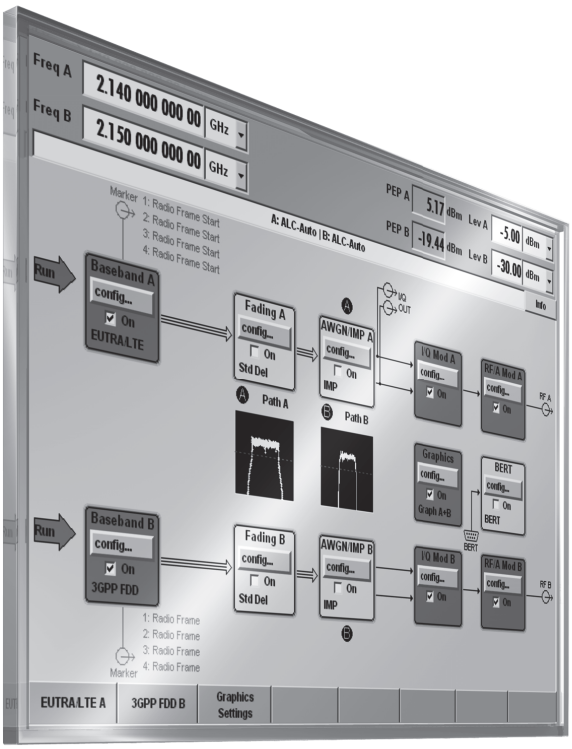
Digital Standards for Signal Generators

Specifications

R&S®SMU200A, R&S®SMATE200A, R&S®SMJ100A,
R&S®SMBV100A, R&S®AMU200A,
R&S®AFQ100A, R&S®AFQ100B



ROHDE&SCHWARZ

Test & Measurement

Data Sheet | 07.00

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Introduction

This document describes the digital standard options of the R&S®SMU200A, R&S®SMATE200A, R&S®SMJ100A and R&S®SMBV100A vector signal generators as well as the R&S®AMU200A baseband signal generator and fading simulator. Furthermore, it describes digital standards working with an external PC software or waveform libraries for the instruments listed above as well as for the R&S®AFQ100A and R&S®AFQ100B I/Q modulation generators.

Notations and abbreviations

Option names consist of the instrument name and a designation that refers to the respective standard. For example, K42 refers to 3GPP FDD. This means that R&S®SMU-K42 is the 3GPP FDD option for the R&S®SMU200A, R&S®SMJ-K42 is the 3GPP FDD option for the R&S®SMJ100A, and so on. The functionality of a digital standard is the same for all instruments, unless otherwise stated. Therefore, the specifications of a standard (e.g. 3GPP FDD – K42 option) are valid for the respective options of all instruments (in this example R&S®SMU-K42, R&S®SMATE-K42, R&S®SMJ-K42, R&S®SMBV-K42, R&S®AMU-K42), unless otherwise stated.

I/Q baseband generators and memory size

Any digital standard requires an I/Q baseband generator installed on the respective Rohde & Schwarz instrument. The following I/Q baseband generators are available:

For the R&S®SMU200A	R&S®SMU-B9	baseband generator with ARB (128 Msample) and digital modulation (realtime)
	R&S®SMU-B10	baseband generator with ARB (64 Msample) and digital modulation (realtime)
	R&S®SMU-B11	baseband generator with ARB (16 Msample) and digital modulation (realtime)
For the R&S®SMATE200A	R&S®SMATE-B9	baseband generator with ARB (128 Msample) and digital modulation (realtime)
	R&S®SMATE-B10	baseband generator with ARB (64 Msample) and digital modulation (realtime)
	R&S®SMATE-B11	baseband generator with ARB (16 Msample) and digital modulation (realtime)
For the R&S®SMJ100A	R&S®SMJ-B9	baseband generator with ARB (128 Msample) and digital modulation (realtime)
	R&S®SMJ-B10	baseband generator with ARB (64 Msample) and digital modulation (realtime)
	R&S®SMJ-B11	baseband generator with ARB (16 Msample) and digital modulation (realtime)
	R&S®SMJ-B50	baseband generator with ARB (64 Msample)
	R&S®SMJ-B51	baseband generator with ARB (16 Msample)
For the R&S®SMBV100A	R&S®SMBV-B10	baseband generator with digital modulation (realtime) and ARB (32 Msample), 120 MHz RF bandwidth
	R&S®SMBV-B50	baseband generator with ARB (32 Msample), 120 MHz RF bandwidth
	R&S®SMBV-B51	baseband generator with ARB (32 Msample), 60 MHz RF bandwidth
For the R&S®AMU200A	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)

As the baseband generators with the same number have the same functionality for all instruments,
R&S®SMU-B9, R&S®SMATE-B9, R&S®SMJ-B9 and R&S®AMU-B9 are referred to as B9,
R&S®SMU-B10, R&S®SMATE-B10, R&S®SMJ-B10, R&S®SMBV-B10 and R&S®AMU-B10 are referred to as B10,
R&S®SMU-B11, R&S®SMATE-B11, R&S®SMJ-B11 and R&S®AMU-B11 are referred to as B11.

All options described in this document can be installed on B9, B10 or B11 baseband generators. Except for the K6, K256 and K352 options, they cannot be installed on R&S®SMJ-B50, R&S®SMJ-B51, R&S®SMBV-B50 and R&S®SMBV-B51. These baseband generators are designed for use with R&S®WinIQSIM2™.

For digital standards options on the R&S®SMBV100A, it is required to install the R&S®SMBV-B92 option (hard disk).

The R&S®AFQ100A and R&S®AFQ100B I/Q modulation generators do not use internal digital standards. They can be used with R&S®WinIQSIM2™, external PC software or waveforms only.

Related documents

This document contains the functional specifications of the digital standards that are running on the instrument (K40 to K81 options) as well as the digital standards that require a specific external PC software (K6 option) or work with waveform libraries (K256 and K352 options). The digital standards with R&S®WinIQSIM2™ (K240 to K268 options) are described in the R&S®WinIQSIM2™ data sheet (PD 5213.7460.22).

For instrument-specific signal performance data such as ACLR or EVM, see the data sheets of the respective Rohde & Schwarz instruments:

R&S®SMU200A data sheet:	PD 0758.0197.22
R&S®SMATE200A data sheet:	PD 0758.1893.22
R&S®SMJ100A data sheet:	PD 5213.5074.22
R&S®SMBV100A data sheet:	PD 5214.1114.22
R&S®AMU200A data sheet:	PD 5213.7954.22
R&S®AFQ100A/B data sheet:	PD 5214.0799.22

Key features

Large variety of digital standards

- EUTRA/LTE including Release 9 and Release 10
- 3GPP FDD with HSDPA, HSUPA and HSPA+ (HSPA Evolution)
- CDMA2000® [1] and 1xEV-DO
- TD-SCDMA
- GSM/EDGE/EDGE Evolution
- WLAN IEEE 802.11 a, b, g, n and ac
- WiMAX™ [2] 802.16
- DVB-H, DVB-T, DAB, T-DMB
- GPS
- Bluetooth® [3]
- XM Radio, Sirius, HD Radio™ [4]
- TETRA Release 2

EUTRA/LTE Release 8, Release 9 and Release 10

- Supports FDD and TDD
- Intuitive user interface with graphical display of time plan
- Full support of P-SYNC, S-SYNC and DL reference signal derived from cell ID
- PBCH, PDSCH, PDCCH, PCFICH, PHICH supported
- PDCCH with full DCI configuration (all DCI formats supported)
- Channel coding and scrambling for PDSCH and PBCH (including MIB)
- Automatic PDSCH scheduling from DCI
- Full MIMO and transmit diversity support
- Supports PUSCH with channel coding and scrambling
- Configuration of all PRACH and PUCCH formats
- Fixed reference channels (FRC) in line with 3GPP TS 36.141
- Downlink test models (E-TMs) in line with 3GPP TS 36.141
- Test case wizard
- Realtime processing of HARQ feedback commands and timing adjustment commands for closed-loop base station tests
- Simulation of single-layer and dual-layer beamforming scenarios (transmission modes 7 and 8) on antenna ports 5, 7 and 8
- Support of MBMS single frequency network (MBSFN) subframes on antenna port 4
- Generation of positioning reference signals (PRS) on antenna port 6
- Access to intermediate results of the FEC chain for design cross-verification
- Generation of LTE-Advanced carrier aggregation scenarios (up to 5 carriers) with support for cross-carrier scheduling
- LTE-Advanced enhanced SC-FDMA with PUSCH/PUCCH synchronous transmission and clustered PUSCH

3GPP FDD/HSDPA/HSUPA/HSPA+

- Support of all physical channels of 3GPP FDD, HSDPA, HSUPA and HSPA+
- HSDPA H-Sets 1 to 12 with channel coding; user-definable H-Set configuration
- HSUPA fixed reference channels with channel coding and HARQ feedback simulation
- Realtime generation of P-CCPCH and up to three DPCHs in downlink
- One UE in realtime in uplink, up to 128 additional mobile stations via ARB
- External dynamic power control of a code channel possible
- Support of UL-DTX and DC-HSDPA

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

[2] "WiMAX Forum" is a registered trademark of the WiMAX Forum. "WiMAX", the WiMAX Forum logo, "WiMAX Forum Certified" and the WiMAX Forum Certified logo are trademarks of the WiMAX Forum. All other trademarks are the properties of their respective owners.

