
R&S®AMU-B17	Baseband I/Q Input (digital/analog)
R&S®AMU-B18	Baseband Digital I/Q Output
R&S®AMU-B14	Fading Simulator
R&S®AMU-B15	Fading Simulator Extension

Reference frequency

Aging	after 14 days of uninterrupted operation	typ. 1×10^{-6} /year
Temperature effect	in operating temperature range	$<1 \times 10^{-6}$
Output for internal reference signal	frequency (approx. sinewave)	10 MHz or external input frequency
	level	typ. 5 dBm
	source impedance	50 Ω
Input for external reference	frequency	5 MHz, 10 MHz, or 13 MHz
	maximum deviation	5×10^{-6}
	input level	≥ -6 dBm to ≤ 19 dBm
	input impedance	50 Ω

Baseband outputs

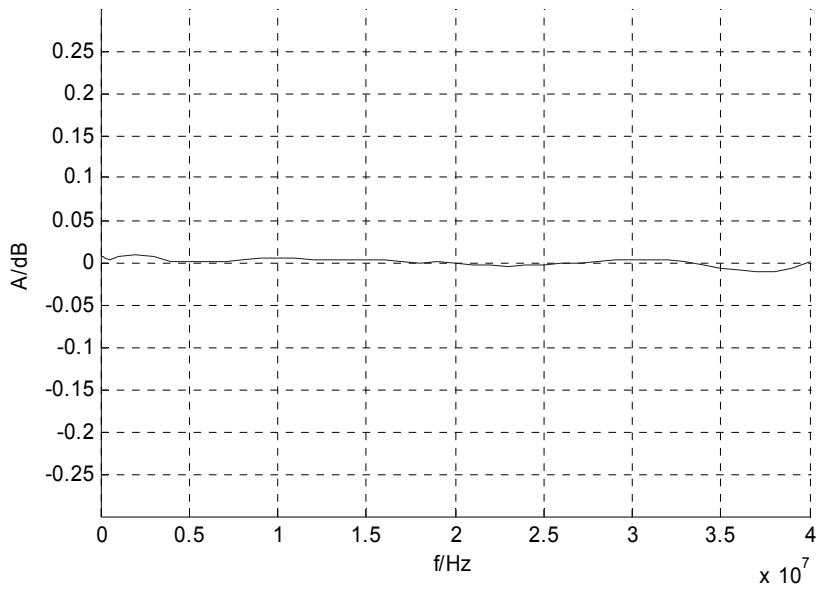
There are three kinds of baseband outputs available for the R&S®AMU200A: analog single-ended, analog differential (R&S®AMU-B16), and/or digital baseband outputs (R&S®AMU-B18). For each type of baseband output, the RMS level or PEP value can be set. The main level display can be configured to show the output level of the analog (single-ended/differential) or the digital baseband output.

Analog I/Q outputs

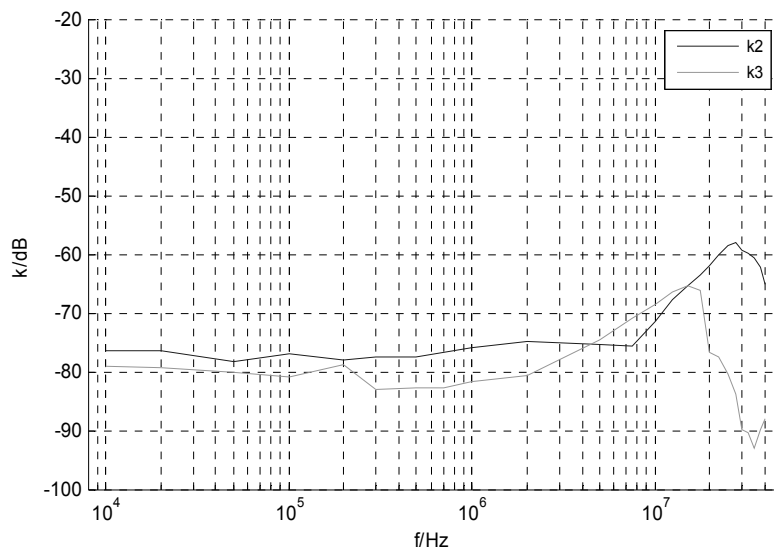
A DA board (R&S®AMU-B13) converts the internal digital baseband signals into analog I/Q output signals.

Output impedance		50 Ω
Output voltage	EMF	0.02 V to 2 V (V_p)
	output load type	EMF, 50 Ω
Offset	EMF	<1 mV
D/A converter	data rate	100 MHz
	resolution	16 bit
	sampling rate	400 MHz (internal interpolation $\times 4$)
Aliasing filter	with amplitude, group-delay, and Si correction	
	bandwidth, roll-off to -0.1 dB	40 MHz
	D/A converter interpolation spectra	
	up to 10 MHz	<-80 dBc
up to 40 MHz	<-73 dBc	
I/Q impairment	carrier leakage I, Q	
	setting range	-10 % to $+10$ %
	resolution	0.01 %
	I \neq Q (imbalance)	
	setting range	-1 dB to $+1$ dB
	resolution	0.001 dB
	quadrature offset	
setting range	-10° to $+10^\circ$	
resolution	0.01°	
Frequency response	at $R_L = 50 \Omega$, output voltage > 0.5 V (V_p)	
	magnitude	
	up to 10 MHz	typ. 0.02 dB
	up to 40 MHz	typ. 0.03 dB
	nonlinear phase	
	up to 10 MHz	typ. 0.1°
up to 30 MHz	typ. 0.3°	
I/Q balance	at $R_L = 50 \Omega$	
	magnitude	
	up to 10 MHz	typ. 0.01 dB
	up to 40 MHz	typ. 0.02 dB
	nonlinear phase	
	up to 10 MHz	typ. 0.1°
up to 30 MHz	typ. 0.2°	

Spectral purity	at $R_L = 50 \Omega$	
	SFDR (sine)	
	up to 2 MHz	>70 dB
	up to 20 MHz	typ. 60 dB
	phase noise	
	10 MHz sinewave at 20 kHz offset	typ. -150 dBc
	wideband noise	
10 MHz sinewave at 1 MHz offset	typ. -155 dBc	



Frequency response of I/Q outputs



Harmonic distortion of I/Q outputs

Differential I/Q output (R&S® AMU-B16 option)

One or two R&S® AMU-B16 can be installed.

Additional specifications for I/Q outputs with R&S® AMU-B16 option		
Output impedance		
Single-ended		50 Ω
Differential		100 Ω
Output voltage	output voltage depends on set modulation signal	
Single-ended	EMF	0.02 V to 2 V (V_p)
Resolution		1 mV
Differential	EMF	0.04 V to 4 V (V_{pp})
Resolution		2 mV
Bias voltage (single-ended and differential)	EMF	-3.6 V to 3.6 V
Resolution		2 mV
Uncertainty		1 % + 4 mV
Offset voltage		
Differential	EMF	-300 mV to 300 mV
Resolution		0.2 mV
Uncertainty		1 % + 0.1 % × bias voltage + 1 mV
Differential signal balance	at $R_L = 50 \Omega$, output voltage $>0.5 V (V_p)$	
	magnitude	
	up to 10 MHz	<0.2 dB, typ. 0.05 dB
	up to 40 MHz	typ. 0.2 dB
Frequency response	at $R_L = 50 \Omega$, output voltage $>0.5 V (V_p)$	
	magnitude	
	up to 10 MHz	typ. 0.02 dB
	up to 40 MHz	typ. 0.03 dB
	nonlinear phase	
	up to 10 MHz	typ. 0.1°
	up to 30 MHz	typ. 0.2°

Digital I/Q outputs (R&S® AMU-B18 option)

With the R&S® AMU-B18, digital I/Q signals are available on the rear of the instrument. The digital I/Q output can be used for losslessly connecting the R&S® AMU200A to the digital I/Q input of other Rohde & Schwarz instruments (e.g. R&S® SMU200A vector signal generator). One or two R&S® AMU-B18 can be installed.

Interface	standard	in line with Rohde & Schwarz TVR290, I/Q data and control signals, data and interface clock
	level	LVDS
	connector	26-pin MDR
	data rate	100 MHz, 87.5 MHz
I/Q sample rate	With source 'user defined', the sample rate must be entered via the parameter 'sample rate'; no I/Q data clock is necessary. With source 'digital I/Q out', 'digital I/Q in', the sample rate will be estimated by the applied I/Q data clock.	
	source	user-defined, digital I/Q out, digital I/Q in
	sample rate	
	resolution (user-defined)	1 kHz to 100 MHz
I/Q data	frequency uncertainty (user-defined)	0.001 Hz 5×10^{-14} max. sample rate depends on interface data rate
	resolution	18 bit
	logic format	2s complement
	physical signal level	
	setting range	0 dBFS to -60 dBFS
	resolution	0.01 dBFS
	bandwidth	
	sample rate = 100 MHz (no interpolation, user-defined)	40 MHz
	sample rate <100 MHz (interpolation)	0.31 × sample rate
	Control signals	markers
data valid		valid samples are marked in the data stream

Baseband input (analog/digital) (R&S® AMU-B17 option)

With the R&S® AMU-B17, external analog or digital signals can be fed to the baseband section of the R&S® AMU200A. The frequency of the signals can be shifted, and the signals can be added to the internally generated signal with variable level ratio. If the R&S® AMU200A is equipped with a fading simulator, the input signals can also be faded. One or two R&S® AMU-B17 can be installed.

Mode		analog input digital input
Input level	peak level	
	setting range	–10 dB to 0 dB referenced to full scale
	resolution	0.01 dB
	crest factor	
	setting range	0 dB to 30 dB
	resolution	0.01 dB
	The adjust level function automatically determines the peak level and crest factor of the input signal.	
Frequency offset	With the aid of the frequency offset, the center frequency of the input signal can be shifted in the baseband. The restrictions caused by the modulation bandwidth apply.	
	setting range	–40 MHz to +40 MHz
	resolution	0.01 Hz
	frequency accuracy	$<5 \times 10^{-10} \times \text{frequency offset} + \text{reference frequency error}$
I/Q swap	I and Q signals swapped	ON/OFF
Analog I/Q inputs		
All specifications apply to a peak level of 0 dB.		
I/Q inputs	input impedance	50 Ω
	VSWR up to 30 MHz	< 1.1, typ. 1.03
	input voltage for full-scale input	$\sqrt{V_i^2 + V_q^2} = 0.5 \text{ V}$
I/Q impairment	carrier leakage I, Q	
	setting range	–10 % to +10 %
	resolution	0.01 %
	I \neq Q (imbalance)	
	setting range	–3 dB to +3 dB
	resolution	0.001 dB
	I/Q skew	
setting range	–1 ns to 1 ns	
resolution	1 ps	
A/D converter	sampling rate	100 MHz
	resolution	14 bit
Aliasing filter	with amplitude and group-delay correction	
	bandwidth, roll-off to –0.1 dB	30 MHz
	stopband rejection, $f \geq 70 \text{ MHz}$	typ. 80 dB
Carrier leakage	referenced to full scale	< –55 dBc, typ. < –65 dBc
Spectral purity	wideband noise, with full-scale DC input	typ. –150 dBc
	ACLR with an ideal input signal 3GPP, test model 1, 64 DPCHs	
	offset 5 MHz	typ. 70 dB
offset 10 MHz	typ. 72 dB	
Digital I/Q inputs		
Interface	standard	in line with Rohde & Schwarz TVR290, I/Q data and control signals, data and interface clock
	level	LVDS
	connector	26-pin MDR
	data rate	66 MHz to 100 MHz

I/Q sample rate	With source 'user defined', the sample rate must be entered via the parameter 'sample rate'; no I/Q data clock is necessary. With source 'digital I/Q in', the sample rate will be estimated by the applied I/Q data clock. Max. sample rate depends on interface data rate.	
	source	user-defined, digital I/Q in
	sample rate	1 kHz to 100 MHz
	resolution (user-defined)	0.001 Hz
	frequency uncertainty (user-defined)	$<5 \times 10^{-14}$
I/Q data	resolution	18 bit
	logic format	2s complement
	bandwidth	
	sample rate = 100 MHz (no interpolation, user-defined)	40 MHz
	sample rate <100 MHz (interpolation)	$0.31 \times \text{sample rate}$
Control signals	markers	4
	data valid	valid samples are marked in the data stream

I/Q baseband generator (R&S® AMU-B9/B10/B11 option) – arbitrary waveform mode

One or two R&S® AMU-B9/B10/B11 can be installed. Their I/Q signals can be assigned a frequency offset and/or be added in the digital domain.

Waveform memory	output memory	
	waveform length R&S® AMU-B9	128 sample to 128 Msample in one-sample steps
	waveform length R&S® AMU-B10	128 sample to 64 Msample in one-sample steps
	waveform length R&S® AMU-B11	128 sample to 16 Msample in one-sample steps
	resolution	16 bit
	loading time 10 Msample	15 s
	nonvolatile memory	hard disk
Multisegment waveform	number of segments	max. 100 segments
	changeover modes	GUI, remote control, external trigger
	extended trigger modes	same segment, next segment, next segment seamless
	changeover time (external trigger, without clock change)	$\leq (84 \cdot t_{\text{clk}} + 6 \mu\text{s})$
	seamless changeover	output up to end of current segment before changeover to next segment
Clock generation	clock rate	400 Hz to 100 MHz
	resolution	0.001 Hz
	operating mode	internal, external
	frequency uncertainty (internal)	$< 5 \times 10^{-14} \times \text{clock rate} + \text{uncertainty of reference frequency}$
Interpolation	The sampling rate of the waveform is automatically interpolated to the internal 100 MHz data rate.	
	bandwidth	
	clock rate = 100 MHz (no interpolation), roll-off to -0.1 dB	40 MHz
	clock rate \leq 100 MHz, drop to -0.1 dB	$0.31 \times \text{clock rate}$
Frequency offset	With the aid of the frequency offset, the center frequency of the wanted baseband signal can be shifted. The restrictions caused by the modulation bandwidth still apply.	
	range	-40 MHz to +40 MHz
	resolution	0.01 Hz
	frequency uncertainty	$< 5 \times 10^{-10} \times \text{frequency offset} + \text{uncertainty of reference frequency}$

Triggering	In clock mode internal, a trigger event restarts the clock generation. The clock phase is then synchronous with the trigger (with a certain timing uncertainty). In external clock mode, the trigger event is synchronized to the symbol clock.	
	operating mode	internal, external
	modes	Auto, Retrig, Armed Auto, Armed Retrig
	setting accuracy for clock phase related to the trigger in internal clock mode	<18 ns
	external trigger delay	
	setting range	0 to 2 ¹⁶ sample
	resolution	
	internal clock mode	0.01 sample
	external clock mode	1 sample
	setting accuracy	<5 ns
	external trigger inhibit	
	setting range	0 to 2 ²⁶ sample
	resolution	1 sample
	external trigger pulse width	>15 ns
	external trigger frequency	<0.02 × sampling rate
Marker outputs	number	4
	level	LVTTL
	operating modes	unchanged, restart, pulse, pattern, ratio
	marker delay	
	setting range	0 sample to (waveform length – 1) sample
	setting range without recalculation	0 sample to 2000 sample
	resolution of setting	0.001 sample
setting accuracy	<10 ns	
Operation with R&S®WinIQSIM2™: As of version 2.04, the software supports download of I/Q data and control of the R&S®AMU-B9/-B10/-B11.		

I/Q baseband generator (R&S® AMU-B9/B10/B11 option) – realtime operation

One or two R&S® AMU-B9/B10/B11 can be installed. Their I/Q signals can be assigned a frequency offset and/or be added.

Types of modulation	ASK	
	modulation index	0 % to 100 %
	resolution	0.1 %
	FSK	2FSK, 4FSK, MSK
	deviation	0.1 to $1.5 \times f_{\text{sym}}$
	maximum	10 MHz
	resolution	<0.1 Hz
	setting uncertainty	<0.5 %
	variable FSK	4FSK, 8FSK, 16FSK
	deviations	$-1.5 \times f_{\text{sym}}$ to $+1.5 \times f_{\text{sym}}$
	maximum	10 MHz
	resolution	<0.1 Hz
	PSK	BPSK, QPSK, QPSK 45° offset, OQPSK, $\pi/4$ -QPSK, $\pi/2$ -DBPSK, $\pi/4$ -DQPSK, $\pi/8$ -D8PSK, 8PSK, 8PSK EDGE
QAM	16QAM, 32QAM, 64QAM, 256QAM, 1024QAM	
Coding	Not all coding methods can be used with every type of modulation.	OFF, Differential, Diff. Phase, Diff. + Gray, Gray, GSM, NADC, PDC, PHS, TETRA, APCO25 (PSK), PWT, TFTS, INMARSAT, VDL, EDGE, APCO25(FSK), ICO, CDMA2000®, WCDMA
Baseband filter	Any filter can be used with any type of modulation. The bandwidth of the modulation signal is max. 25 MHz; the signal is clipped when the bandwidth is exceeded.	
	cosine, root cosine	
	filter parameter α	0.05 to 1.00
	Gaussian	
	filter parameter B × T	0.15 to 2.50
	cdmaOne, cdmaOne + equalizer	
	cdmaOne 705 kHz	
	cdmaOne 705 kHz + equalizer, CDMA2000® 3X, APCO25 C4FM	
	rectangular	
	split phase	
	filter parameter B×T	0.15 to 2.5
	resolution of filter parameter	0.01
	Symbol rate	If an external clock is used, the applied data rate may deviate from the set clock rate by ± 2 %. The external clock can be used for internal and external data.
operating mode		internal, external
setting range		
ASK, PSK, and QAM		400 Hz to 25 MHz
FSK		400 Hz to 15 MHz
resolution		0.001 Hz
frequency uncertainty (internal)		$<5 \times 10^{-14} \times \text{symbol rate} + \text{reference frequency uncertainty}$
external clock		symbol, K × symbol and bit clock
clock divider K		1 to 64
external clock rate		max. 100 MHz

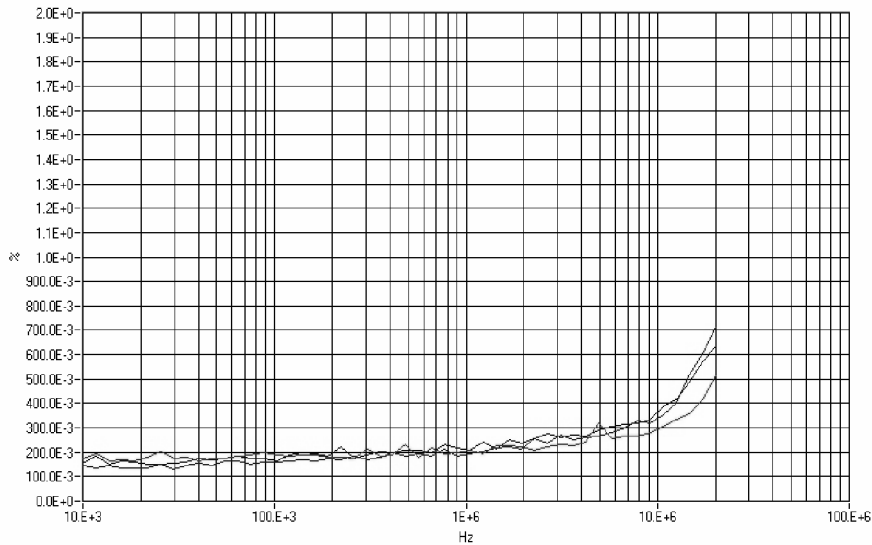
Frequency offset	With the aid of the frequency offset, the center frequency of the modulation signal in the baseband can be shifted. The restrictions caused by the modulation bandwidth apply.	
	setting range	-40 MHz to +40 MHz
	resolution	0.01 Hz
	frequency uncertainty	$<5 \times 10^{-10} \times$ frequency offset + reference frequency uncertainty
Data sources	internal	
	all 0, all 1	
	PRBS	
	sequence length	9, 11, 15, 16, 20, 21, 23
	pattern	
	length	1 bit to 64 bit
	data lists	
	output memory	
	R&S [®] AMU-B9	8 bit to 1 Gbit
	R&S [®] AMU-B10	8 bit to 2 Gbit
	R&S [®] AMU-B11	8 bit to 4 Gbit
	nonvolatile memory	hard disk
	external	
	In the case of serial transmission, the symbol strobe marks the LSB of the symbol, and the maximum symbol rate is limited by the data rate of the interface.	
	serial	
	word width	1 bit to 10 bit
	bit rate	max. 60 MHz
parallel		
word width	1 bit to 10 bit	
symbol rate	max. 25 MHz	
Triggering	In internal clock mode, a trigger event restarts the clock generation. The clock phase is then synchronous with the trigger (with a certain timing uncertainty). In external clock mode, the trigger event is synchronized to the symbol clock.	
	operating mode	internal, external
	modes	Auto, Retrig, Armed Auto, Armed Retrig
	setting accuracy for clock phase related to the trigger in internal clock mode	<18 ns
	external trigger delay	
	setting range	0 sample to 2^{16} sample
	resolution	
	internal clock mode	0.01 sample
	external clock mode	1 sample
	setting accuracy	<5 ns
	external trigger inhibit	
	setting range	0 sample to 2^{26} sample
	resolution	1 sample
	external trigger pulse width	>15 ns
	external trigger frequency	$<0.02 \times$ sampling rate
Marker outputs	number	4
	level	LVTTL
	operating modes	control list, restart, pulse, pattern, ratio
	marker delay (in sample)	
	setting range	0 to $(2^{24} - 1)$
	setting range without recalculation	0 to 2000
	resolution of setting	0.001
	setting uncertainty	<10 ns

Level reduction	Internal or external via LEVATT input. The signal switches between nominal and reduced level (without edge shaping). When an internal LEVATT signal is used, the connector is used as an output.	
	setting range	0 dB to 60 dB
	additional level error in case of reduction	
	up to 30 dB	<1 dB
Burst	up to 50 dB	<3 dB
	Internal or external via BURST input. The signal triggers the beginning of a power ramp. The positive edge starts power ramping from blank to full level; the negative edge ramping in the opposite direction from full level to blanking. When an internal BURST GATE signal is applied, the connector is used as an output.	
	operating range	max. 5 MHz
	rise/fall time	
	setting range	0.5 symbol to 16 symbol
	resolution	0.1 symbol
Trigger/clock/data inputs	ramp shape	cosine, linear
	Input impedance and trigger threshold can be set separately for the trigger and the clock/data inputs.	
	input impedance	1 k Ω , 50 Ω
	trigger threshold	
Clock/data outputs	setting range	0 V to 2.50 V
	resolution	0.01 V
Predefined settings	level	LVTTL
	modulation, filter, symbol rate, and coding in line with standard	
	standards	Bluetooth [®] , DECT, ETC, GSM, GSM EDGE, NADC, PDC, PHS, TETRA, WCDMA 3GPP, TD-SCDMA, CDMA2000 [®] Forward, CDMA2000 [®] Reverse, Worldspace
Modulation errors		
Deviation error with 2FSK, 4FSK	deviation 0.2 to 0.7 \times symbol rate	
	Gaussian filter with $B \times T = 0.2$ to 0.7	
	symbol rate up to 2 MHz	1.2 %, typ. 0.25 %
	symbol rate up to 10 MHz	typ. 0.75 %
Phase error with MSK	Gaussian filter with $B \times T = 0.2$ to 0.7	
	bit rate up to 2 MHz	0.4°, typ. 0.15°
	bit rate up to 10 MHz	typ. 0.3°
EVM with QPSK, OQPSK, $\pi/4$ -DQPSK, 8PSK, 16QAM, 32QAM, 64QAM	cosine, root cosine filter with $\alpha = 0.2$ to 0.7	
	symbol rate up to 5 MHz	0.8 %, typ. 0.2 %
	symbol rate up to 20 MHz	typ. 0.7 %



EVM versus Symbolrate

19:11 h / 8.Aug.2003



—○— QPSK, RRC 0.22,
 —△— P/4 DQPSK, RRC 0.35
 —×— 16 QAM, RRC 0.15

Typical EVM versus symbol rate

Modulation accuracy for main standards

Typical values

Standard	GSM	EDGE	WCDMA 3GPP (1DPCH)	CDMA2000® forward (9 channels)	DECT	TETRA	NADC	PDC	IEEE 802.11a
EVM in %	—	0.2	0.25	0.2	—	0.2	0.2	0.2	0.4
Phase error in °	0.15	—	—	—	—	—	—	—	—
Dev. error in kHz	—	—	—	—	0.5	—	—	—	—
Channel spacing	200 kHz	200 kHz	5 MHz	1.25 MHz	1.728 MHz	25 kHz	30 kHz	25 kHz	—
Adjacent channel power ratio (ACPR) in dB									
In adjacent channel	-37	-41	-82	-86 ²	—	-78 ³	-34	-74	-56 at 11 MHz
In alternate channel	-71	-71	-84	-89 ⁴	—	-86 ⁸	-86	-82	-65 at 20 MHz
In 2nd alternate channel	-90	-86	—	-90 ⁵	—	—	—	—	-66 at 30 MHz

² 885 kHz offset and 30 kHz bandwidth.

³ Measured with root cosine filter.

⁴ 1.25 MHz offset and 30 kHz bandwidth.

⁵ 1.98 MHz offset and 30 kHz bandwidth.

Digital modulation systems

At least one I/Q baseband generator (R&S®AMU-B9/-B10/-B11 option) must be installed. If two I/Q baseband generators are installed and two signals of the same standard (e.g. GSM/EDGE) are to be output simultaneously, two corresponding software options must also be installed (in this case R&S®AMU-K40). If only one R&S®AMU-K40 is installed and GSM/EDGE is selected in one I/Q baseband generator, the other I/Q baseband generator is disabled for GSM/EDGE. However, a software option is not tied to a specific I/Q baseband generator.

The data specified applies together with the parameters of the respective standard.