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

[4] HD Radio™ is a proprietary trademark of iBiquity Digital Corporation.

WiMAX™ IEEE 802.16

- Support of IEEE 802.16™-2004/Cor1/D5 and IEEE 802.16e-2005
- Physical layer modes: OFDM, OFDMA, OFDMA/WiBro
- Forward and reverse link, FDD and TDD duplexing
- Burst types: FCH, DL-MAP, UL-MAP, DCD, UCD, HARQ; ranging, fast feedback, data
- Multiple zones and segments (PUSC, FUSC, AMC, sounding)
- Diversity and MIMO coding (DL, UL)

WLAN 802.11n/ac

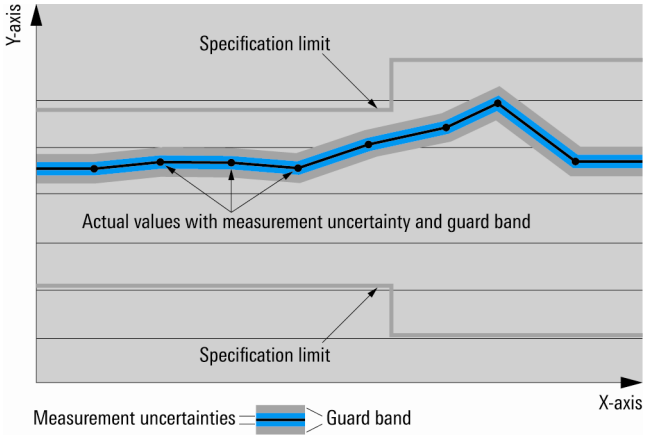
- In line with IEEE 802.11n™-2009 and IEEE P802.11ac/D1.0
- Support of 3 or 4 TX antennas, ready for MIMO
- Bandwidths of 20 MHz, 40 MHz and 80 MHz supported
- Frame block types: data, sounding
- Transmit modes: Legacy, Mixed Mode, Green Field
- Space-time block coding

Definitions

General
Product data applies under the following conditions:

- Three hours storage at ambient temperature followed by 30 minutes warm-up operation
- Specified environmental conditions met
- Recommended calibration interval adhered to
- All internal automatic adjustments performed, if applicable

Specifications with limits
Represent warranted product performance by means of a range of values for the specified parameter. These specifications are marked with limiting symbols such as <, ≤, >, ≥, ±, or descriptions such as maximum, limit of, minimum. Compliance is ensured by testing or is derived from the design. Test limits are narrowed by guard bands to take into account measurement uncertainties, drift and aging, if applicable.



Specifications without limits
Represent warranted product performance for the specified parameter. These specifications are not specially marked and represent values with no or negligible deviations from the given value (e.g. dimensions or resolution of a setting parameter). Compliance is ensured by design.

Typical data (typ.)
Characterizes product performance by means of representative information for the given parameter. When marked with <, > or as a range, it represents the performance met by approximately 80 % of the instruments at production time. Otherwise, it represents the mean value.

Nominal values (nom.)
Characterize product performance by means of a representative value for the given parameter (e.g. nominal impedance). In contrast to typical data, a statistical evaluation does not take place and the parameter is not tested during production.

Measured values (meas.)
Characterize expected product performance by means of measurement results gained from individual samples.

Uncertainties
Represent limits of measurement uncertainty for a given measurand. Uncertainty is defined with a coverage factor of 2 and has been calculated in line with the rules of the Guide to the Expression of Uncertainty in Measurement (GUM), taking into account environmental conditions, aging, wear and tear.

Typical data as well as nominal and measured values are not warranted by Rohde & Schwarz.

In line 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.

Digital standards

The data specified applies together with the parameters of the associated standard. The entire frequency range of the respective instrument as well as filter parameters and symbol rates can be set by the user.

Prerequisite for installation – R&S®SMU200A, R&S®SMATE200A, R&S®AMU200A

At least one I/Q baseband generator of the following types must be installed:

- For the R&S®SMU200A: R&S®SMU-B9, R&S®SMU-B10 or R&S®SMU-B11
- For the R&S®SMATE200A: R&S®SMATE-B9, R&S®SMATE-B10 or R&S®SMATE-B11
- For the R&S®AMU200A: R&S®AMU-B9, R&S®AMU-B10 or R&S®AMU-B11

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®SMU-K40 for an R&S®SMU200A). If only one R&S®SMU-K40 option 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.

Prerequisite for installation – R&S®SMJ100A

An R&S®SMJ-B9, R&S®SMJ-B10 or R&S®SMJ-B11 I/Q baseband generator must be installed. The options cannot be used with the R&S®SMJ-B50 and R&S®SMJ-B51 I/Q baseband generators.

Prerequisite for installation – R&S®SMBV100A

An R&S®SMBV-B10 baseband generator must be installed. The options cannot be used with the R&S®SMBV-B50 and R&S®SMBV-B51 I/Q baseband generators.

It is required to install the R&S®SMBV-B92 option (hard disk).

EUTRA/LTE digital standard

For the R&S®SMU-K55, R&S®SMATE-K55, R&S®SMJ-K55, R&S®SMBV-K55 and R&S®AMU-K55 options.

EUTRA/LTE digital standard		in line with 3GPP Release 8: TS 36.211 v.8.9.0, TS 36.212 v.8.8.0, TS 36.213 v.8.8.0
General settings		
Frequency		user-selectable in entire frequency range of respective Rohde & Schwarz instrument
Output level		default: –30 dBm user-selectable in entire output level range of respective Rohde & Schwarz instrument
Test case wizard (not available for the R&S®AMU-K55 option)	configuration assistant for easy setup of test cases in line with TS 36.141	
Sequence length	sequence length can be entered in frames (10 ms each); max. length depending on channel bandwidth and ARB size: 16 Msample: 54 (20 MHz BW) to 873 (1.4 MHz BW) frames 64 Msample: 218 (20 MHz BW) to 3495 (1.4 MHz BW) frames 128 Msample: 436 (20 MHz BW) to 6990 (1.4 MHz BW) frames Note: The max. length is only valid if realtime filtering is used.	
Baseband filter	EUTRA/LTE filter with different optimization modes	best EVM, balanced EVM and ACP, best ACP, best ACP (narrow)
	other	see data sheet of respective Rohde & Schwarz instrument, “I/Q baseband generator” section
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 %
Marker		subframe radio frame start frame active marker restart pulse pattern on/off ratio
Triggering		see data sheet of respective Rohde & Schwarz instrument, “I/Q baseband generator” section
Duplexing		FDD, TDD
Link direction		downlink, uplink
Physical layer mode	fixed value; depends on selected link direction: OFDMA in downlink, SC-FDMA in uplink	
EUTRA test models (downlink)	in line with 3GPP TS 36.141 v.8.7.0 both FDD and TDD E-TMs are supported	E-TM1.1, E-TM1.2, E-TM2, E-TM3.1, E-TM3.2, E-TM3.3
Physical settings		
Channel bandwidth	determines the channel bandwidth used	1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz, user-defined
FFT size	The FFT size (128, 256, 512, 1024, 2048) is user-selectable if it is larger than the selected number of occupied subcarriers. For 15 MHz bandwidth, an FFT size of 1536 can be selected.	
Sampling rate	The sampling rate is automatically set in line with the selected channel bandwidth.	
Number of occupied subcarriers	The number of occupied subcarriers is automatically set in line with the selected channel bandwidth.	
Number of left guard subcarriers	The number of left guard carriers is automatically set in line with the selected FFT size.	
Number of right guard subcarriers	The number of right guard carriers is automatically set in line with the selected FFT size.	
Number of resource blocks	The number of resource blocks is automatically set in line with the selected channel bandwidth and physical resource block bandwidth.	