GSM/EDGE digital standard (R&S®AMU-K40 option)

GSM/EDGE digital standard		in line with GSM standard
Modes	unframed	generation of a signal without slot and frame structure and power ramping, with symbol rate and filtering in line with GSM standard; MSK or 8PSK EDGE modulation can be selected
	framed (single)	configuration of a signal via frame structure (see frame structure below)
	framed (double) application: simulation of modulation change in a slot versus time	configuration of simple multiframe scenarios by combining two frames (frame structure see below); a repetition factor can be specified for each of the two frames
Modulation		MSK, switchable to FSK with settable deviation for simulating frequency deviation errors 8PSK EDGE
Symbol rate	standard	270.833 kHz
	range	400 Hz to 300 kHz
Baseband filter	GSM, standard	Gaussian with $B \times T = 0.3$
	range	$B \times T = 0.15$ to 2.5
	EDGE, standard	Gaussian linearized (EDGE)
Frame structure	Change between GSM and EDGE possible from slot to slot and frame to frame; half rate and GPRS at the physical layer. Slots 0 to 7 of the frames are user-defined for uplink and downlink. In the normal burst half-rate mode, the burst parameters can be defined independently for two users that alternate from frame to frame.	
	burst types	normal (full rate) normal (half rate) EDGE synchronization frequency correction (normal + compact) dummy access all data (GSM) all data (EDGE)
Burst rise/fall time	standard	in line with GSM power time template
	selectable	
	ramp time	0.3 symbol to 4 symbol
	ramp delay	-1.0 symbol to 1.0 symbol
	rise delay	-9 symbol to 9 symbol
Settable slot attenuation		-9 symbol to 9 symbol
		0.0 dB to 60.0 dB, 8 different levels simultaneously possible (full level and 7 attenuated levels)
Burst ON/OFF ratio		>100 dB

Data sources	For data source characteristic, see section "I/Q baseband generator (R&S®AMU-B9/B10B11 option) – realtime operation".	
	internal data sources	all 0 all 1 PRBS 9, 11, 15, 16, 20, 21, 23 pattern (length 1 bit to 64 bit) data list
Training sequence	for normal burst (full rate), normal burst (half rate), EDGE burst	TSC0 to TSC7, user TSC
	for sync burst	standard, CTS, compact, user
	for access burst	TS0 to TS2
Triggering		see I/Q baseband generator
Markers		convenient graphics editor for defining marker signals, and in addition: frame, multiple frame slot, multiple slot pulse pattern ON/OFF ratio
Phase error	MSK, Gaussian filter $B \times T = 0.3$	
	rms	$\leq 0.4^\circ$, typ. 0.15°
	peak	$\leq 1.2^\circ$, typ. 0.4°
Error vector magnitude	8PSK EDGE, Gaussian linearized filter	
	rms	$\leq 0.5\%$, typ. 0.2%
Power density spectrum	values measured with 30 kHz resolution bandwidth, referenced to level in band center without power ramping	
	200 kHz offset	typ. -37 dB
	400 kHz offset	typ. -71 dB
	600 kHz offset	typ. -90 dB

3GPP FDD digital standard (R&S[®] AMU-K42 option)

WCDMA 3GPP FDD digital standard		in line with 3GPP standard, release 6
Signal generation modes/sequence length	<p>Combination of realtime operation (enhanced channels) and arbitrary waveform mode. In downlink mode, the P-CCPCH (BCCH with running SFN) and up to three DPCHs can be generated in realtime. All other channels (frame-cycle control channels such as SCH, OCNS simulation, other base stations, etc) can be added via the ARB. In uplink mode, one mobile station can be simulated in realtime (PRACH, PCPCH, or DPCCH and up to 6 DPDCHs); further mobile stations (three user-configured and up to 64 of identical mode) can be simulated via the ARB and added to the realtime signal.</p> <p>The sequence length of the ARB component can be entered in frames (10 ms each); the max. length depends on chip rate, mode, and in some cases on oversampling.</p>	
Enhanced channels	<p>special capabilities in up to 4 channels of base station 1 on downlink and in all channels of mobile station 1 on uplink: realtime calculation, optional channel coding, simulation of bit and block errors, data lists as sources for data and TPC fields</p>	
Modulation		BPSK (uplink) QPSK (downlink) 16QAM (downlink HSDPA)
Test models	downlink (in line with TS 25.141)	test model 1 with 16/32/64 channels test model 2 test model 3 with 16/32 channels test model 4 test model 5 with 8/4/2 HS-PDSCH channels
	uplink (not standardized)	DPCCH + 1 DPDCH at 60 ksps DPCCH + 1 DPDCH at 960 ksps
Generate waveform file		filtering of data generated in ARB mode and saving it as waveform file
Realtime component		
WCDMA signal in realtime	generation of WCDMA signals with up to 4 active enhanced channels	
Applications	continuous measurement of BER and BLER (with channel coding) in a code channel with any (PN) data without wrap-around problems use of user data (data lists) with externally processed long data sequences for enhanced channels	
Data lists for data and TPC field	The data fields and the transmit power control (TPC) field of the slots of enhanced channels can be filled from data lists. Externally generated data can thus be fed into the signal generation process of the R&S [®] AMU200A, e.g. with payload information from higher layers, on transport or physical layer. Long power control profiles for power control of the DUT can also be generated.	
Applications	measurement of power control steps of a mobile station (UE power control steps) measurement of maximum output power of a mobile station (UE max. output power)	

Channel coding	coding of up to 4 enhanced channels in line with the definition of reference measurement channels in TS 25.101, TS 25.104 and TS 25.141; in addition, user-configurable channel coding for each enhanced channel station	
	predefined channel coding schemes for uplink and downlink	RMC 12.2 kbps AMR 12.2 kbps RMC 64 kbps RMC 144 kbps RMC 384 kbps
	possible settings of user-configurable channel coding	
	transport channels	1 DCCH up to 6 DTCHs
	transport block size	1 to 4096
	transport blocks	1 to 16
	rate matching attribute	16 to 1024
	transport time interval	10 ms, 20 ms, 40 ms, 80 ms
	CRC size	none, 8, 12, 16, 24
	error protection	none, convolutional coding rate 1/3, convolutional coding rate 1/2, turbo coding rate 1/3
	interleaver 1/2 state	ON/OFF
Applications	BER measurements in line with TS 25.101/104/141 (radio transmission and reception), e.g. adjacent channel selectivity blocking characteristics intermodulation characteristics BLER measurements in line with TS 25.101/104 (radio transmission and reception) e.g. demodulation of dedicated channel under static propagation conditions (AWGN generation together with R&S [®] AMU-K62) test of decoder in receiver	
Bit error insertion	deliberate generation of bit errors by impairing the data stream prior to channel coding or at the physical layer	
	bit error ratio	0.5 to 10 ⁻⁷
Application	verification of internal BER calculation in line with TS 25.141 (BS conformance testing)	
Block error insertion	deliberate generation of block errors by impairing the CRC during coding of enhanced channels	
	block error ratio	0.5 to 10 ⁻⁴
Application	verification of internal BLER calculation in line with TS 25.141 (BS conformance testing)	
Add OCNS	Simulation of orthogonal background and interfering channels of a base station in line with TS 25.101. The power of the OCNS channels is configured automatically so that the total power of the BS is 1.	
Applications	testing the receiver of the mobile station under real conditions; measuring the maximum input level in line with TS 25.101	
Additional mobile stations	Simulation of up to 64 mobile stations in addition to the 4 user-configurable mobile stations; the additional mobile stations use different scrambling codes.	
Parameters	number of additional mobile stations	1 to 50
	scrambling code step	1 to 1000 hex
	power offset	-20 dB to 20 dB
Applications	base station tests under real receive conditions	

General settings		
Triggering		see I/Q baseband generator
Chip rate	standard	3.840 Mcps (15 slots/frame)
	range	1 Mcps to 5 Mcps
Link direction		uplink (reverse link) and downlink (forward link)
Baseband filter	standard	$\sqrt{\cos}$, $\alpha = 0.22$
	other filters	$\sqrt{\cos}$, \cos , user filters
Clipping	Setting of clipping value relative to highest peak in percent. Clipping takes place prior to baseband filtering. Clipping reduces the crest factor.	
	modes	vector $ i + j \cdot q $ scalar $ i , q $
	clipping level	1 % to 100 %
Code channels	downlink	up to 512 data channels (plus special channels) divided among up to 4 base stations (BS) of 128 code channels each
	uplink	up to four user-configurable mobile stations (MS) and 64 additional MS of identical configuration in each of the modes PRACH only, PCPCH only, DPCCH + DPDCBs
Parameters of every BS		
State		ON/OFF
Scrambling code		0 to 5FFF hex
2nd search code group		0 to 63
Page indicators per frame		18, 36, 72, 144
Time delay	The signals of the various base stations are delayed against each other.	0 chips to 38400 chips
Transmit diversity	The output signal can be generated either for antenna 1 or 2, as defined in the standard.	OFF/antenna 1/antenna 2
Physical channels in downlink		
	primary common pilot channel (P-CPICH)	
	secondary common pilot channel (S-CPICH)	
	primary sync channel (P-SCH)	
	secondary sync channel (S-SCH)	
	primary common control physical channel (P-CCPCH)	
	secondary common control physical channel (S-CCPCH)	
	page indication channel (PICH)	
	access preamble acquisition indication channel (AP-AICH)	
	collision detection acquisition indication channel (AICH)	
	physical downlink shared channel (PDSCH)	
	dedicated physical control channel (DL-DPCCH)	
	dedicated physical channel (DPCH)	
	high-speed shared control channel (HS-SCCH)	
	high-speed physical downlink shared channel (HS-PDSCH), modulation QPSK or 16QAM	
Parameters of every downlink code channel that can be set independently		
State		ON/OFF
Slot format	depending on physical channel type	0 to 16
Symbol rate	depending on physical channel type	7.5 ksps to 960 ksps
Channelization code	value range depending on physical channel type and symbol rate	0 to 511
Power		-80 dB to 0 dB
Payload data		PRBS: 9, 11, 15, 16, 20, 21, 23 all 0, all 1, pattern (length 1 bit to 64 bit) data lists
Multicode state		ON/OFF
Timing offset	time offset that can be separately set for each code channel	0 to 150 (in units of 256 chips)
Pilot length	depending on symbol rate	2 bit, 4 bit, 8 bit, 16 bit
Pilot power offset	power offset of pilot field against data fields	-10 dB to 10 dB

TPC pattern		all 0, all 1, pattern (length 1 bit to 32 bit), data lists
TPC pattern readout mode	application mode for TPC pattern	continuous, single + all 0, single + all 1, single + alt. 01, single + alt. 10
Use of TPC for dynamic output power control	If this function is active, the TPC pattern is used to vary the transmit power of the code channels versus time.	
	state	ON/OFF
	output power control step	-10 dB to +10 dB
TPC power offset	power offset of TPC field relative to data fields	-10 dB to +10 dB
TFCI state		ON/OFF
TFCI		0 dB to 1023 dB
TFCI power offset	power offset of TFCI field relative to data fields	-10 dB to +10 dB
Parameters of every MS		
State		ON/OFF
Mode		PRACH only, PCPCH only, DPCCH + DPDCHs
Scrambling code		0 to FF FFFF hex
Scrambling code mode		long, short
Time delay	The signals of the various mobile stations are delayed against each other.	0 chips to 38400 chips
Physical channels in uplink		
	physical random access channel (PRACH)	
	physical common packet channel (PCPCH)	
	dedicated physical control channel (DPCCH)	
	dedicated physical data channel (DPDCH)	
PRACH Only mode		
Submodes	Preamble only: Only preambles are generated.	
	Application: Detection of RACH preamble in line with TS 25.141.	
	Standard: The message part of the PRACH is generated in addition to a settable number of preambles. It can also be channel-coded. Application: Demodulation of RACH message part in line with TS 25.141.	
Frame structure		preamble(s), message part consisting of data and control component
Slot format		0 to 3
Symbol rate		15 ksps, 30 ksps, 60 ksps, 120 ksps
Preamble part power		-80 dB to 0 dB
Preamble power step		0 dB to 10 dB
Preamble repetition		1 to 10
Data part power		-80 dB to 0 dB
Control part power		-80 dB to 0 dB
Signature		0 to 15
Access slot		0 to 14
AICH transmission timing		0 (3 access slots) or 1 (4 access slots)
Message part length		1 frame, 2 frames
TFCI		0 to 1023
Payload data		PRBS: 9, 11, 15, 16, 20, 21, 23 all 0, all 1, pattern (length 1 bit to 64 bit), data lists
Channel coding	reference measurement channel for UL RACH in line with TS 25.141	
	state	ON/OFF
	transport block size	168, 360
PCPCH Only mode		
Submodes	Preamble only: Only preambles are generated.	
	Application: Detection of CPCH preamble in line with TS 25.141.	
	Standard: The message part of the PCPCH is generated in addition to a settable number of preambles. It can also be channel-coded. Application: Demodulation of CPCH message part in line with TS 25.141.	
Frame structure		access preamble(s), collision detection preamble, power control preamble, message part consisting of data and control component