Cell-specific settings		
Physical cell ID group	determines cell ID together with physical layer ID	0 to 167
Physical layer ID	determines cell ID together with physical cell ID group	0 to 2
TDD special subframe configuration	only selectable if duplexing mode is set to TDD	0 to 8
TDD uplink/downlink configuration	only selectable if duplexing mode is set to TDD	0 to 6
Cyclic prefix	determines whether a normal or extended cyclic prefix is used for the subframes Note: It automatically determines the number of symbols per subframe.	normal, extended, user-defined
Downlink simulation		
Additional cell-specific settings in downlink		
PDSCH ratio P_B/P_A	sets the energy per resource element ratio between OFDM symbols containing a reference signal and those not containing one for PDSCH	selectable values in line with TS 36.213
PDCCH ratio P_B/P_A	sets the energy per resource element ratio between OFDMA symbols containing a reference signal and those not containing one for PDCCH	–10 dB to +10 dB in steps of 0.01 dB
PBCH ratio P_B/P_A	sets the energy per resource element ratio between OFDMA symbols containing a reference signal and those not containing one for PBCH	–10 dB to +10 dB in steps of 0.01 dB
PHICH duration		normal, extended
PHICH N_g		1/6, 1/2, 1, 2, custom
MIMO		
Global MIMO configuration	simulated antenna configuration Note: One baseband generator simulates one antenna.	1, 2, 4 transmit antennas, SISO + BF
Simulated antenna	simulated antenna Note: One baseband generator simulates one antenna.	antenna 1, 2, 3, 4
Downlink reference signal structure		
Reference symbol power	power of reference symbol	–80 dB to +10 dB, in steps of 0.01 dB
Synchronization signal settings		
P-/S-SYNC TX antenna	determines the antenna(s) from which the SYNC signal is transmitted	all, antenna 1, 2, 3, 4
P-SYNC power	determines the power of the primary synchronization signal	–80 dB to +10 dB, in steps of 0.01 dB
S-SYNC power	determines the power of the secondary synchronization signal	–80 dB to +10 dB, in steps of 0.01 dB
Resource allocation downlink		
Number of configurable subframes	determines the number of configurable subframes; the subframe configurations are used periodically Note: P/S-SYNC and PBCH are configured globally and therefore not copied here. The use of this function ensures a valid frame configuration.	up to 40 subframes The actual range depends on the duplex mode, on the sequence length and – in the case of TDD – on the UL/DL configuration.
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 a normal or extended cyclic prefix is used for a specific subframe Note: It automatically determines the number of OFDMA symbols per subframe.	normal, extended Note: The cyclic prefix type can be set here only if the cyclic prefix type in the general settings dialog is set to user-defined.
Number of allocations used	determines the number of scheduled allocations in the selected subframe	1 to total number of RBs

Allocation table		
Code word	up to 2 code words can be configured for MIMO	1/1,1/2, 2/2
Modulation	determines modulation scheme used	QPSK, 16QAM, 64QAM
VRB gap	generates VRBs of localized and distributed type	0 (localized), 1, 2
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 selected 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
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 to PN 23, data list, pattern, All 0, All 1
Power	determines power of selected allocation	–80 dB to +10 dB in steps of 0.01 dB
Content type	determines type of selected allocation	PDSCH, PDCCH, PBCH, RSVD (user-configurable)
State	sets state of selected allocation	on, off
Enhanced settings PDSCH		
Precoding scheme	sets multi-antenna mode for selected allocation Note: The available selection depends on the global MIMO configuration.	none, transmit diversity, spatial multiplexing, TX mode 7
Number of layers	The available selection depends on the global MIMO configuration.	1 to 4
Codebook index	The available selection depends on the global MIMO configuration.	0 to 15
Cyclic delay diversity	The available selection depends on the global MIMO configuration.	no CDD, large delay
Scrambling state		on, off
UE ID/n_RNTI	user equipment identifier (n_RNTI) for selected allocation	0 to 65535
Channel coding state	enables channel coding (FEC)	on, off
Transport block size		1 to 100000
Redundancy version index		0 to 3
IR soft buffer size		800 to 304000
Configuration of PCFICH, PHICH, PDCCH		
State	enables PCFICH, PHICH, PDCCH	on, off
Precoding scheme	sets multi-antenna mode for PCFICH, PHICH and PDCCH Note: The available selection depends on the global MIMO configuration.	transmit diversity
PCFICH power	determines power of PCFICH	–80 dB to +10 dB in steps of 0.01 dB
PCFICH scrambling state		on, off
Control region for PDCCH		1 to 3 OFDM symbols
PHICH power	determines power of a single PHICH symbol	–80 dB to +10 dB in steps of 0.01dB
Number of PHICH groups		0 to 10
ACK/NACK pattern	can be set individually for each PHICH group	0, 1, – (up to 8 values)
PDCCH power	determines power of PDCCH	–80 dB to +10 dB in steps of 0.01dB
PDCCH scrambling state		on, off
PDCCH format	PDCCH format –1 is Rohde & Schwarz signal generator's proprietary format for legacy support; PDCCH format variable allows flexible configuration of DCIs	–1 to 3, variable
Number of PDCCHs		depends on selected PDCCH format
Data source PDCCH	determines data source of PDCCH	PN9, PN11, PN15 to PN 23, data list, pattern, All 0, All 1
DCI format	can be individually mapped to CCEs	0, 1, 1a, 1b, 1c, 1d, 2, 2a, 3, 3a

Configure user		
	The Configure User dialog makes it possible to define and configure up to four scheduled UEs that can be distributed over the entire frame by setting the data source of a specific allocation in the allocation table to User. Subframe allocations that are not adjacent or allocations of a different subframe can be configured to allow the use of a common data source.	
Scrambling state	enables scrambling for all allocations belonging to the selected user	on, off
Channel coding state	enables channel coding (FEC) for all allocations belonging to the selected user	on, off
UE ID/n_RNTI	user equipment identifier (n_RNTI) for selected user	0 to 65535
Data source	determines data source of user currently being configured	PN9, PN11, PN15 to PN 23, data list, pattern, All 0, All 1
Configure dummy data		
Dummy data modulation		QPSK, 16QAM, 64QAM
Dummy data source		PN9, PN11, PN15 to PN 23, data list, pattern, All 0, All 1
Dummy data power	determines power of dummy data allocations	–80 dB to +10 dB in steps of 0.01 dB

Uplink simulation		
Additional cell-specific settings in uplink		
Group hopping	activates reference signal group hopping while deactivating sequence hopping	on, off
Sequence hopping	only selectable if group hopping is deactivated	on, off
Delta sequence shift for PUSCH		0 to 29
n(1)_DMRS	sets the broadcast part of the DMRS index	0 to 11
Enable n_PRS		on, off
PRACH configuration		1 to 63
Restricted set		on, off
Number of shifts available in cell		1 to 12
Uplink frequency hopping mode		intra-SF, inter-SF
PUSCH hopping offset		0 to total number of RBs – 2
Number of subbands		1 to 4
Number of RBs used for PUCCH		0 to total number of RBs
Delta shift		1 to 3
Delta offset		0 to delta shift – 1
N(1)_cs	if number of RBs used for PUCCH is 0	always 0
	otherwise	0 to 7, but only multiples of delta shift
N(2)_RB	if N(1)_cs is 0	0 to number of RBs used for PUCCH
	otherwise	0 to number of RBs used for PUCCH – 1
SRS subframe configuration		0 to 15
SRS bandwidth configuration		0 to 7
Resource allocation uplink		
Select user equipment	Up to 4 UEs can be configured individually and allocated to the subframes.	
Number of configurable subframes (for FDD), number of configurable uplink subframes (for TDD)	determines the number of configurable uplink subframes; the subframe configurations are used periodically Note: Sounding reference signals are configured globally and therefore not copied here.	up to 40 subframes The actual range depends on the duplex mode, on the sequence length and – in the case of TDD – on the UL/DL configuration.
Cyclic prefix	determines whether a normal or extended cyclic prefix is used for a specific subframe Note: It automatically determines the number of SC-FDMA symbols per subframe.	normal, extended Note: The cyclic prefix type can be set here only if the cyclic prefix type in the general settings dialog is set to user-defined.
Allocation table		
Content type	UE can be set to PUSCH or PUCCH	PUSCH, PUCCH
Modulation	determines the modulation scheme used if content type is PUSCH or the PUCCH format if content type is PUCCH	QPSK, 16QAM, 64QAM or format 1, 1a, 1b, 2, 2a, 2b
Number of resource blocks (RB)	defines size of selected allocation in terms of resource blocks	1 to total number of RBs

Offset VRB	sets the virtual resource block offset; the physical resource block offset for the two slots of the corresponding subframe is set automatically depending on the frequency hopping settings	0 to total number of RBs – 1
Power	determines power of selected allocation	–80 dB to +10 dB in steps of 0.01 dB
State	sets state of selected allocation	on, off
User equipment configuration		
UE ID/n_RNTI	user equipment identifier (n_RNTI) for selected user equipment	0 to 65535
Power	sets power level of selected UE	–80 dB to +10 dB in steps of 0.01 dB
Mode		standard, PRACH
Restart Data, A/N, CQI and RI every subframe	If activated, all data sources are restarted every subframe.	on/off
FRC state	If activated, several parameters are set in line with the fixed reference channel definitions in 3GPP TS 36.141 v.8.3.0.	on/off
FRC	selects the FRC	A1-1, A1-2, A1-3, A1-4, A1-5, A2-1, A2-2, A2-3, A3-1, A3-2, A3-3, A3-4, A3-5, A3-6, A3-7, A4-1, A4-2, A4-3, A4-4 A4-5, A4-6, A4-7, A4-8, A5-1, A5-2, A5-3, A5-4, A5-5, A5-6, A5-7, A7-1, A7-2, A7-3, A7-4, A7-5, A7-6, A8-1, A8-2, A8-3, A8-4, A8-5, A8-6 (The actual range depends on the configured bandwidth and cyclic prefix settings of the general settings dialog.)
Offset VRB	If the FRC state is switched on, this value replaces all offset VRB values in the allocation table.	0 to total number of FRC RBs – 1
n(2)_DMRS	If the FRC state is switched on, this value replaces all n(2)_DMRS values in the enhanced settings for PUSCH.	0 to 11
Data source	determines data source used for PUSCH of selected UE	PN9, PN11, PN15 to PN 23, data list, pattern, All 0, All 1
Scrambling state		on/off
Channel coding state	enables channel coding (FEC) and multiplexing of control and data information	on/off
Channel coding mode	selects whether data, control information or both is transmitted on the PUSCH	UL-SCH only, UCI + UL-SCH, UCI only
I_HARQ_Offset		0 to 14
I_RI_Offset		0 to 12
I_CQI_Offset		2 to 15
DRS power offset	sets power of DRS relative to power level of PUSCH/PUCCH allocation of corresponding subframe	–80 dB to +10 dB in steps of 0.01 dB
SRS state	enables sending of sounding reference signals	on, off
A/N + SRS simultaneous TX	enables simultaneous transmission of SRS and PUCCH	on, off
SRS power offset	sets power of SRS relative to power level of corresponding UE	–80 dB to +10 dB in steps of 0.01 dB
SRS cyclic shift	cyclic shift used for SRS	0 to 11
Configuration index I_SRS	SRS configuration index	0 to 636 for FDD, 0 to 644 for TDD
Bandwidth config. B_SRS	SRS bandwidth configuration	0 to 3
Transmission comb k_TC	SRS transmission comb	0 to 1
Hopping bandwidth b_hop	SRS hopping bandwidth	0 to 3
Frequency domain position n_RRC	SRS frequency domain position	0 to 100

Enhanced settings for PUSCH		
n(2)_DMRS	sets the part of the DMRS index which is part of the uplink scheduling assignment	0 to 11
Frequency hopping		on, off
Information in hopping bits		0 to 1 if the total number of RBs is less than 50 0 to 3 otherwise
HARQ ACK mode	Note: Bundling will be supported in a later version.	multiplexing, bundling
Number of ACK/NACK bits		1 to 4
ACK/NACK pattern		0, 1
Number of RI bits		1 to 2
RI pattern		0, 1
Number of CQI bits		0 to 64
CQI pattern		0, 1
Transport block size UL-SCH		1 to 100000
Redundancy version index UL-SCH		0 to 3
Enhanced settings for PUCCH		
n_PUCCH	sets PUCCH index	range depending on cell-specific settings
ACK/NACK pattern		0, 1
Number of CQI bits		1 to 13
Number of coded CQI bits		20
CQI pattern		0, 1
Settings for PRACH		
Preamble format	set indirectly by PRACH configuration	0 to 4
RB offset	sets the start resource block used for the PRACH Note: Can be set individually for each subframe that is allowed to carry a PRACH in line with the selected PRACH configuration.	0 to total number of RBs – 1
N_cs configuration	Note: Can be set individually for each subframe that is allowed to carry a PRACH in line with the selected PRACH configuration.	0 to 15
Logical root sequence index	Note: Can be set individually for each subframe that is allowed to carry a PRACH in line with the selected PRACH configuration.	0 to 837
Sequence index (v)	Note: Can be set individually for each subframe that is allowed to carry a PRACH in line with the selected PRACH configuration.	0 to 63
Δt	delays the corresponding PRACH by Δt in µs Note: Can be set individually for each subframe that is allowed to carry a PRACH in line with the selected PRACH configuration.	–250.00 µs to +250.00 µs in steps of 0.01 µs
State	activates the PRACH for the corresponding subframe Note: Can be set individually for each subframe that is allowed to carry a PRACH in line with the selected PRACH configuration.	on, off

EUTRA/LTE closed-loop BS test

For the R&S®SMU-K69, R&S®SMATE-K69, R&S®SMJ-K69 and R&S®AMU-K69 options.

For each K69 option, a K55 option must also be installed on the respective instrument.

General description	This option enhances the K55 option (EUTRA/LTE digital standard) to support realtime processing of feedback commands for HARQ feedback, timing adjustment and timing advance in order to be able to perform uplink closed-loop base station tests in line with 3GPP TS 36.141. The K69 option requires the K55 option. Therefore, all general parameters of the K55 option are also valid for the K69 option, unless stated otherwise in the sections below. Realtime processing of feedback commands is possible only for UE1 in standard mode (not in PRACH mode). Two types of commands are supported: binary commands (for HARQ feedback) and serial commands (for HARQ feedback, timing adjustment and timing advance).	
Uplink realtime feedback configuration for UE1		
Realtime feedback mode	switches on realtime feedback processing and selects the mode	off, binary, serial, serial 3 × 8
Redundancy version sequence	specifies the possible redundancy versions for uplink HARQ transmissions in the PUSCH channel	sequence of up to 8 entries in the range from 0 to 3
Maximum number of transmissions	specifies the maximum number of transmissions in the individual HARQ processes if NACK commands are received before a restart of the redundancy versions is enforced	1 to 20
Assume ACK until first received ACK command (only if serial realtime feedback mode or serial 3 × 8 realtime feedback mode is selected)	If enabled, the instrument behaves as if it constantly receives ACK commands before the first real ACK is received from the DUT; useful for synchronization of DUT and instrument.	on, off
Initial timing advance	specifies the initial timing advance of the uplink UE1 signal at the output of the instrument's baseband unit	0 to 1282 in units of 16 × T_S
ACK definition (only if binary realtime feedback mode is selected)	specifies if a low or high binary voltage level means ACK	low, high
Connector	specifies the connector to be used for the feedback commands	USER 1, LEVATT
Distance mode (only if binary realtime feedback mode is selected)	specifies when a binary feedback command affects the generated uplink signal	3GPP, direct response
Additional user delay	used for the determination of the points in time when the instrument expects the feedback commands	
	range if binary realtime feedback mode is selected	–1.00 to +2.99
	range if serial realtime feedback mode or serial 3x8 realtime feedback mode is selected	–1.00 to +1.99
Baseband selector (only if serial realtime feedback mode or serial 3 × 8 realtime feedback mode is selected)	specifies the identifier of the baseband unit, which is needed if feedback commands for several units are transmitted via one line	0 to 3
Serial rate (only if serial realtime feedback mode is selected)	specifies the bit rate for serial transmission	115.2 kbps, 1.6Mbps, 1.92 Mbps
Block error insertion	simulation of block errors	off, first HARQ process, all HARQ processes
Block error rate		0.0001 to 1.0000

Changes in the parameter ranges of parameters that are also present without the K69 option (These changes apply only if the realtime feedback functionality is used.)		
Parameters in the UE1 configuration dialog	restart data, A/N, CQI and RI every subframe	on
Parameters in the UL frame configuration dialog	number of configurable subframes (for FDD) or number of configurable uplink subframes (for TDD)	number of HARQ processes (in line with 3GPP TS 36.213) or integer divisions of the number of HARQ processes
Parameters in the UE 1 PUSCH enhanced settings dialog	redundancy version index	auto
Parameters in the Filter/Clipping settings dialog	time domain windowing state	off
	filter optimization	best EVM, balanced EVM and ACP
	filter mode	realtime
Parameters in the Trigger/Marker/Clock dialog	marker 4	not available
Parameters in the User Marker/Aux I/O dialog	map output connector user 1 (BNC) to	general-purpose input

EUTRA/LTE log file generation

For the R&S®SMU-K81, R&S®SMATE-K81, R&S®SMJ-K81 and R&S®AMU-K81 options.

For each K81 option, a K55 option must also be installed on the respective instrument.

General description	This option enhances the K55 option (EUTRA/LTE digital standard) to generate logging files that contain intermediate results from the signal processing chain including forward error correction (FEC). The intermediate results are stored in files either in bit stream or I/Q sample format, depending on the type of logging point. Furthermore, summary log files can be generated containing additional information about the generated signal (e.g. detailed DCI mapping information).	
General settings		
Logging state		off, on
Output path	The output path the logging files are stored to is user-selectable.	
Physical channels		
Downlink	PDSCH, PBCH, PCFICH/PHICH/PDCCH	
Uplink	PUSCH including UCI	
Logging points		
Downlink	Logging files can be generated for transport block, transport block CRC, code block segmentation/CRC, channel coding, rate matching, code block concatenation, scrambling, modulation, layer mapping and precoding.	
Uplink	Logging files can be generated for transport block, transport block CRC, code block segmentation/CRC, channel coding, rate matching, code block concatenation, data/control multiplexer, channel interleaver, scrambling, modulation and DFT precoding.	

EUTRA/LTE Release 9 and enhanced features

For the R&S®SMU-K84, R&S®SMATE-K84, R&S®SMJ-K84, R&S®SMBV-K84 and R&S®AMU-K84 options.

For each K84 option, a K55 option must also be installed on the respective instrument.