Slot format control part		0 to 2
Symbol rate		15 ksps, 30 ksps, 60 ksps, 120 ksps, 240 ksps, 480 ksps, 960 ksps
Preamble part power		-80 dB to 0 dB
Preamble power step		0 dB to 10 dB
Preamble repetition		1 to 10
Data part power		-80 dB to 0 dB
Control part power		-80 dB to 0 dB
Signature		0 to 15
Access slot		0 to 14
AICH transmission timing		0 (3 access slots) or 1 (4 access slots)
Message part length		1 to 10 frames
Power control preamble length		0 slots, 8 slots
FBI state		OFF/1 bit/2 bit
FBI pattern		pattern (length 1 bit to 32 bit)
Payload data		PRBS: 9, 11, 15, 16, 20, 21, 23 all 0, all 1, pattern (length 1 bit to 64 bit) data lists
Channel coding	reference measurement channel for UL CPCH in line with TS 25.141	
	state	ON/OFF
	transport block size	168, 360
DPCCH + DPDCH Only mode		
DPCCH (dedicated physical control channel)	symbol rate	15 ksps
	power	-80 dB to 0 dB
	channelization code	0, fixed
	FBI state	OFF/1 bit/2 bit
	FBI pattern	pattern (length 1 bit to 32 bit)
	TFCI state	ON/OFF
	TFCI	0 to 1023
	TPC pattern	all 0, all 1, pattern (length 1 bit to 32 bit), data lists
	TPC pattern readout mode (application mode for TPC pattern)	continuous, single + all 1, single + all 1, single + alt. 01, single + alt. 10
	TPC for dynamic output power control; if this function is active, the TPC pattern is used to vary the transmit power of the code channels of the MS versus time	
state	ON/OFF	
output power control step	-10 dB to +10 dB	
DPDCH (dedicated physical data channel)	overall symbol rate (total symbol rate of all uplink DPDCHs)	15 ksps, 30 ksps, 60 ksps, 120 ksps, 240 ksps, 480 ksps, 960 ksps, 2 × 960 ksps, 3 × 960 ksps, 4 × 960 ksps, 5 × 960 ksps, 6 × 960 ksps
	depending on overall symbol rate:	
	active DPDCHs	1 to 6
	symbol rate	fixed for active DPDCHs
	channelization code	fixed for active DPDCHs
	channel power	-80 dB to 0 dB
payload data	PRBS: 9, 11, 15, 16, 20, 21, 23 all 0, all 1, pattern (length 1 bit to 64 bit) data lists	
Graphical display		domain conflicts, code domain, channel graph, slot structure, and formats offered in graphics block
Error vector magnitude	1 DPCH, rms	<0.8 %, typ. 0.3 %
Adjacent-channel leakage ratio (ACLR)	test model 1, 64 DPCHs	
	offset 5 MHz	typ. 78 dB
	offset 10 MHz	typ. 79 dB

3GPP FDD enhanced BS/MS test including HSDPA (R&S® AMU-K43 option)

At least one R&S® AMU-K42 option must be installed.

General parameters	This option extends the R&S® AMU-K42 (3GPP FDD digital standard) to full HSDPA support and dynamic power control. Therefore, all general parameters of the R&S® AMU-K42 such as frequency range or modulation are also valid for the R&S® AMU-K43.	
Downlink simulation		
HSDPA channels (HS-SCCH, HS-PDSCH, and F-DPCH)		
Enhancements	The R&S® AMU-K42 supports simulation of HSDPA channels in a continuous mode needed for TX measurements in line with TS 25.141 (test model 5). The R&S® AMU-K43 now supports simulation of HS-SCCH (high speed shared control channel) and HS-PDSCH (high speed physical downlink shared channel) in line with TS 25.211. This implies the correct timing between these channels as well as the possibility to set start subframe and inter-TTI distance. In addition, several F-DPCHs (fractional dedicated physical channel) can be generated.	
Application	TX measurements on 3GPP FDD Node Bs with realistic statistics RX measurements on 3GPP FDD UEs with correct timing	
Ranges (valid for HS-SCCH and HS-PDSCH)	HSDPA mode	continuous, subframe 0 to subframe 4 (where first packet is sent), H-Set
	inter-TTI distance	1 to 16
	burst mode	ON: DTX between two HS-PDSCH packets OFF: transmission of dummy data between two HS-PDSCH packets
Fixed reference channel definition H-Set		
Enhancements	The R&S® AMU-K43 allows HSDPA downlink channels with channel coding to be generated in line with the definition of the fixed reference channels (H-Set) in TS 25.101; in addition, user-configurable bit/block error insertion is possible.	
Ranges	H-Set	H-Set 1 to H-Set 5
	slot format	QPSK, 16QAM (H-Set 1 to H-Set 3)
	RV parameter	0 to 7
	UEID	0 to 65535
	bit error insertion	0.5 to 10^{-7} (insertion prior to channel coding or at the physical layer)
	block error insertion	0.5 to 10^{-4}
Dynamic power control		
Enhancements	The R&S® AMU-K42 provides a method to vary the output power of a code channel in arbitrary waveform mode by misusing its TPC pattern. The R&S® AMU-K43 now allows the variation of the output power in realtime mode for up to 3 DPCHs in three submodes:	
	external	UE provides TPC info to R&S® AMU200A by external connector (TTL level)
	by TPC pattern	TPC pattern is used to control the output power
	manual	the output power is changed incrementally by pressing buttons or sending the corresponding remote control commands
Application	RX measurements on 3GPP FDD UEs where closed loop power control is needed RX measurements on 3GPP FDD UEs with varied code channel power without dropouts in the signal	
Ranges	mode	external, by TPC pattern, manual
	direction	up, down
	power step	0.5 dB to 6 dB
	up range	0 dB to 20 dB
	down range	0 dB to 20 dB

Uplink simulation		
HS-DPCCH (high speed dedicated physical control channel)		
Enhancements	The R&S®AMU-K42 does not support HSDPA for uplink. The R&S®AMU-K43 now allows the simulation of a HS-DPCCH (high speed dedicated physical control channel) in realtime operation (UE1) and arbitrary waveform mode (UE2 to UE4).	
Application	TX measurements on 3GPP FDD UEs supporting HSDPA RX measurements on 3GPP FDD Node Bs supporting HDSPA	
Ranges	power	-80 dB to 0 dB
	start delay	101 to 250 (in units of 256 chips)
	inter-TTI distance	1 subframe to 16 subframes
	CQI pattern	up to 10 CQI values sent periodically, support of DTX
	ACK/NACK pattern	up to 32 ACK/NACK commands sent periodically, support of DTX
Dynamic power control		
Enhancements	The R&S®AMU-K42 provides a method to vary the output power of a code channel in arbitrary waveform mode by misusing its TPC pattern. The R&S®AMU-K43 now allows the variation of the output power in realtime mode for UE1 in three submodes:	
	external	Node B provides TPC info to the R&S®AMU200A by external connector (TTL level)
	by TPC pattern	TPC pattern is used to control the output power
	manual	the output power is changed incrementally
Application	RX measurements on 3GPP FDD Node Bs where closed loop power control is needed	
	RX measurements on 3GPP FDD Node Bs with varied UE power without dropouts in the signal	
Ranges	mode	external, by TPC pattern, manual
	direction	up, down
	power step	0.5 dB to 6 dB
	up range	0 dB to 20 dB
	down range	0 dB to 20 dB

GPS digital standard (R&S® AMU-K44 option)

GPS digital standard		in line with ICD-GPS-200 revision C
General settings		
Virtual RF frequency		default L1 = 1575.42 MHz
Modulation		BPSK (CDMA)
Symbol rate (chip rate)		1.023 MHz
Baseband filter		Gaussian filter parameter $B \times T = 1$
Simulation modes		generic mode localization mode
Marker		navigation data bit (20460 chips) navigation data word (30 data bits) navigation data subframe (10 data words) navigation page (5 data subframes) complete navigation message (25 data pages) pulse pattern ON/OFF ratio
Triggering		see I/Q baseband generator
Navigation data		
Navigation data	identical for each satellite	all 0 all 1 pattern (up to 64 bit) PN 9 to PN 23 data lists real navigation data
Real navigation data		support of SEM-Almanac, any valid date and time (GMT)
Navigation data rate		50 bps
Satellite configurations		
Number of channels		1 to 4 satellites
Use spreading code	identical for each satellite	ON/OFF
State	separately settable for each satellite	ON/OFF
Space vehicle ID	separately settable for each satellite	C/A codes: 37 Gold codes, 1023 chips each
Time shift	separately settable for each satellite	0 to 10000000 (C/A code chip)/16
Power	separately settable for each satellite	±10 dB
Doppler shift	separately settable for each satellite	±100 kHz (selectable in steps of 0.01 Hz)
Localization mode		
Latitude	latitude of simulated location	±90° (selectable in steps of 0.1 s)
Longitude	longitude of simulated location	±180° (selectable in steps of 0.1 s)
Altitude	altitude of simulated location	±10000 m (selectable in steps of 0.1 m)

3GPP FDD HSUPA (R&S® AMU-K45 option)

At least one R&S® AMU-K42 option must be installed.

General parameters	This option extends the R&S® AMU-K42 (3GPP FDD digital standard) to full HSUPA support. Therefore, all general parameters of the R&S® AMU-K42 such as frequency range or modulation are also valid for the R&S® AMU-K45.	
Downlink simulation		
HSUPA channels (E-AGCH, E-RGCH, E-HICH)		
Enhancements	The R&S® AMU-K45 in downlink supports simulation of HSUPA control channels E-AGCH (E-DCH absolute grant channel), E-RGCH (E-DCH relative grant channel), and E-HICH (E-DCH hybrid ARQ indicator channel) in line with TS 25.211.	
Application	RX measurements on 3GPP FDD UEs with correct timing	
Ranges (valid for E-RGCH and E-HICH)	type of cell	serving cell, non-serving cell
	E-DCH TTI	2 ms, 10 ms
	signature sequence index	0 to 39 (in line with TS 25.211)
	relative grant pattern	up to 32 UP/DOWN/HOLD commands sent periodically
	ACK/NACK pattern	up to 32 ACK/NACK commands sent periodically
Uplink simulation		
E-DPCCH (E-DCH dedicated physical control channel), E-DPDCH (E-DCH dedicated physical data channel)		
Enhancements	The R&S® AMU-K45 in uplink allows the simulation of an E-DPCCH and up to four E-DPDCHs with channel coding in line with the definition of the fixed reference channels in TS 25.104 and TS 25.141.	
Application	RX measurements on 3GPP FDD Node Bs supporting HSUPA	
E-DPCCH	power	-80 dB to 0 dB
	retransmission sequence number	0 to 3
	E-TFCI information	0 to 127
	happy bit	0, 1
	E-DCH TTI	2 ms, 10 ms
	DTX pattern	up to 32 TX/DTX commands sent periodically
E-DPDCH	overall symbol rate (total symbol rate of all uplink E-DPDCHs)	60 ksps, 120 ksps, 240 ksps, 480 ksps, 960 ksps, 2 × 960 ksps, 2 × 1920 ksps, 2 × 960 ksps, 2 × 1920 ksps
	depending on overall symbol rate	
	active E-DPDCHs	1 to 4
	symbol rate	fixed for active E-DPDCHs
	channelization code	fixed for active E-DPDCHs
	common for all E-DPDCHs	
	channel power	-80 dB to 0 dB
	payload data	PRBS: 9, 11, 15, 16, 20, 21, 23 all 0, all 1, pattern (length 1 bit to 64 bit) data lists
	E-DCH TTI	2 ms, 10 ms
	DTX pattern	up to 32 TX/DTX commands sent periodically

HSUPA FRC	channel coding in line with the definition of fixed reference channels in TS 25.104 and TS 25.141; in addition, user-configurable Virtual HARQ mode and bit/block error insertion	
	fixed reference channel (FRC) (predefined channel coding schemes)	FRC 1 to FRC 7
	DTX pattern	up to 32 TX/DTX commands sent periodically
	HARQ ACK/NACK pattern (individual ACK/NACK pattern for each HARQ process)	up to 32 ACK/NACK commands sent periodically
	bit error insertion (deliberate generation of bit errors by impairing the data stream prior to channel coding or at the physical layer)	
	bit error ratio	0.5 to 10^{-7}
	application	verification of internal BER calculation in line with TS 25.141 (BS conformance testing)
	block error insertion (deliberate generation of block errors by impairing the CRC during coding of enhanced channels)	
	block error ratio	0.5 to 10^{-4}
	application	verification of internal BLER calculation in line with TS 25.141 (BS conformance testing)

CDMA2000® digital standard (R&S® AMU-K46 option)