General description	This option enhances the K55 option (EUTRA/LTE digital standard) to support LTE Release 9, including the following features: • Generation of positioning reference signals (PRS) • Dual-layer beamforming (transmission mode 8) • MBMS single frequency network (MBSFN) The K84 option requires the K55 option. Therefore, all general parameters of the K55 option are also valid for the K84 option, unless stated otherwise in the sections below.	
EUTRA/LTE digital standard		in line with 3GPP Release 9 (March 2011): TS 36.211 v.9.1.0, TS 36.212 v.9.3.0, TS 36.213 v.9.3.0
Positioning reference signals (PRS)		
PRS state		on/off
PRS configuration index	in line with TS 36.211-910, table 6.10.4.3-1	0 to 2399
PRS periodicity (T_PRS)	read-only, displays the periodicity of the PRS generation in line with TS 36.211-910, table 6.10.4.3-1	160, 320, 640, 1280 subframes
PRS subframe offset (Delta_PRS)	read-only, displays the subframe offset of the PRS generation in line with TS 36.211-910, table 6.10.4.3-1	0 to 1279 subframes
Number of PRS DL subframes (N_PRS)	defines the number of consecutive PRS subframes	1, 2, 4, 6 subframes
PRS bandwidth	defines the resource blocks in which the PRS are transmitted	1.4/3/5/10/15/20 MHz
PRS power	sets the power of a PRS resource element relative to a common reference signal (CRS) resource element	–80.00 dB to +10.00 dB
Dual-layer beamforming		
This option enables the generation of downlink signals dedicated to UE that is set to transmission mode 8. In order to support this mode, the DCI format 2B is introduced. The way that the (logical) antenna ports are mapped to the (physical) TX antennas of the signal generator is configurable. This feature allows UE receiver testing in line with the beamforming model defined in TS 36.101, B.4.		
Antenna port mapping	defines how the (logical) antenna ports are mapped to the (physical) TX antennas of the signal generator	codebook, random codebook, fixed weights
MBMS single frequency network (MBSFN)		
This option enables the generation of MBSFN subframes. All different allocation, modification and repetition periods can be set individually within the maximum number of frames that can be generated in line with the sequence length enabled by the R&S®SMBV-K55 option. References to the official 3GPP TS 36.331 v.9.5.0 specification are abbreviated as 36.331.		
MBSFN mode	mixed: 15 kHz subcarrier spacing dedicated: 7.5 kHz subcarrier spacing [5]	off, mixed, dedicated
MBSFN rho A	sets the power of the MBSFN channels relative to the common reference signals	–80.00 dB to +10.00 dB
UE category	defines the MBMS UE category as specified in 36.306	1 to 5
Radio frame allocation period	(from 36.331, MBSFN-SubframeConfig) indicates the radio frames that contain MBSFN subframes	1, 2, 4, 8, 16, 32 frames
Radio frame allocation offset	(from 36.331, MBSFN-SubframeConfig) indicates the radio frames that contain MBSFN subframes	0 to 7 frames
Subframe allocation mode	(from 36.331, MBSFN-SubframeConfig) defines whether MBSFN periodic scheduling is done in 1 or 4 frame mode	1 frame, 4 frames
Allocation value (HEX)	(from 36.331, MBSFN-SubframeConfig, identical to bitmap of subframe allocation) defines which subframes are used for MBSFN	
	1 frame	0x00 to 0x3F
	4 frames	0x000000 to 0xFFFFFF

[5] The dedicated mode will be supported in a later version.

Area ID (N_ID_MBSFN)	(from 36.331, MBSFN-AreaInfoList) indicates the MBSFN area ID	0 to 255
Non-MBSFN region length	(from 36.331, MBSFN-AreaInfoList) indicates how many symbols from the beginning of the subframe constitute the non-MBSFN region	1, 2 OFDMA symbols
Notification indicator	(from 36.331, MBSFN-AreaInfoList) indicates which PDCCH bit is used to notify the UE about changes of the MCCH	0 to 7
MCCH state		on/off
MCCH repetition period	(from 36.331, MBSFN-AreaInfoList) defines the interval between transmissions of MCCH information in radio frames	32, 64, 128, 256 frames
MCCH offset	(from 36.331, MBSFN-AreaInfoList) indicates, together with the MCCH repetition period, the radio frames in which the MCCH is scheduled [6]	0 to 7 frames
MCCH modification period	(from 36.331, MBSFN-AreaInfoList) defines periodically appearing boundaries; the contents of different transmissions of MCCH information can only be different if there is at least one such boundary between them	512, 1024 frames
MCCH MCS	(from 36.331, MBSFN-AreaInfoList) indicates the modulation and coding scheme (MCS) for the MCCH	2, 7, 13, 19
Notification subframe index	(from 36.331, MBMS-NotificationConfig) indicates the subframe used to transmit MCCH change notifications on PDCCH	1 to 6
Notification repetition coefficient	(from 36.331, MBMS-NotificationConfig) actual change notification repetition period for the MCCH	2, 4
Notification offset	(from 36.331, MBMS-NotificationConfig) indicates, together with the notification repetition coefficient, the radio frames in which the MCCH information change notification is scheduled [6]	0 to 7 frames
Common subframe allocation period	(from 36.331, MBSFN-AreaConfiguration) indicates the period during which resources corresponding with the radio frame allocation period field are divided between the PMCHs that are configured for this MBSFN area	4, 8, 16, 32, 64, 128, 256 frames
Number of PMCHs	defines the number of PMCHs of the simulated MBSFN area	1 to 15
Subframe allocation start	indicates the first subframe allocated to a specific PMCH within a period identified by the radio frame allocation period	0 to 1534
Subframe allocation end	indicates the last subframe allocated to a specific PMCH within a period identified by the radio frame allocation period	1 to 1535
Scheduling period	(from 36.331, PMCH-InfoList) indicates the MCH scheduling period, i.e. the periodicity used for providing MCH scheduling information at lower layers (MAC) for a specific PMCH	8, 16, 32, 64, 128, 256, 512, 1024 frames
MCS	(from 36.331, PMCH-InfoList) indicates the modulation and coding scheme (MCS) for a specific PMCH	0 to 28
Data source	sets the data source for a specific PMCH	PN9, PN11, PN15 to PN 23, data list, pattern, All 0, All 1

[6] Read-only, same value as radio frame allocation offset.

EUTRA/LTE Release 10/LTE-Advanced

For the R&S®SMU-K85, R&S®SMATE-K85, R&S®SMJ-K85 and R&S®AMU-K85 options.

For each K85 option, a K55 option must also be installed on the instrument.

General description	This option enhances the K55 option (EUTRA/LTE digital standard) to support LTE Release 10/LTE-Advanced including the following features: • DL carrier aggregation including cross-carrier scheduling • Generation of DCIs with carrier indicator field (CIF) • PUCCH format 3 • Simultaneous PUSCH and PUCCH transmission • Non-contiguous PUSCH transmission (uplink resource allocation type 1) The K85 option requires the K55 option. Therefore, all general parameters of the K55 option are also valid for the K85 option, unless stated otherwise in the sections below.	
EUTRA/LTE digital standard		in line 3GPP Release 10 (June 2011): TS 36.211 v.10.2.0, TS 36.212 v.10.2.0, TS 36.213 v.10.2.0

Downlink simulation

Carrier aggregation settings		
This option enables the generation of DL carrier aggregation signals with up to five component carriers (1 × Primary Cell/PCell and 4 x Secondary Cells/SCells) in line with EUTRA Release 10. The exact number of component carriers that can be generated within one baseband depends on the maximum available bandwidth of the baseband generator, the bandwidth and the exact frequency offsets of the individual component carriers. References to the official 3GPP TS 36.331 v.10.2.0 specification are abbreviated as 36.331.		
Activate carrier aggregation	activates the generation of several component carriers (CC)	on, off
Cell index	(from 36.331, RRCConnectionReconfiguration) cell index of SCell, not to be mixed up with the physical cell ID; is required for signaling on the DCI CIF (carrier indicator field)	1 to 7
Phy cell ID	(from 36.331, RRCConnectionReconfiguration) sets the physical cell ID of the SCell	0 to 503
Bandwidth	sets the bandwidth of the SCell	1.4 MHz, 3 MHz, 5 MHz, 10 MHz, 15 MHz, 20 MHz
Delta f/MHz	defines the frequency shift for this SCell relative to the PCell	
	range	depends on the respective Rohde & Schwarz instrument
	resolution	0.1 MHz
CIF present	(from 36.331, CrossCarrierSchedulingConfig) defines whether the CIF (carrier indicator field) is present or not in PDCCH DCI formats transmitted from this cell	on, off
schedCell Index	(from 36.331, CrossCarrierSchedulingConfig) defines from which cell this cell receives the DL and UL grants	0 to 7
PDSCH start	(from 36.331, CrossCarrierSchedulingConfig) sets the starting symbol of the PDSCH for the SCell (control region for PDCCH)	1 to 4
Power/dB	sets the power offset of the SCell relative to the PCell	–80.00 to +10.00
State	activates/deactivates this cell	1, 2, 3, 4

DCI configuration		
Cell index	defines from which cell this DCI is transmitted when carrier aggregation is activated	0 to 7
Carrier indicator field	part of DCI when CIF is set to be present; defines on which cell UL/DL transmission takes place	0 to 7

Uplink simulation

General configuration		
This option enables the generation of uplink signals in line with EUTRA Release 10.		
3GPP release	enables/disables the Release 10 functionality for a user equipment	Releases 8/9, Release 10
Number of configurable uplink subframes	independently configurable for PUSCH and PUCCH if a user equipment is a configured Release 10 user equipment	1 to the number of uplink subframes in 4 frames
PUCCH format 3		
This option enables the generation of PUCCH with format 3 for configured Release 10 user equipment.		
Modulation/format (for the PUCCH of a configured Release 10 user equipment)	selects the format of the PUCCH	F1, F1a, F1b, F2, F2a, F2b, F3
Simultaneous PUSCH and PUCCH transmission		
This option enables the generation of PUSCH and PUCCH of a configured Release 10 user equipment in the same subframe.		
Content	For a configured Release 10 user equipment, both channel types are available for configuration in the same subframe.	PUCCH, PUSCH
Non-contiguous PUSCH transmission (uplink resource allocation type 1)		
This option enables the generation of PUSCH with non-contiguous frequency allocation (two resource block sets according to uplink resource allocation type 1).		
Set 1 No. RB	number of resource blocks for the first set of a Release 10 user equipment PUSCH or for the only set of a Release 8/9 user equipment PUSCH or for the PUCCH	1 to total number of RBs; the actual range can be limited due to other configurations of the cell or of the user equipment
Set 1 Offset VRB	VRB offset for the first set of a Release 10 user equipment PUSCH or for the only set of a Release 8/9 user equipment PUSCH	0 to total number of RBs – 1; the actual range can be limited due to other configurations of the cell or of the user equipment
Set 2 No. RB	number of resource blocks for the second set of a Release 10 user equipment PUSCH	0 to total number of RBs – 2; the actual range can be limited due to other configurations of the cell or of the user equipment
Set 2 Offset VRB	VRB offset for the second set of a Release 10 user equipment PUSCH	2 to total number of RBs – 3; the actual range can be limited due to other configurations of the cell or of the user equipment

3GPP FDD digital standard

For the R&S®SMU-K42, R&S®SMATE-K42, R&S®SMJ-K42, R&S®SMBV-K42 and R&S®AMU-K42 options.

WCDMA 3GPP FDD digital standard		in line with 3GPP Release 9
Frequency range	frequency bands in line with 3GPP TS 25.101 in uplink and downlink	UTRA FDD frequency bands I to XXI
	range	depending on the respective Rohde & Schwarz instrument
Signal generation modes/sequence length	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, the DPCCH and one DPDCH of one mobile station can be simulated in realtime; further channels and mobile stations (three user-configured ones and up to 128 of identical configuration) can be simulated via the ARB and added to the realtime signal. The sequence length of the ARB component can be entered in frames (10 ms each); the max. length depends on the available baseband option.	
Enhanced channels	special capabilities in up to 4 channels of base station 1 in downlink and in channels of mobile station 1 in uplink: realtime calculation, optional channel coding, simulation of bit and block errors, data lists as sources for data and TPC fields	
Modulation		BPSK (uplink) QPSK (downlink) 16QAM (downlink HS-PDSCH) 64QAM (downlink HS-PDSCH)
Test models	downlink (in line with TS 25.141)	test model 1 with 4/8/16/32/64 DPCH test model 2 test model 3 with 4/8/16/32 DPCH test model 4 test model 5 with 8/4/2 HS-PDSCH channels (in case of 4 HS-PDSCH with 4 or 14 DPCH) test model 6 with 8/4 HS-PDSCH
	uplink (not standardized)	DPCCH + 1 DPDCH at 60 ksps DPCCH + 1 DPDCH at 960 ksps
Test case wizard (not available for the R&S®SMBV-K42 option)	configuration assistant for easy setup of test cases in line with TS 25.141	
Generate waveform file	filtering of data and saving it as ARB waveform file	
Realtime component		
WCDMA signal in realtime	generation of WCDMA signals with 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. As a result, externally generated data can be fed into the signal generation process of the Rohde & Schwarz instrument, e.g. with payload information from higher layers, on transport layer or physical layer. Long power control profiles for DUT power control 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 (max. UE output power)	

Channel coding	coding of 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	
	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 24
	rate matching attribute	1 to 1024
	transport time interval	10 ms, 20 ms, 40 ms
	CRC size	none, 8, 12, 16, 24
	error protection	none, convolutional coding rate ⅓, convolutional coding rate ½, turbo coding rate ⅓
	interleaver ½ 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 K62 AWGN option) • 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 rate	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 rate	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.	
Parameters	OCNS state	on/off
	OCNS mode	standard, HSDPA, HSDPA 2
Applications	testing the receiver of the mobile station under real conditions; measuring the maximum input level in line with TS 25.101	
Additional user equipment	simulation of up to 128 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 128
	scrambling code step	1 to FFFFFF hex
	power offset	–80 dB to 0 dB
Applications	base station tests under real receive conditions	

General settings		
Triggering		see data sheet of respective Rohde & Schwarz instrument, “I/Q baseband generator” section
Chip rate	standard	3.840 Mcps
	range	0.4 Mcps to 5 Mcps
Link direction		uplink (reverse link) and downlink (forward link)
Baseband filter	standard	$\sqrt{\cos}$, α = 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	up to 512 data channels (plus special channels) divided among up to 4 base stations (BS) of 128 code channels each
	uplink	up to 4 user-configurable mobile stations (MS) and 128 additional MS of identical configuration in each of the following modes: PRACH Only, PCPCH Only, DPCCH + DPDCHs
Level reference	for uplink only	RMS power, first DPCCH, PRACH message part, last PRACH preamble
Parameters of every BS		
State		on/off
Scrambling code		0 to 5FFF hex
Second 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 chip to 38400 chip
Diversity/MIMO	The antenna type can be selected in line with different antenna configurations.	single antenna/antenna 1 of 2/ antenna 2 of 2
Open-loop transmit diversity	The output signal can be generated in line with an antenna configuration with or without open-loop transmit diversity.	on/off
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, 16QAM or 64QAM	

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	depending on physical channel type	on/off
Timing offset	depending on physical channel type, time offset that can be separately set for each code channel	0 to 150 (in units of 256 chip)
Pilot length	depending on physical channel type and 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 64 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 chip to 38400 chip
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: PRACH message part 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 components
Start offset		0 to 100 access slots
Time from preamble to preamble		1 to 14 access slots
Time from preamble to message part		1 to 14 access slots
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
Message part length		1, 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: PCPCH message part 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
Start offset		0 to 14 access slots
Time from preamble to preamble		1 to 14 access slots
Time from preamble to message part		1 to 14 access slots
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
Message part length		1 frame to 10 frames
Power control preamble length		0, 8 slots
FBI mode		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		
	power	–80 dB to 0 dB
	DL-UL timing offset	0 chip, 1024 chip
	channelization code	0, fixed
	slot format	0 to 3
	FBI mode	off/1 bit
	FBI pattern	pattern (length: 1 bit to 32 bit)
	TFCI state	on/off
	TFCI	0 to 1023
	TPC mode	2 bit
	TPC data source	All 0, All 1, pattern (length: 1 bit to 64 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
	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	see data sheet of respective Rohde & Schwarz instrument, "Signal performance for digital standards" section	
Adjacent channel leakage ratio (ACLR)		

3GPP FDD enhanced MS/BS tests including HSDPA

For the R&S®SMU-K43, R&S®SMATE-K43, R&S®SMJ-K43, R&S®SMBV-K43 and R&S®AMU-K43 options.

At least one K42 option must be installed on the respective instrument.

General parameters	This option enhances the K42 option (3GPP FDD digital standard) to support HSDPA and dynamic power control. Therefore, all general parameters of the K42 option such as frequency range or modulation are also valid for the K43 option.	
Downlink simulation		
HSDPA channels (HS-SCCH, HS-PDSCH and F-DPCH)		
Enhancements	The K42 option supports simulation of HSDPA/HSPA+ channels in a continuous mode needed for TX measurements in line with TS 25.141 (test models 5 and 6). The K43 option 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 capability 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 NodeBs with realistic statistics	
	RX measurements on 3GPP FDD UEs with correct timing	
Ranges (valid for HS-SCCH and HS-PDSCH with QPSK or 16QAM modulation)	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 or HS-SCCH packets; off: transmission of dummy data between two HS-PDSCH or HS-SCCH packets
Ranges (valid for F-DPCH)	slot format	0