CDMA2000® digital standard	release C	in line with 3GPP2 C.S0002-C
Chip rates	standard	1.2288 MHz (1X)
	range	1 MHz to 5 MHz
Modes		1× direct spread (spreading rate 1)
Link direction		forward link and reverse link
Signal generation modes/sequence length	sequence length of ARB component entered in frames (80 ms each), max. length 1022 frames with R&S® AMU-B9, 511 frames with R&S® AMU-B10, 160 frames with R&S® AMU-B11	
Baseband filter	standard for reverse link	cdmaOne
	standard for forward link	cdmaOne + equalizer
	for enhanced ACLR:	
	reverse link	cdmaOne 705 kHz
Code channels	forward link	4 base stations with a maximum of 78 code channels each (depending on radio configuration)
	reverse link	4 mobile stations with a maximum of 8 code channels each (depending on radio configuration)
Clipping level	setting of a limit value relative to the highest peak in percent; limitation is effected prior to baseband filtering and reduces the crest factor	1 % to 100 %
Generate waveform file		filtering of data generated in ARB mode and saving it as waveform file
Parameters of every BS		
State		OFF/ON
Time delay	timing offset of signals of individual base stations	
	BS1	0 chips (fixed)
	BS2 to BS4	0 chips to 98304 chips
PN offset		0 to 511
Transmit diversity	If this function is activated, the output signal can be generated for either antenna 1 or 2, as defined in the standard.	OFF antenna 1 antenna 2
Diversity mode		OTD/STS
Quasi-orthogonal Walsh sets		set 1 to set 3
Parameters of every forward link code channel that can be set independently		
State		OFF/ON
Channel types Forward link	forward pilot (F-PICH)	
	transmit diversity pilot (F-TDPICH)	
	auxiliary pilot (F-APICH)	
	auxiliary transmit diversity pilot (F-ATDPCH)	
	sync (F-SYNC)	
	paging (F-PCH)	
	broadcast (F-BCH)	
	quick paging (F-QPCH)	
	common power control (F-CPCCH)	
	common assignment (F-CACH)	
	common control (F-CCCH)	
	packet data control (F-PDCCH)	
	packet data (F-PDCH)	
	traffic channel	
	fundamental (F-FCH)	
	supplemental (F-SCH)	
dedicated control (F-DCCH)		
Radio configuration	chip rate 1.2288 Mcps (1X)	RC 1 to RC 5 and RC 10
Frame length	depending on channel type and radio configuration	5 ms, 10 ms, 20 ms, 40 ms, 80 ms, 160 ms
Data rate	depending on channel type and radio configuration	1.2 kbps to 1036.8 kbps

Walsh code	depending on channel type and radio configuration	0 to 127
Quasi-orthogonal code		ON/OFF
Power		-80 dB to 0 dB
Data		all 0 all 1 pattern (up to 64 bit) PN 9 to PN 23 data lists
Long code mask		0 to 3FF FFFF FFFF hex
Power control data source		all 0 all 1 pattern (up to 64 bit) data list
(Mis)use for output power control	If this function is active, the power control data is used to vary the transmit power of the code channels versus time.	
	state	ON/OFF
	output power control step	-10 dB to +10 dB
Channel coding	All stages of channel coding specified by IS-2000 (e.g. frame quality indicator, convolutional encoder/turbo coder, symbol puncture, and interleaver) are available. All frame length and data rate combinations are supported. Four options are available:	
	OFF	channel coding OFF
	complete	channel coding completely ON
	without interleaving	channel coding ON but without interleaver
	interleaving only	channel coding OFF, only interleaver is active
Parameters of every MS		
State		ON/OFF
Radio configuration	chip rate 1.2288 Mcps (1X)	RC 1 to RC 4
Channel coding	All stages of channel coding specified by IS-2000 (e.g. frame quality indicator, convolutional encoder, symbol puncture, and interleaver) are available. All frame length and data rate combinations are supported. Four options are available:	
	OFF	channel coding OFF
	complete	channel coding completely ON
	without interleaving	channel coding ON but without interleaver
	interleaving only	channel coding OFF, only interleaver is active
Operating mode	simulates MS operating mode and defines available channels	traffic access enhanced access common control
Long code mask		0 to 3FF FFFF FFFF hex
Power control data source	in reverse link, the power control data is used only for the misuse mode	all 0 all 1 pattern (up to 64 bit) data list
(Mis)use for output power control	If this function is active, the power control data is used to vary the transmit power of the code channels versus time.	
	state	ON/OFF
	output power control step	-10 dB to +10 dB

Parameters of every reverse link code channel that can be set independently		
State		ON/OFF
Channel types	reverse pilot (R-PICH)	
Reverse link	access (R-ACH)	
	enhanced access (R-EACH)	
	reverse common control (R-CCCH)	
	reverse dedicated control (R-DCCH)	
	traffic channel	
	fundamental (R-FCH)	
	supplemental code (R-SCCH)	
	supplemental (R-SCH)	
Frame length	depending on channel type and radio configuration	5 ms, 10 ms, 20 ms, 40 ms, 80 ms
Data rate	depending on channel type and radio configuration	1.2 kbps to 1036.8 kbps
Power		-80 dB to 0 dB
Data		all 0 all 1 pattern (up to 64 bit) PN 9 to PN 23 data lists
Error vector magnitude (EVM)	F-PICH, F-SYNC, and one F-FCH, rms	<0.8 %, typ. 0.3 %
Adjacent-channel leakage ratio (ACLR)	F-PICH, F-SYNC, and one F-FCH	
	channel spacing 0.75 MHz (bandwidth 30 kHz)	typ. 79 dB
	channel spacing 1.98 MHz (bandwidth 30 kHz)	typ. 91 dB

IEEE 802.11 a/b/g digital standard (R&S[®] AMU-K48 option)

IEEE 802.11 a/b/g digital standard		in line with IEEE 802.11a-1999, IEEE 802.11b-1999, IEEE 802.11g-2003
General settings		
Modes	unframed	generation of a non-packet-oriented signal without frame structure, with the modulation modes and data rates defined by the IEEE 802.11 standard
	framed	generation of a sequence of data packets with the frame structure defined by the standard, interrupted by an idle time
Sequence length		1 frame to 511 frames (depending on frame duration)
Clipping		vector or scalar clipping, applied before filtering
Marker modes		restart, frame start, frame active part, pulse, pattern, ON/OFF ratio
Triggering		see I/Q baseband generator
Parameters in framed mode		
Idle time	time between two successive packets (PPDUs)	
	range	0 s to 10000 μ s
MAC header		activating and configuring the MAC header with the following parameters: frame control, duration/ID, addresses 1 to 4, and sequence control
Frame check sequence		activating or deactivating a 32 bit (4 byte) check sum for protecting MAC header and user data (frame body)
Settings for CCK (IEEE 802.11b/IEEE 802.11g)		
Chip rate	standard	11 Mcps
	range	as R&S [®] AMU200A
Baseband filter		spectral mask in line with IEEE 802.11b-1999 – Wireless LAN MAC and PHY specifications – chapter 18.4.7.3
Parameters in framed mode	PLCP preamble and header format	long PLCP and short PLCP
	PSDU bit rate	1 Mbps, 2 Mbps, 5.5 Mbps, 11 Mbps
	PSDU modulation (depending on PSDU bit rate)	DBPSK, DQPSK, CCK
	PSDU data length (length of user data field in bytes of the packet to be transferred)	
	range	0 byte to 4095 byte
	scrambling	data scrambling can be activated or deactivated
Parameters in unframed mode	PSDU bit rate	1 Mbps, 2 Mbps, 5.5 Mbps, 11 Mbps
	PSDU modulation (depending on PSDU bit rate)	DBPSK, DQPSK, CCK
	scrambling	data scrambling can be activated or deactivated

Settings for OFDM (IEEE 802.11a/IEEE 802.11g)		
Kernel sample rate	standard	20 Msample/s
	range	as R&S [®] AMU200A
Baseband filter		spectral mask in line with IEEE 802.11b-1999 – Wireless LAN MAC and PHY specifications – chapter 17.3.9.6.2
Parameters in framed mode	PLCP preamble and header format	long PLCP and short PLCP
	PLCP signal field	automatically calculated
	PSDU bit rate	6 Mbps, 9 Mbps, 12 Mbps, 18 Mbps, 24 Mbps, 36 Mbps, 48 Mbps, or 54 Mbps
	PSDU modulation (depending on PSDU bit rate)	BPSK, QPSK, 16QAM, 64QAM
	PSDU data length (length of user data field in bytes of the packet to be transferred)	
	range	0 byte to 4095 byte
	number of data symbols (number of OFDM symbols in data portion of packet)	directly proportional to PSDU data length
	scrambling	data scrambling can be activated or deactivated; initial scrambler state can be set randomly or to a user-defined value
	interleaver	can be activated or deactivated
	time domain windowing (transition times)	0 s to 1000 ns
service field	user-defined service field value supported	
Parameters in unframed mode	PSDU bit rate	6 Mbps, 9 Mbps, 12 Mbps, 18 Mbps, 24 Mbps, 36 Mbps, 48 Mbps, or 54 Mbps
	PSDU modulation (depending on PSDU bit rate)	BPSK, QPSK, 16QAM, 64QAM
	PSDU data length (length of user data field in bytes of the packet to be transferred)	
	range	0 byte to 2312 byte
	number of data symbols (number of OFDM symbols to be generated)	directly proportional to PSDU data length
	scrambling	data scrambling can be activated or deactivated; initial scrambler state can be set randomly or to a user-defined value
	interleaver	can be activated or deactivated
	time domain windowing (transition times)	0 s to 1000 ns
	service field	user-defined service field value supported
Settings for PBCC (IEEE 802.11b/IEEE 802.11g)		
Chip rate	standard	11 Mcps
	range	as R&S [®] AMU200A
Baseband filter		spectral mask in line with IEEE 802.11b-1999 – Wireless LAN MAC and PHY specifications – chapter 18.4.7.3
Parameters in framed mode	PLCP preamble and header format	long PLCP and short PLCP
	PSDU bit rate	1 Mbps, 2 Mbps, 5.5 Mbps, 11 Mbps, 22 Mbps
	PSDU modulation (depending on PSDU bit rate)	DBPSK, DQPSK, PBCC
	PSDU data length (length of user data field in bytes of the packet to be transferred)	
	range	0 byte to 4095 byte
scrambling	data scrambling can be activated or deactivated	
Parameters in unframed mode	PSDU bit rate	1 Mbps, 2 Mbps, 5.5 Mbps, 11 Mbps, 22 Mbps
	PSDU modulation (depending on PSDU bit rate)	DBPSK, DQPSK, PBCC
	scrambling	data scrambling can be activated or deactivated

IEEE 802.16 WiMAX digital standard including IEEE 802.16e (R&S® AMU-K49 option)

IEEE 802.16 digital standard		in line with IEEE 802.16™-2004/Cor1/D5 and IEEE 802.16e-2005
Link direction		forward link and reverse link
Physical layer modes		OFDM, OFDMA, OFDMA/WiBro
Duplexing		TDD, FDD
Frame durations		2 ms, 2.5 ms, 4 ms, 5 ms, 8 ms, 10 ms, 12.5 ms, 20 ms, continuous, user
Sequence length (frames)	depending on frame duration, sample rate, and available ARB memory	1 to >2000
Predefined frames	in OFDM mode	short, medium, and long test messages for BPSK, QPSK, 16QAM, and 64QAM modulation
	in OFDMA mode	predefined setups for all bandwidths and modulations specified in MRCT 1.0.0, appendix 2
Level reference	in OFDM mode	FCH/burst or preamble
	in OFDMA/WiBro mode	preamble or subframe RMS power
Generate waveform file	filtering of data generated in ARB mode and	saving it as waveform file
Parameters in OFDM mode		
Predefined frequency bands		ETSI, MMDS, WCS, U-NII, user
Channel bandwidth	depending on selected frequency band	1.25 MHz to 30 MHz
Sampling rate	depending on channel bandwidth	1.5 MHz to 32 MHz
Tg/Tb settings		1/4, 1/8, 1/16, 1/32
FFT size		256 (fixed)
Frame preamble		long, short, OFF
Modulation and RS-CC rates		BPSK 1/2, QPSK 1/2, QPSK 3/4, 16QAM 1/2, 16QAM 3/4, 64QAM 2/3, 64QAM 3/4
Subchannelization (number of possible channels)		1, 2, 4, 8, 16 (all)
Number of bursts with different modulation formats per frame		64
Burst types		data, DL-MAP, UL-MAP, ranging
Data		all 0 all 1 pattern (up to 64 bit) PN 9 to PN 23 data lists
Midamble repetition	in uplink mode	OFF, 5, 9, 17
Parameters in OFDMA mode		
Predefined frequency bands		ETSI, MMDS, WCS, U-NII, WiBro, user
Channel bandwidth	depending on selected frequency band	1.25 MHz to 30 MHz
Sampling rate	depending on channel bandwidth	1.5 MHz to 32 MHz
Tg/Tb settings		1/4, 1/8, 1/16, 1/32
FFT size		128, 512, 1024, 2048
Preamble modes		Auto and User with index 0 to 113
Number of zones/segments		8
Space-time coding modes		OFF 2 antennas matrix A 2 antennas matrix B
Modulation and coding rates		QPSK 1/2, QPSK 3/4, 16QAM 1/2, 16QAM 3/4, 64QAM 1/2, 64QAM 2/3, 64QAM 3/4, 64QAM 5/6
Channel coding modes		OFF, CC, CTC
Channel coding parts		scrambler, FEC, interleaver can be switched ON/OFF independently
Repetition coding		0, 2, 4, 6
Subcarrier permutation		FUSC, PUSC, AMC2x3
Subchannel map		user-definable for PUSC
Subchannel rotation		ON/OFF (for uplink PUSC)

Dedicated pilots		ON/OFF (for downlink PUSC and AMC2x3)
Number of bursts with different modulation formats		64/zone
Burst types		FCH, DL-MAP, UL-MAP, DCD, UCD, HARQ, ranging, fast feedback, data
Data		all 0 all 1 pattern (up to 64 bit) PN 9 to PN 23 data lists

TD-SCDMA digital standard (3GPP TDD LCR) (R&S® AMU-K50 option)