Fixed reference channel definition H-Set		
Enhancements	The K43 option allows HSDPA downlink channels with channel coding to be generated in line with the definition of the fixed reference channels (H-Sets 1 to 6, H-Set 10, H-Set 12) in TS 25.101; in addition, a user-editable H-Set configuration is possible, as well as user-configurable bit/block error insertion for H-Sets 1 to 5.	
Ranges	H-Set	H-Set 1 to H-Set 6, H-Set 10, H-Set 12 user-editable H-Set
	advanced mode	on: The H-Set channels are generated in arbitrary waveform mode. off (only for H-Sets 1 to 5): The H-Set channels are generated in realtime mode.
	HS-SCCH type	type 1 (normal)
	data source	PRBS: 9, 11, 15, 16, 20, 21, 23, All 0, All 1, pattern (length: 1 bit to 64 bit), data lists
	UEID	0 to 65535
	number of HS-PDSCH channel codes	1 to 15
	total HS-PDSCH power	range depends on the number of HS-PDSCH channel codes
	HS-PDSCH modulation	QPSK, 16QAM
	UE supports 64QAM (only for 16QAM modulation)	on: The information signaled in the HS-SCCH is provided under the assumption that the device under test basically supports 64QAM modulation. off: The information signaled in the HS-SCCH is provided under the assumption that the device under test does not support 64QAM modulation.
	transport block size table	0: The transport block size is evaluated in line with table 0 in TS 25.321, subclause 9.2.3.1. 1: The transport block size is evaluated in line with table 1 in TS 25.321, subclause 9.2.3.1.
	transport block size index	0 to 62 in line with TS 25.321, subclause 9.2.3.1.
	virtual IR buffer size (per HARQ process)	up to 304000 in steps of 800; the lower limit depends on the transport block size configuration
	number of HARQ processes per stream	1 to 8
	HARQ simulation mode	constant ACK: Every transmitted HS-PDSCH packet contains new data. constant NACK: Several retransmissions of the same data take place in the HS-PDSCH packets of the individual HARQ processes.
	redundancy version (only for HARQ simulation mode set to constant ACK)	0 to 7
	redundancy version sequence (only for HARQ simulation mode set to constant NACK)	Sequence of a maximum of 30 entries in the range from 0 to 7. The number of entries also determines the number of transmissions of the same data in the HS-PDSCH packets of the individual HARQ processes before new data is transmitted.
	bit error insertion (only if advanced mode is set to off)	rate: 0.5 to 10^{-7} (insertion prior to channel coding or at the physical layer)
	block error insertion (only if advanced mode is set to off)	rate: 0.5 to 10^{-4}

Dynamic power control		
Enhancements	The K42 option makes it possible to vary the output power of a code channel in arbitrary waveform mode by misusing its TPC pattern. The K43 option now allows the variation of the output power in realtime mode for up to 3 DPCHs in three submodes:	
	external (not available for the R&S®SMBV-K43 option)	The UE provides TPC info to the Rohde & Schwarz instrument by an external connector (TTL level).
	by TPC pattern	The 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 K42 option does not support HSDPA for the uplink. The K43 option now allows the simulation of an HS-DPCCH (high speed dedicated physical control channel) in realtime operation (UE1 in “up to Release 7” or “Release 8 and later RT” compatibility mode) and arbitrary waveform mode (UE1 in “Release 8 and later” compatibility mode, UE2 to UE4, additional mobile stations).	
Application	TX measurements on 3GPP FDD UEs supporting HSDPA RX measurements on 3GPP FDD Node Bs supporting HSDPA	
Ranges	compatibility mode	up to Release 7, Release 8 and later, Release 8 and later RT
	power	–80 dB to 0 dB
	start delay	0 to 250 (in units of 256 chip)
Ranges if “up to Release 7” compatibility mode is selected	inter-TTI distance	1 subframe to 16 subframes
	power offset ACK	–10 dB to +10 dB
	power offset NACK	–10 dB to +10 dB
	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
Ranges if “Release 8 and later” or “Release 8 and later RT” compatibility mode is selected	inter-TTI distance (interval)	1 subframe to 16 subframes
	number of table rows	1 to 32
	HARQ-ACK repeat after	max. 2.5 s; range in intervals depends on the inter-TTI distance
	PCI/CQI repeat after	max. 2.5 s; range in intervals depends on the inter-TTI distance
	ranges for parameters in each table row	
	HARQ-ACK from interval	range depends on the inter-TTI distance
	HARQ-ACK to interval	range depends on the inter-TTI distance
	HARQ-ACK	DTX, A, N, PRE,POST
	power offset HARQ-ACK	–10 dB to +10 dB
	PCI/CQI from interval	range depends on the inter-TTI distance
	PCI/CQI to interval	range depends on the inter-TTI distance
	CQI type	DTX, CQI
	$CQI/CQI_s/CQI_1$	0 to 30
	power offset PCI/CQI	–10 dB to +10 dB

Dynamic power control		
Enhancements	The K42 option makes it possible to vary the output power of a code channel in arbitrary waveform mode by misusing its TPC pattern. The K43 option now allows the variation of the output power in realtime mode for UE1 in three submodes:	
	external (not available for the R&S®SMBV-K43 option)	NodeB provides TPC info to the Rohde & Schwarz instrument by an external connector (TTL level)
	by TPC pattern	The 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 NodeBs where closed-loop power control is needed RX measurements on 3GPP FDD NodeBs 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
Uplink test models (in line with TS 34.121)		
3GPP Release 6 test models	K43 option required	TS 34.121, table C.10.1.4, subtests 1 to 6
3GPP Release 8 test models	K43 option required	TS 34.121, table C.10.1.4, subtests 1 to 4
	K43 and K45 options required	TS 34.121, table C.11.1.3, subtests 1 to 5
	K43, K45 and K59 options required	TS 34.121, table C.11.1.4, subtest 1

3GPP FDD HSUPA

For the R&S®SMU-K45, R&S®SMATE-K45, R&S®SMJ-K45, R&S®SMBV-K45 and R&S®AMU-K45 options.

At least one K42 option must be installed on the respective instrument.

General parameters	This option enhances the K42 option (3GPP FDD digital standard) to support HSUPA. Therefore, all general parameters of the K42 option such as frequency range or modulation are also valid for the K45 option.	
Downlink simulation		
HSUPA channels (E-AGCH, E-RGCH, E-HICH)		
Enhancements	In downlink, the K45 option supports simulation of the 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)
	τ <DPCH>	0 to 149 (in units of 256 chip)
Ranges (valid for E-RGCH)	relative grant pattern	up to 32 UP/DOWN/HOLD commands sent periodically
Ranges (valid for E-HICH)	ACK/NACK pattern	up to 32 ACK/NACK commands sent periodically
Ranges (valid for E-AGCH)	E-AGCH information field coding	on/off
	E-DCH TTI	2 ms, 10 ms
	number of configurable TTIs	1 to 10
	ranges for the parameters in each TTI configuration (used cyclically)	
	UEID	0 to 65535
	absolute grant value index	0 to 31
	absolute grant scope	all HARQ processes, per HARQ process

Uplink simulation		
E-DPCCH (E-DCH dedicated physical control channel), E-DPDCH (E-DCH dedicated physical data channel)		
Enhancements	In uplink, the K45 option supports the simulation of one E-DPCCH and up to four E-DPDCHs in each of the mobile stations, and for mobile station 1 also with channel coding in line with the definition of the fixed reference channels in TS 25.104 and TS 25.141 or with user-configured coding chain. Furthermore, a method is provided to control the output of the FRC HARQ processes in realtime using a feedback line (TTL) by which ACKs and NACKs are received in order to fulfill the requirements defined in 3GPP TS 25.141, chapters 8.12 and 8.13.	
Application	RX measurements on 3GPP FDD NodeBs 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-DPDCH	overall symbol rate (total symbol rate of all uplink E-DPDCHs)	15 ksps, 30 ksps, 60 ksps, 120 ksps, 240 ksps, 480 ksps, 960 ksps, 2 × 960 ksps, 2 × 1920 ksps, 2 × 960 ksps + 2 × 1920 ksps, 2 × 960 ksps I only, 2 × 960 ksps Q only, 2 × 1920 ksps I only, 2 × 1920 ksps Q only, 2 × 960 + 2 × 1920 ksps I only, 2 × 960 + 2 × 1920 ksps Q only
	depending on overall symbol rate	
	modulation	BPSK
	active E-DPDCHs	1 to 4
	symbol rate	fixed for active E-DPDCHs
	channelization code	fixed for active E-DPDCHs
	separately for each E-DPDCH	
	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 scheduling	E-DCH TTI	2 ms, 10 ms
	number of table rows	1 to 32
	E-DCH schedule repeats after	max. 2.5 s; range in TTIs depends on the E-DCH TTI size
	ranges for parameters in each table row	
	E-DCH from TTI	range depends on the E-DCH TTI size
	E-DCH to TTI	range depends on the E-DCH TTI size