WCDMA 3GPP TDD LCR (TD-SCDMA) digital standard		in line with 3GPP TDD standard for chip rate 1.28 Mcps (low chip rate mode)
Signal generation modes/sequence length	Simulation of up to 4 TD-SCDMA cells with variable switching point of uplink and downlink. User-configurable channel table for each slot and simulation of the downlink and uplink pilot timeslot. In uplink, a PRACH can also be generated. The sequence length can be entered in frames (10 ms each).	
Modulation		QPSK, 8PSK
Generate waveform file		filtering of data generated in ARB mode and saving it as waveform file
	application	for multicarrier or multisegment scenarios
General settings		
Triggering		see I/Q baseband generator
Chip rate	standard	1.28 Mcps (7 slots/subframe)
	range	1 Mcps to 5 Mcps
Link direction		uplink (reverse link) downlink (forward link)
Baseband filter	standard	$\sqrt{\cos}$, $\alpha = 0.22$
	other filters	$\sqrt{\cos}$, \cos , user filters
Clipping	Setting of clipping value relative to highest peak in percent. Clipping takes place prior to baseband filtering. Clipping reduces the crest factor.	
	modes	vector $ i + j q $ scalar $ i , q $
	clipping level	1 % to 100 %
Code channels	downlink/uplink	up to 16 data channels (plus special channels) per slot, 7 slots per subframe, simulation of up to 4 cells
Configure cell		
Reset all cells		all channels are deactivated
Copy cell		adopting a specific cell configuration to another cell to define multicell scenarios
	parameters	source and destination of copying
Predefined settings		generation of complex signal scenarios with parameterizable default settings
	selectable parameters	use of P-CCPCH, number and spreading factors of data channels
	crest factor	minimal/average/worst
Parameters of each cell		
State		ON/OFF
Scrambling code	scrambling code can be disabled for testing	0 to 127
SYNC-DL code	automatic selection depending on scrambling code	0 to 31
SYNC-UL code	range depending on SYNC-DL Code	0 to 255
Number of users		2, 4, 6, 8, 10, 12, 14, 16
Switching point	switchover between uplink and downlink slots	1 to 6
DwPTS power		-80 dB to 10 dB
Parameters for each downlink slot		
State		ON/OFF
Slot mode	downlink dedicated: simulation of up to 16 DPCHs and max. 6 special channels	DPCH QPSK/8PSK: 0 to 24 DPCH PDSCH: 0 to 24 S-CCPCH: 0 to 9

Parameters for each uplink slot		
State		OFF/ON
Slot mode	uplink dedicated: simulation of up to 16 DPCHs and 1 PUSCH PRACH: simulation of one physical random access channel	DPCH QPSK, PUSCH: 0 to 69 DPCH 8PSK: 0 to 24
Physical channels in downlink		
	primary common control physical channel 1 (P-CCPCH 1)	
	primary common control physical channel 2 (P-CCPCH 2)	
	secondary common control physical channel 1 (S-CCPCH 1)	
	secondary common control physical channel 2 (S-CCPCH 2)	
	fast physical access channel (FPACH)	
	physical downlink shared channel (PDSCH)	
	dedicated physical channel modulation QPSK (DPCH QPSK)	
	dedicated physical channel modulation 8PSK (DPCH 8PSK)	
Physical channels in uplink		
	physical uplink shared channel (PUSCH)	
	dedicated physical channel modulation QPSK (DPCH QPSK)	
	dedicated physical channel modulation 8PSK (DPCH 8PSK)	
Parameters of every code channel that can be set independently		
State		ON/OFF
Midamble shift	time shift of midamble in chips: step width 8 chips controlled via the current user and the number of users	0 to 120
Slot format	depending on physical channel type	0 to 69
Spreading factor	depending on physical channel type and link direction	1, 2, 4, 8, 16
Spreading code	depending on physical channel type and spreading factor	1 to 16
Power		-80 dB to 0 dB
Payload data	PRBS	9, 11, 15, 16, 20, 21, 23 all 0, all 1, pattern (length 1 bit to 64 bit), data lists
Number of TFCI bits	depending on modulation type	
	QPSK	0, 4, 8, 16, 32
	8PSK	0, 6, 12, 24, 48
TFCI value		0 to 1023
Number of sync shift & TPC bits	depending on modulation type	
	QPSK	0 & 0, 3 & 3, 48 & 48
	8PSK	0 & 0, 2 & 2, 32 & 32
Sync shift pattern	up to 64 UP/DOWN/HOLD commands sent periodically	"1" → up: increase sync shift "0" → down: decrease sync shift "-" → do nothing
Sync shift repetition M		1 to 8
TPC source		all 0, all 1, pattern (length 1 bit to 64 bit), data lists
TPC readout mode		continuous, single + all 0, single + all 1, single + alt. 01, single + alt. 10
Parameters in uplink PRACH mode		
UpPTS start subframe	selection of first frame in which UpPTS is sent	1 subframe to 10 subframes
UpPTS power		-80 dB to 0 dB
UpPTS power step		0 dB to 10 dB
Distance UpPTS	distance UpPTS to PRACH message part	1 subframe to 4 subframes
UpPTS repetition	number of UpPTS repetitions	1 to 10
RACH message part state		ON/OFF
Message part length		1 subframe, 2 subframes, 4 subframes
Spreading factor		4, 8, 16
Spreading code		0 to (spreading factor - 1)
Message part power		-80 dB to 0 dB
Payload data		PRBS: 9, 11, 15, 16, 20, 21, 23 all 0, all 1, pattern (length 1 bit to 64 bit), data lists
Current user		1 to 16

TD-SCDMA (3GPP TDD LCR) enhanced BS/MS test including HSDPA (R&S® AMU-K51 option)

At least one R&S® AMU-K50 option must be installed.

General parameters	This option extends the R&S® AMU-K50 (TD-SCDMA digital standard) to full channel coding and HSDPA support. Therefore, all general parameters of the R&S® AMU-K50 such as frequency range or modulation are also valid for the R&S® AMU-K51.	
Signal generation modes/sequence length	Simulation of up to 4 TD-SCDMA cells with generation of the coded P-CCPCH (BCH with running SFN) and the reference measurement channels RMC 12.2 kbps up to RMC 2048 kbps. Simulation of the HSDPA channels HS-SCCH, HS-PDSCH (QPSK and 16QAM modulation), HS-SICH, and the channel-coded H-RMC 526 kbps and H-RMC 730 kbps. Furthermore, bit and block errors can be inserted.	
Modulation	QPSK, 8PSK, 16QAM	
HSDPA physical channels	high speed shared control channel 1 (HS-SCCH 1)	
	high speed shared control channel 2 (HS-SCCH 2)	
	high speed physical downlink shared channel QPSK (HS-PDSCH QPSK)	
	high speed physical downlink shared channel 16QAM (HS-PDSCH 16QAM)	
	high speed shared information channel (HS-SICH)	
Channel coding	coding of enhanced channels in line with the definition of reference measurement channels in TS 25.102, TS 25.105, and TS 25.142	
	predefined channel coding schemes for	
	downlink	coded BCH including SFN RMC 12.2 kbps RMC 64 kbps RMC 144 kbps RMC 384 kbps RMC 2048 kbps H-RMC 526 kbps H-RMC 730 kbps
uplink	RMC 12.2 kbps RMC 64 kbps RMC 144 kbps RMC 384 kbps RMC 2048 kbps	
Applications	BER measurements in line with TS 25.102/105/142 (radio transmission and reception) e.g. adjacent channel selectivity blocking characteristics intermodulation characteristics	
	BLER measurements in line with TS 25.102/105 (radio transmission and reception), e.g. demodulation of dedicated channel under static propagation conditions (AWGN generation together with R&S® AMU-K62) test of decoder in receiver	
Bit error insertion	deliberate generation of bit errors by impairing the data stream prior to channel coding or at the physical layer	
	bit error ratio	0.5 to 10^{-7}
Application	verification of internal BER calculation in line with TS 25.142 (BS conformance testing)	
Block error insertion	deliberate generation of block errors by impairing the CRC during coding of enhanced channels	
	block error ratio	0.5 to 10^{-4}
Application	verification of internal BLER calculation in line with TS 25.142 (BS conformance testing)	

DVB-H digital standard (R&S® AMU-K52 option)

DVB-H digital standard		in line with ETSI EN 300 744 V1.5.1 standard
General settings		
Hierarchy mode		non-hierarchical
Sequence length	number of superframes	min.: 1 max.: depending on memory option
Baseband filter	standard	cosine, $\alpha = 0.1$
	other	see I/Q baseband generator
Clipping	Setting of clipping value relative to highest peak in percent. Clipping takes place prior to baseband filtering. Clipping reduces the crest factor	
	modes	vector i + j q scalar j , q
	clipping level	1 % to 100 %
Generate waveform file	filtering of data generated in ARB mode and	saving it as waveform file
Marker		restart superframe start frame start pulse pattern ON/OFF ratio
Triggering		see I/Q baseband generator
Signal path parameters		
Input data	zero packets are generated and filled up with desired data	PN 15, 23 all 0 all 1
	transport stream	transport stream file (*.gts)
Scrambler	state	ON/OFF
Outer coder		Reed Solomon (204, 188, t = 8)
	state	ON/OFF
Outer interleaver		convolutional byte-wise (depth: 12)
	state	ON/OFF
Inner coder		convolutional, punctured
	state	ON/OFF
	code rates	1/2, 2/3, 3/4, 5/6, 7/8
Inner interleaver		bit-wise interleaving symbol interleaving
	state	ON/OFF
	symbol interleaving block size	1512 bits in 2K mode 3024 bits in 4K mode 6048 bits in 8K mode
	symbol interleaving modes	native, in-depth
Modulation		QPSK, 16QAM, 64QAM
Transmission modes		2K with 1705 carriers 4K with 3409 carriers 8K with 6817 carriers
Guard interval	cyclic continuation of useful signal part	length: 1/4, 1/8, 1/16, 1/32 of useful signal part
Framing and signaling		
Super frame size		4 frames
Frame size		68 OFDM symbols
TPS settings	cell ID	0000 to FFFF (user-defined)
	time-slicing	ON/OFF
	MPE-FEC	ON/OFF

EUTRA/LTE digital standard (R&S® AMU-K55 option)

EUTRA/LTE digital standard		in line with 3GPP standard release 8
General settings		
Sequence length	number of frames	sequence length can be entered in frames (10 ms each); max. length depends on sample rate and ARB size
Baseband filter	standard	cosine, $\alpha = 0.1$
	other	see I/Q baseband generator
Clipping	Setting of clipping value relative to highest peak in percent. Clipping takes place prior to baseband filtering. Clipping reduces the crest factor.	
	Modes	vector $ i + j \cdot q $ scalar $ i , q $
	clipping level	1 % to 100 %
Marker		subframe radio frame start restart pulse pattern ON/OFF ratio
Triggering		see I/Q baseband generator
Duplexing	determines duplexing mode Note: TDD is not supported in this version.	FDD, TDD
Link direction	determines whether uplink or downlink is simulated Note: Uplink is not supported in this version.	downlink, uplink
Physical layer mode	fixed value: depends on chosen link direction: OFDMA in downlink, SC-FDMA in uplink	
Frame duration		fixed value: 10 ms
Subframe duration		fixed value: 0.5 ms
Physical settings		
Channel bandwidth	determines the channel bandwidth used	1.25 MHz, 2.5 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz
Physical resource block bandwidth	determines the size of a physical resource block (this parameter will be finally determined in the R&S® AMU-K55 as soon as it is defined in the official 3GPP specification) Note: 180 kHz is not supported in this version.	180 kHz, 375 kHz
Sampling rate		automatically set in line with the selected channel bandwidth
FFT size		automatically set in line with the selected channel bandwidth
Number of occupied subcarriers		automatically set in line with the selected channel bandwidth
Number of left guard subcarriers		automatically set in line with the selected FFT size
Number of right guard subcarriers		automatically set in line with the selected FFT size
Number of resource blocks		automatically set in line with the selected channel bandwidth and physical resource block bandwidth

Downlink reference signal structure		
Reference symbol configuration	simulated antenna configuration Note: Antennas 2 to 4 are not supported in this version.	antennas 1 to 4
First reference symbol position	position in subframe of the first reference symbols	1st symbol, 2nd symbol
Frequency spacing	determines spacing in subcarriers between two pilots	2/4/6/8 subcarriers
Subcarrier offset	offset in subcarriers within one resource block	0 to (subcarrier_interleaving_factor – 1)
Reference symbol repetition period	determines the period in subframes after which the sequence for reference symbols is repeated Note: The uploaded sequence for the reference symbols should be long enough to fill the selected period.	1/2/4/5/10/20 subframes
First reference symbol power	power of 1st reference symbols	–80 dB to 10 dB
Use second reference symbols	determines whether 2nd reference symbols are used	yes, no
Second reference symbol power	power of 2nd reference symbols	–80 dB to 10 dB
Reference symbol sequence	Note: QPSK is assumed to be used for reference symbols.	data set for reference symbols to be uploaded (in R&S®AMU200A data list format)
SCH/BCH settings		
SCH repetition period	determines the period in subframes between two SCH subframes	2/4/5/10/20 subframes
First SCH subframe	determines the subframe in the frame in which the SCH is initially transmitted Note: The SCH is automatically mapped to the endmost symbol of the subframe.	0 to (SCH_rep_period – 1)
SCH power	determines the power of the SCH allocations	–80 dB to 10 dB
SCH sequence	Note: QPSK is assumed to be used for SCH. The first 150 bits are taken from the selected sequence and are mapped to the subcarriers used; therefore, the SCH always consists of the same sequence, regardless of the subframe.	data set for SCH to be uploaded (in R&S®AMU200A data list format)
BCH subframe	determines the subframe in the frame in which the BCH is transmitted Note: Must not overlap with SCH subframes. Otherwise, last valid configuration is restored.	0 to 19
BCH length	determines the length of the BCH in OFDMA symbols Note: The BCH is automatically mapped to the endmost symbols of the subframe	1 OFDMA symbol to 4 OFDMA symbols
BCH bandwidth	determines the bandwidth of the BCH Note: BCH bandwidth of 5MHz is only selectable if channel bandwidth \geq 5MHz	1.25 MHz, 5 MHz
BCH power	determines the power of the BCH allocation	–80 dB to 10 dB
BCH data source	determines the data source of the BCH allocation Note: QPSK is assumed to be used for BCH.	PN9, PN11, PN15, ..., PN 23, DList, pattern, all 0, all 1

Resource allocation downlink		
Number of configurable subframes	determines the number of configurable subframes; the 20 subframes of one frame are filled periodically with the configured subframes Note: SCH and BCH are configured globally and therefore not copied here. Using this function ensures a valid frame configuration.	1 to 20
Behavior in unscheduled resource blocks	determines whether unscheduled resource blocks and subframes are filled with dummy data or left DTX	dummy data, DTX
Cyclic prefix	determines whether short or long cyclic prefix is used for a specific subframe Note: Automatically determines number of OFDM symbols per subframe.	short, long
Number of allocations used	determines the number of scheduled allocations in the selected subframe	0 to ("total number of RBs" + SCH/BCH + L1/L2CCH)
Allocation table		
Modulation	determines the modulation scheme used	QPSK, 16QAM, 64QAM
CC (channel coding)	determines the channel coding scheme used Note: Turbo coder is not supported in this version.	TC (turbo coding)/OFF
Transmission	determines whether the allocation is localized or distributed Note: <i>Distributed</i> is not supported in this version.	localized, distributed
Number of resource blocks (RB)	defines size of selected allocation in terms of resource blocks	1 to "total number of RBs"
Number of symbols	defines size of selected allocation in terms of OFDM symbols	1 to "number of OFDM symbols per subframe"
Offset RB	defines start resource block of selected allocation Note: This value is read-only if Auto mode is activated for this allocation.	0 to "total number of RBs" – 1
Offset symbol	defines start OFDM symbol of allocation	0 to "number of OFDM symbols per subframe" – 1
Number of bits	shows size of selected allocation in bits	
Data source	determines data source of selected allocation Note: Data sources for users 0 to 3 can be configured in the Configure User panel	user 0, user 1, user 2, user 3, PN9, PN11, PN15, ..., PN 23, DList, pattern, all 0, all 1
Power	determines power of selected allocation	–80 dB to +10 dB
Content type	determines type of selected allocation Note: SCH and BCH will be set automatically in line with the General E-UTRA DL Settings menu.	data, L1/L2 CCH
Conflict	Note: If a resource conflict between a data allocation and a control channel occurs, the control channel wins, and no conflict is displayed here.	display in case an allocation collides with another allocation

Configure user		
	The Configure User dialog offers the possibility to define and configure up to 4 scheduled UEs that can be distributed as required over the whole frame by setting the data source of a specific allocation in the allocation table to User. Thus, subframe allocations that are not adjacent or allocations of a different subframe can be configured to allow the use of a common data source.	
TTI	determines the transport time interval in subframes of the user currently being configured	1 subframe
Channel coding	determines the channel coding scheme of the user currently being configured Note: Turbo coder is not supported in this version.	TC (turbo coding)/OFF
Data source	determines the data source of the user currently being configured	PN9, PN11, PN15, ..., PN 23, DList, pattern, all 0, all 1
Configure dummy data		
Dummy data – modulation	determines modulation of dummy data	QPSK, 16QAM, 64QAM
Dummy data – data source	determines data source of dummy data	PN9, PN11, PN15, ..., PN 23, DList, pattern, all 0, all 1
Dummy data – power	determines power of dummy data allocations	-80 dB to +10 dB

Multicarrier CW signal generation (R&S® AMU-K61 option)

Signal generation		simulation of unmodulated multicarrier signals in arbitrary waveform mode
Number of carriers		1 to 8192
Carrier spacing	user-settable, maximum spacing depending on number of carriers	1 Hz to 80 MHz
Parameters of each carrier	state	ON/OFF
	power	-80 dB to 0 dB
	start phase	0° to +360°
Crest factor	optimization of crest factor by varying the start phases of the carrier; available modes:	
	OFF	no optimization, manual entry of phase possible
	chirp	the phases of each carrier are set such that a chirp signal is obtained for the I and Q components
	target crest	iterative variation of carrier start phases until a pre-settable crest factor is attained
Trigger	In internal clock mode, a trigger event restarts the clock generation. The clock phase is then synchronous with the trigger (with a certain timing uncertainty). In external clock mode, the trigger event is synchronized to the symbol clock.	
	operating mode	internal, external
	modes	Auto, Retrig, Armed Auto, Armed Retrig
	setting uncertainty for clock phase related to trigger in internal clock mode	<18 ns
	external trigger delay	
	setting range	0 sample to 2 ¹⁶ sample
	resolution	
	internal clock mode	0.01 sample
	external clock mode	1 sample
	setting uncertainty	<5 ns
	external trigger inhibit	
	setting range	0 sample to 2 ²⁶ sample
	resolution	1 sample
	external trigger pulse width	>15 ns
	external trigger frequency	<0.02 × sampling rate
Marker	number	4
	level	LVTTTL
	operating modes	unchanged, restart, pulse, pattern, ratio
	marker delay (in sample)	
	setting range	0 to (waveform length – 1)
	setting range without recalculation	0 to 2000
	resolution of setting	0.001
setting uncertainty	<10 ns	

Digital standards with R&S® WinIQSIM2™ (for R&S® AMU-B9/-B10/-B11 ARB)

GSM/EDGE digital standard	R&S® AMU-K240 option
3GPP FDD digital standard	R&S® AMU-K242 option
3GPP FDD enhanced BS/MS tests including HSDPA	R&S® AMU-K243 option
GPS digital standard	R&S® AMU-K244 option
3GPP FDD enhanced BS/MS tests including HSUPA	R&S® AMU-K245 option
CDMA2000® digital standard	R&S® AMU-K246 option
IEEE 802.11 a/b/g digital standard	R&S® AMU-K248 option
IEEE 802.16 WiMAX digital standard including 802.16e	R&S® AMU-K249 option
TD-SCDMA digital standard (3GPP TDD LCR)	R&S® AMU-K250 option
TD-SCDMA (3GPP TDD LCR) enhanced BS/MS tests including HSDPA	R&S® AMU-K251 option
DVB-H digital standard	R&S® AMU-K252 option
EUTRA/LTE digital standard	R&S® AMU-K255 option
Multicarrier CW signal generation	R&S® AMU-K261 option
Additive white Gaussian noise	AWGN, R&S® AMU-K262 option

The options are described in the R&S® WinIQSIM2™ data sheet (PD 5213.7460.22).

Fading and noise

Fading simulator (R&S® AMU-B14 option) and fading simulator extension (R&S® AMU-B15 option)

The R&S® AMU-B9/-B10/-B11 or R&S® AMU-B17 is required to generate input signals for the fading simulator. All frequency and time settings are coupled to the internal reference frequency.

Number of signal paths	with R&S® AMU-B14	1
	with R&S® AMU-B14 and R&S® AMU-B15	1 or 2
Signal routing	only possible with R&S® AMU-B14 and R&S® AMU-B15	
	input	both signal paths split or combined
	output	split, one signal path only, or sum of both signal paths
Number of fading paths	depending on options and signal routing, see table on page 48	
Fading path loss	setting range	0 dB to 50 dB
	resolution	0.01 dB
	accuracy	<0.01 dB
Fading path delay	setting range	0 s to 2.56 ms
	resolution	10 ns
	with R&S® AMU-K71 option	0.01 ns
Delay groups		max. 4 per signal path
	permitted delay differences within one group	<40 µs
Speed range	at f = 1 GHz	0 km/h to 1725 km/h
	accuracy	<0.128 %
Doppler frequency	setting range	0 Hz to 1600 Hz
	accuracy	<0.1 %
Restart	standard	auto
	with R&S® AMU-B9/-B10/-B11 option installed	auto, internal from baseband A or B, external
Total insertion loss	automatic or user-definable, with clipping indicator	0 dB to 18 dB
Correlation	fading paths in signal path A pairwise with fading paths in signal path B	
	correlation coefficient	
	setting range	0 % to 100 %
	resolution	5 %
	correlation phase	
	setting range	0° to 360°
resolution	1°	
Fading profiles		
Rayleigh	pseudo-noise interval	>93 h
Pure Doppler	frequency ratio	(-1 to +1) × current Doppler frequency
	resolution	0.01 × current Doppler frequency
Rician	combination of Rayleigh and pure Doppler	
	power ratio	-30 dB to +30 dB
Lognormal	standard deviation	0 dB to 12 dB
	resolution	1 dB
	local constant at f = 1 GHz	12 m to 200 m
Static, constant phase	path loss	0 dB to 50 dB
	phase	0° to 360°
	resolution	1°

Number of fading paths, RF bandwidth, and timing resolution

With R&S® AMU-K71 only

With R&S® AMU-B14			
Signal paths	Fading paths	RF bandwidth	Timing resolution
1	20	80 MHz	10 ns
1	12	30 MHz	0.01 ns
1	8	50 MHz	0.01 ns

With R&S® AMU-B14 and R&S® AMU-B15			
Signal paths	Fading paths	RF bandwidth	Timing resolution
1	40	80 MHz	10 ns
1	24	30 MHz	0.01 ns
1	16	50 MHz	0.01 ns
2	20	80 MHz	10 ns
2	12	30 MHz	0.01 ns
2	8	50 MHz	0.01 ns

Dynamic fading and enhanced resolution (R&S® AMU-K71 option)

At least one R&S® AMU-B14 fading simulator must be installed. If both the R&S® AMU-B14 and the R&S® AMU-B15 are installed (signal path A and B), dynamic fading and enhanced resolution can be used either on signal path A or B with one R&S® AMU-K71 option. For dynamic fading and enhanced resolution to be used on signal paths A and B simultaneously, two R&S® AMU-K71 must be installed.

Moving delay mode		
System bandwidth		50 MHz
Number of fading paths		2 per signal path
Fading profiles		none
Basic delay	in steps of 10 ns	0 ms to 2.56 ms
Delay variation	peak to peak	300 s to 40 µs
Variation period		10 s to 500 s
Variation speed		0 µs/s to 500 µs/s
Delay step size		<10 ps
Birth-death mode		
System bandwidth		50 MHz
Number of fading paths		2 per signal path
Fading profiles		pure Doppler
Delay range ⁶		0 s to 40 µs
Delay grid		0 s to 20 µs
Positions		3 to 50
Hopping dwell		100 ms to 5 s
Start offset	separately settable for each signal path	1 ms to 200 ms
Delay resolution		10 ns

⁶ The maximum delay range of 40 µs cannot be exceeded.

Extended statistic functions (R&S® AMU-K72 option)

At least one R&S® AMU-B14 fading simulator must be installed. If both the R&S® AMU-B14 and the R&S® AMU-B15 are installed (signal path A and B), extended statistic functions can be used either on signal path A or B with one R&S® AMU-K72 option. For dynamic fading and enhanced resolution to be used on signal paths A and B simultaneously, two R&S® AMU-K72 must be installed.

Fading profiles		
Gauss I, Gauss II	sum of two Gaussian distributions	in line with DAB standard
Gauss DAB 1, Gauss DAB 2	Gaussian distribution, shifted in frequency	in line with DAB standard
WiMAX Doppler	rounded Doppler PSD model	in line with IEEE 802.16a-03-01
WiMAX Rice	like WiMAX Doppler plus pure Doppler	in line with IEEE 802.16a-03-01
Predefined settings	SUI1 to SUI6	in line with IEEE 802.16a-03-01
	ITU OIP-A ITU OIP-B ITU V-A	in line with 3GPP TS34.121-1 annex D.2.2 table D.2.2.1A
	DAB-RA, DAB-TU, DAB-SFN	in line with EN 50248-2001

Additive white Gaussian noise (AWGN, R&S® AMU-K62 option)

At least one R&S® AMU-B13 baseband main module must be installed. If two R&S® AMU-B13 are installed (paths A and B), AWGN can be generated either on path A or B with one R&S® AMU-K62 option. For AWGN to be generated on paths A and B simultaneously, two R&S® AMU-K62 must be installed.

Addition of an AWGN signal of settable bandwidth and settable C/N ratio or E_b/N_0 to a wanted signal. If the noise generator is used, a frequency offset cannot be added to the wanted signal.

Noise	distribution density	Gaussian, statistical, separate for I and Q
	crest factor	>18 dB
	periodicity	>48 h
C/N, E_b/N_0	setting range	-30 dB to +30 dB
	resolution	0.1 dB
	uncertainty for system bandwidth = symbol rate, symbol rate <4 MHz, -24 dB < C/N < 30 dB and crest factor <12 dB	<0.1 dB
System bandwidth	bandwidth for determining noise power	
	range	1 kHz to 80 MHz
	resolution	100 Hz

Other options

Bluetooth^{® 7} digital standard (external PC software) (R&S[®] AMU-K5 option)

Supported packet types		DH1, DH3, DH5, AUX1 in all data mode or with packet editor
Data sources (in all data mode)		all 0, all 1, PRBS 7 to PRBS 23, user data
Data whitening		supported
Packet editor features	access code	calculated from entered device address
	header bits	can be set individually, SEQN bit toggles with each generated packet
	HEC	calculated automatically
	payload data sources	all 0, all 1, PRBS 7 to 23, pattern, user data
	payload CRC	calculated automatically
Sequence length		up to 53687 packets
Power ramping	ramp function	cos ² , linear
	ramp time	1 symbol to 32 symbol
	rise offset, fall offset	0 symbol to 32 symbol
Modulation	defaults	preset in line with Bluetooth [®] standard 2FSK, 160 kHz deviation, 1 MHz symbol rate
	2FSK frequency deviation	100 kHz to 200 kHz
	2FSK symbol rate	400 Hz to 15 MHz
Filter	filter function	Gaussian, rectangle
	B × T (for Gaussian filter)	0.1 to 2.5

⁷ The Bluetooth[®] word mark and logos are owned by the Bluetooth SIG, Inc. and any use of such marks by Rohde & Schwarz is under license.

Pulse sequencer (external PC software) (R&S® AMU-K6 option)

The pulse sequencer software generates complex pulses and bursts for use with any of the R&S® AMU-B9, R&S® AMU-B10, or R&S® AMU-B11 baseband generators. This software is a standalone, PC-based application that creates waveform files.

Typical applications	DFS pulse generation	FCC CFR 47 part 15.407 (06-96A), ETSI EN 301 893 V1.3.1
	RFID signal generation	ISO/IEC 14443, 18000
	radar waveform generation	receiver tests
	component test with pulsed signals	amplifiers, mixers, converters
Data structure of project files	pulse library	up to 256 pulse definitions
	sequence library	up to 64 sequences
	multisegment waveforms	up to 64
	RF lists	up to 12
Pulse timing parameters	settings	delay, rise, pulse ON, fall, pulse OFF, PRI, PRF
	resolution	1 ns or 1/ARB clock rate, whichever is greater
	minimum pulse width, internal BB	175 ns (7th harmonic, 40 MHz bandwidth)
Pulse level parameters	settings	attenuation, droop
	ON/OFF ratio	>55 dB
Other pulse parameters	ramp type	linear, raised cosine, \cos^2 , custom
	frequency	frequency offset, start phase
Intrapulse modulation	types	ASK, FSK, BPSK, QPSK, FM chirp, FM, AM, user plugin (custom)
	data sources	user data, PRBS: 7,9,11,15,16, 20, 21, 23
Marker settings	markers 1 to 4	delay, rise, pulse ON, fall, OFF, restart
Jitter	distribution	uniform, Gaussian, list, shape
	number of jitters	up to 3, independent
	affected parameters	any timing setting, frequency offset, phase, all level settings, FM deviation
Baseband filter	filter function	rectangular, Gaussian, cosine, root raised cosine
	window functions	Rife Vincent 2, von Hann, Hamming, Blackman, Blackman-Harris, Flat Top
Sequences	pulse entries in sequence	up to 128
	pulse data mode	append, overlay add, overlay multiply
	jitter mode vs repetitions	all individual, all same, continue, OFF
	marker mask vs repetitions	all, first only, last only, none
Multisegment waveforms	sequence entries in MSW	up to 64
Graphical display	I/Q vs time	I/Q traces, polar, envelope in dB
	I/Q plane	vector, density plot
	FFT	entire data, view port only
	cursors	t1, t2, Δt , Δf

BER measurement (R&S® AMU-K80 option)

The data supplied by the DUT is compared with a reference pseudo-random bit sequence.

Clock		supplied by DUT; a clock pulse is required for each valid bit
Clock rate		100 Hz to 60 MHz
Data	PRBS	
	sequence length	9, 11, 15, 16, 20, 21, 23
	pattern ignore	OFF, all 0, all 1
	data enable	external
	modes	OFF, high, low
	restart	external
	modes	ON/OFF
Synchronization time		28 clock cycles
Interface		9-pin D-Sub connector, D-Sub/BNC cable supplied with option
Clock, data, enable, and restart inputs	input impedance	1 k Ω , 50 Ω
	trigger threshold	
	setting range	0 V to 2.50 V
	resolution	0.01 V
Polarity	data, clock, data enable	normal, inverted
Measurement time		selectable through maximum number of data bits or bit errors (max. 2 ³¹ bits each), continuous measurement
Measurement result	if selected number of data bits or bit errors is attained	BER in ppm, %, or decade values
Status displays		not synchronized, no clock, no data

BLER measurement (R&S® AMU-K80 option)

In BLER measurement mode, arbitrary data can be provided by the DUT. A signal marking the block's CRC has to be provided on the data enable connector of the BER/BLER option.

Clock		supplied by DUT; a clock pulse is required for each valid bit
Clock rate		100 Hz to 60 MHz
Data	input data	arbitrary
	data enable (marking the block's CRC)	external
	modes	high, low
CRC	CRC type	CCITT CRC16 ($x^{16} + x^{12} + x^5 + 1$)
	CRC bit order	MSB first, LSB first
Synchronization time		1 block
Interface		9-pin D-Sub connector, D-Sub/BNC cable supplied with option
Clock, data, and enable inputs	input impedance	1 k Ω , 50 Ω
	trigger threshold	
	setting range	0.00 V to 2.50 V
	resolution	0.01 V
Polarity	data, clock, data enable	normal, inverted
Measurement time		selectable through maximum number of received blocks or errors (max. 2 ³¹ blocks each), continuous measurement
Measurement result	if selected number of received blocks or errors is attained	BLER in ppm, %, or decade values
Status displays		not synchronized, no clock, no data

General Data

Remote Control

Systems		IEC/IEEE bus, IEC 60625 (IEEE 488) Ethernet, TCP/IP
Command set		SCPI 1999.5
Connector		
IEC/IEEE		24-contact Amphenol
Ethernet		Western
USB		USB
IEC/IEEE-bus address		0 to 30
Interface functions		IEC: SH1, AH1, T6, L4, SR1, RL1, PP1, DC1, DT1, C0

Operating Data

Power supply	input voltage range, AC, nominal	100 V to 240 V
	AC supply frequency	50 Hz to 60 Hz
	input current	5.0 A to 1.6 A
	power factor correction	in line with EN 61000-3-2
EMC		in line with EN 55011 class B, EN 61326
	with activated digital I/Q output or input	in line with EN 55011 class A, EN 61326
Immunity to interfering field strength		up to 10 V/m
Environmental conditions	operating temperature range	+5 °C to +45 °C in line with DIN EN 60068-2-1, DIN EN 60068-2-2
	storage temperature range	-20 °C to +60 °C
	climatic resistance	+40 °C/90 % rel. humidity in line with DIN EN 60068-2-3
Mechanical resistance		
Vibration	sinusoidal	5 Hz to 150 Hz, max. 2 g at 55 Hz, 55 Hz to 150 Hz, 0.5 g const., in line with DIN EN 60068-2-6
	random	10 Hz to 300 Hz, acceleration 1.2 g (rms), in line with DIN EN 60068-2-64
Shock		40 g shock spectrum, in line with DIN EN 60068-2-27, MIL STD 810E
Electrical safety		in line with EN 61010-1
Dimensions	W × H × D	435 mm × 192 mm × 560 mm (17.1 in × 7.6 in × 22.0 in)
Weight	when fully equipped	13 kg (28.7 lb)
Recommended calibration interval		3 years

Ordering information

Designation	Type	Order No.
Baseband Signal Generator⁸ including power cable, Quick Start Guide, and CD-ROM (with operating and service manual)	R&S [®] AMU200A	1402.4090.02
Options		
Baseband		
Baseband Generator with ARB (128 Msample) and Digital Modulation (realtime)	R&S [®] AMU-B9	1402.8809.02
Baseband Generator with ARB (64 Msample) and Digital Modulation (realtime)	R&S [®] AMU-B10	1402.5300.02
Baseband Generator with ARB (16 Msample) and Digital Modulation (realtime)	R&S [®] AMU-B11	1402.5400.02
Baseband Main Module	R&S [®] AMU-B13	1402.5500.02
Differential I/Q Outputs	R&S [®] AMU-B16	1402.5800.02
Analog/Digital Baseband Inputs	R&S [®] AMU-B17	1402.5900.02
Digital I/Q Output	R&S [®] AMU-B18	1402.6006.02
Digital modulation systems		
Digital Standard GSM/EDGE	R&S [®] AMU-K40	1402.6106.02
Digital Standard 3GPP FDD	R&S [®] AMU-K42	1402.6206.02
3GPP Enhanced MS/BS Tests incl. HSDPA	R&S [®] AMU-K43	1402.6306.02
Digital Standard GPS	R&S [®] AMU-K44	1402.6406.02
Digital Standard 3GPP FDD HSUPA	R&S [®] AMU-K45	1402.8909.02
Digital Standard CDMA2000 [®]	R&S [®] AMU-K46	1402.6506.02
Digital Standard IEEE 802.11 (a/b/g)	R&S [®] AMU-K48	1402.6706.02
Digital Standard IEEE 802.16	R&S [®] AMU-K49	1402.7002.02
Digital Standard TD-SCDMA	R&S [®] AMU-K50	1402.8950.02
Digital Standard TD-SCDMA Enhanced BS/MS Test	R&S [®] AMU-K51	1402.9005.02
Digital Standard DVB-H	R&S [®] AMU-K52	1402.9557.02
Digital Standard EUTRA/LTE	R&S [®] AMU-K55	1402.9405.02
Multicarrier CW Signal Generation	R&S [®] AMU-K61	1402.7102.02
Digital modulation systems using R&S WinIQSIM2™ ⁹		
Digital Standard GSM/EDGE	R&S [®] AMU-K240	1402.7602.02
Digital Standard 3GPP FDD	R&S [®] AMU-K242	1402.7702.02
3GPP Enhanced MS/BS Tests incl. HSDPA	R&S [®] AMU-K243	1402.7802.02
Digital Standard GPS	R&S [®] AMU-K244	1402.7902.02
Digital Standard 3GPP FDD HSUPA	R&S [®] AMU-K245	1402.8009.02
Digital Standard CDMA2000 [®]	R&S [®] AMU-K246	1402.8109.02
Digital Standard IEEE 802.11 (a/b/g)	R&S [®] AMU-K248	1402.8209.02
Digital Standard IEEE 802.16	R&S [®] AMU-K249	1402.8309.02
Digital Standard TD-SCDMA	R&S [®] AMU-K250	1402.8409.02
Digital Standard TD-SCDMA Enhanced BS/MS Test	R&S [®] AMU-K251	1402.8509.02
Digital Standard DVB-H	R&S [®] AMU-K252	1402.9505.02
Digital Standard EUTRA/LTE	R&S [®] AMU-K255	1402.9457.02
Multicarrier CW Signal Generation	R&S [®] AMU-K261	1402.8609.02
AWGN	R&S [®] AMU-K262	1402.8709.02

⁸ The base unit can only be ordered with an R&S[®] AMU-B13 plus one option out of R&S[®] AMU-B9/-B10/-B11/-B17.

⁹ R&S[®] WinIQSIM2™ requires an external PC.

Digital modulation systems using external PC software		
Digital Standard Bluetooth	R&S® AMU-K5	1402.9257.02
Pulse Sequencer	R&S® AMU-K6	1402.9805.02
Fading and noise		
Fading Simulator	R&S® AMU-B14	1402.5600.02
Fading Simulator Extension	R&S® AMU-B15	1402.5700.02
Additive White Gaussian Noise (AWGN)	R&S® AMU-K62	1402.7202.02
Dynamic Fading and Enhanced Resolution	R&S® AMU-K71	1402.7302.02
Enhanced Fading Profiles	R&S® AMU-K72	1402.9605.02
Other options		
BER/BLER Measurement	R&S® AMU-K80	1402.7402.02
I/Q Rear Connectors	R&S® AMU-B81	1402.6858.02
Recommended extras		
Hardcopy manuals (in English, UK)		1402.5222.32
Hardcopy manuals (in English, USA)		1402.5222.39
19" Rack Adapter	R&S® ZZA-411	1096.3283.00
Adapter for Telescopic Sliders	R&S® ZZA-T45	1109.3774.00
BNC Adapter for AUX I/O Connector	R&S® SMU-Z5	1160.4545.02
Keyboard with USB Interface (US assignment)	R&S® PSL-Z2	1157.6870.03
Mouse with USB Interface, optical	R&S® PSL-Z10	1157.7060.02
External USB CD-RW Drive	R&S® PSP-B6	1134.8201.12



For data sheet, see PD 5213.7954.32
and www.rohde-schwarz.com
(search term: AMU200A)



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