HSUPA FRC	channel coding in line with the definition of fixed reference channels in TS 25.104 and TS 25.141 or with user-configured coding chain; in addition, a user-configurable virtual HARQ mode or a HARQ feedback mode and bit/block error insertion are possible	
	fixed reference channel (FRC) (channel coding schemes)	FRC 1 to FRC 7, user
	data source E-DCH	PRBS: 9, 11, 15, 16, 20, 21, 23, All 0, All 1, pattern (length: 1 bit to 64 bit), data lists
	overall symbol rate	15 ksps, 30 ksps, 60 ksps, 120 ksps, 240 ksps, 480 ksps, 960 ksps, 2 × 960 ksps, 2 × 1920 ksps, 2 × 960 ksps + 2 × 1920 ksps
	modulation	BPSK
	E-DCH TTI	2 ms, 10 ms
	transport block size table	table 0 (2 ms), table 1 (2 ms), table 0 (10 ms), table 1 (10 ms)
	transport block size index (E-TFCI)	range depends on the selected table
	DTX pattern	up to 32 TX/DTX commands sent periodically
	HARQ feedback simulation (not available for the R&S®SMBV-K45 option): feedback (TTL) connected to LEVATT	
	always use redundancy version 0	on/off
	maximum number of retransmissions	0 to 20
	ACK definition	high, low
	additional user delay	–50 to +60 (in units of 256 chip)
	virtual HARQ mode	
	always use redundancy version 0	on/off
	HARQ ACK/NACK pattern (individual ACK/NACK pattern for each HARQ process)	up to 32 ACK/NACK commands used 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 rate	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 rate	0.5 to 10^{-4}
	application	verification of internal BLER calculation in line with TS 25.141 (BS conformance testing)
Uplink test models (in line with TS 34.121)		
3GPP Release 6 test models	K43 option required	TS 34.121, table C.10.1.4, subtests 1 to 6
3GPP Release 8 test models	K43 option required	TS 34.121, table C.10.1.4, subtests 1 to 4
	K43 and K45 options required	TS 34.121, table C.11.1.3, subtests 1 to 5
	K43, K45 and K59 options required	TS 34.121, table C.11.1.4, subtest 1

3GPP FDD HSPA+

For the R&S®SMU-K59, R&S®SMATE-K59, R&S®SMJ-K59, R&S®SMBV-K59 and R&S®AMU-K59 options.

At least one K43 or K45 option must be installed on the respective instrument. The functionalities of the K59 option depend on the availability of the K43 and K45 options.

General parameters	This option enhances the K43 option (3GPP FDD enhanced MS/BS tests including HSDPA) and/or the K45 option (3GPP HSUPA) to support HSPA+ in downlink and uplink. The K43 and K45 options require the K42 option (3GPP FDD digital standard). Therefore, all general parameters of the K42 option such as frequency range or modulation are also valid for the K59 option. All general parameters of the K43 and/or K45 option(s) such as the H-Set parameters or the FRC HARQ simulation parameters are also valid for the K59 option, unless stated otherwise in the sections below.	
Downlink simulation		
Downlink continuous packet connectivity (CPC): HS-SCCH-less operation (requires the K43 option)		
Enhancements	The K43 option supports simulation of the HS-SCCH in H-Sets with HS-SCCH type 1 (in line with TS 25.212) only. In order for the instrument to support HS-SCCH-less operation, the K59 option now enables simulation of H-Sets with HS-SCCH type 2 (for H-Set 7 and user-editable H-Set).	
Ranges	H-Set	H-Set 1 to H-Set 12, user-editable H-Set; CPC (HS-SCCH-less operation) can be simulated by selecting H-Set 7 or the user-editable H-Set with appropriate settings
	advanced mode (if H-Set is set to H-Set 7 or user-editable H-Set)	always on
	HS-SCCH type	HS-SCCH type 1 to 3, in line with TS 25.212; CPC can be simulated by selecting HS-SCCH type 2
	number of HS-PDSCH channel codes (if HS-SCCH type is set to HS-SCCH type 2)	1 to 2
	HS-PDSCH modulation (if HS-SCCH type is set to HS-SCCH type 2)	always QPSK
	transport block size reference (if HS-SCCH type is set to HS-SCCH type 2)	0 to 3, representing the signaled transport block size information in the HS-SCCH blocks, in line with TS 25.212 Note: The actual transport block size configuration for the HS-PDSCH channel is the same as in the K43 option.
	redundancy version (if HS-SCCH type is set to HS-SCCH type 2 and HARQ simulation mode is set to constant ACK)	always 0
	redundancy version sequence (if HS-SCCH type is set to HS-SCCH type 2 and HARQ simulation mode is set to constant NACK)	The three entries are always 0, 3, 4.

Downlink higher order modulation (HOM): 64QAM (requires the K43 option)		
Enhancements	The K43 option supports simulation of HS-PDSCH channels with channel coding in H-Sets with QPSK and 16QAM modulation only. The K59 option enhances the functionality by providing 64QAM modulation for HS-PDSCH channels with channel coding inside H-Sets (for H-Set 8, H-Set 11 and user-editable H-Set). Note: 64QAM for HS-PDSCH channels in continuous mode without channel coding is already supported by the K42 option.	
Ranges	H-Set	H-Set 1 to H-Set 12, user-editable H-Set; 64QAM can be simulated by selecting H-Set 8, H-Set 11 or the user-editable H-Set with appropriate settings
	advanced mode (if H-Set is set to H-Set 8, H-Set 11 or user-editable H-Set)	always on
	HS-SCCH type	HS-SCCH type 1 to 3, in line with TS 25.212; 64QAM available only for HS-SCCH type 1 or HS-SCCH type 3
	HS-PDSCH modulation (if HS-SCCH type is set to HS-SCCH type 1 or HS-SCCH type 3)	QPSK, 16QAM or 64QAM
	transport block size table (if HS-PDSCH modulation is set to 64QAM)	always table 1: transport block size evaluated in line with table 1 in TS 25.321, subclause 9.2.3.1
Downlink MIMO (requires the K43 option)		
Enhancements	The K43 option does not support MIMO. The K59 option now supports MIMO for the downlink HS-PDSCH channels (double transmit antenna array, D-TxAA).	
Ranges	precoding weight pattern (w2) (if HS-PDSCH channels with MIMO are used)	sequence of up to 16 entries in the range from 0 to 3; specifies the MIMO precoding weight w_2 in line with TS 25.214 used for the HS-PDSCH packets
	stream 2 active pattern (if HS-PDSCH channels with MIMO are used)	sequence of up to 16 entries that are either “1” or “–“ and specify in which HS-PDSCH packets (TTIs) one or two transport blocks are sent
Ranges if HSDPA mode is not set to H-Set	modulation (if HS-PDSCH channels with MIMO are used)	The modulation for the two MIMO streams can be set independently to QPSK, 16QAM or 64QAM.

Ranges if HSDPA mode is set to H-Set	H-Set	H-Set 1 to H-Set 12, user-editable H-Set; MIMO can be simulated by selecting H-Set 9, H-Set 11 or the user-editable H-Set with appropriate settings
	advanced mode (if H-Set is set to H-Set 9, H-Set 11 or user-editable H-Set)	always on
	HS-SCCH type	HS-SCCH type 1 to 3, in line with TS 25.212; MIMO is simulated by selecting HS-SCCH type 3
	HS-PDSCH modulation (if HS-PDSCH modulation is set to HS-SCCH type 3)	The modulation for the two MIMO streams can be QPSK, 16QAM or 64QAM. Note: Only the combinations of modulation modes in line with TS 25.212 table 14 are possible.
	transport block size table (if HS-PDSCH modulation is set to HS-SCCH type 3)	can be set independently for the two MIMO streams 0: The transport block size is evaluated in line with table 0 in TS 25.321, subclause 9.2.3.1. 1: The transport block size is evaluated in line with table 1 in TS 25.321, subclause 9.2.3.1. For 64QAM modulation, only table 1 is applicable to the respective stream.
	transport block size index (if HS-PDSCH modulation is set to HS-SCCH type 3)	can be set independently for the two MIMO streams; 0 to 62; index in line with TS 25.321, subclause 9.2.3.1
	virtual IR buffer size (per HARQ process) (if HS-PDSCH modulation is set to HS-SCCH type 3)	can be set independently for the two MIMO streams; up to 304000 in steps of 800; lower limit depends on transport block size
	redundancy version (if HS-PDSCH modulation is set to HS-SCCH type 3 and HARQ simulation mode to constant ACK)	can be set independently for the two MIMO streams; 0 to 3
	redundancy version sequence (if HS-PDSCH modulation is set to HS-SCCH type 3 and HARQ simulation mode to constant NACK)	can be set independently for the two MIMO streams; sequence of a maximum of 30 entries in the range from 0 to 3; the number of entries also determines the number of transmissions of the same data in the HS-PDSCH packets of the individual HARQ processes before new data is transmitted
Enhanced F-DPCH (requires the K43 option)		
Enhancements	The K43 option supports simulation of F-DPCH channels with slot format 0 only. The K59 option now enables simulation of slot formats 0 to 9.	
Ranges (valid for F-DPCH)	slot format	0 to 9

Features for type 3i enhanced performance requirements tests (requires the K43 option)		
Enhancements	The K43 option does not support OCNS generation for type 3i enhanced performance requirements tests or generation of H-Sets with varying modulation and number of HS-PDSCH codes. The K59 enhances the functionality for supporting both of these features.	
Ranges in the H-Set dialog	randomly varying modulation and number of codes state (only if advanced mode is set to on and HS-SCCH type is set to type 1)	on/off
	alternative HS-PDSCH modulation (only if advanced mode is set to on and HS-SCCH type is set to type 1)	QPSK, 16QAM, 64QAM
	alternative number of HS-PDSCH channelization codes (only if advanced mode is set to on and HS-SCCH type is set to type 1)	1 to 15
	random seed (only if advanced mode is set to on and HS-SCCH type is set to type 1)	0 to 65535
Ranges in the 3GPP main dialog	OCNS mode	standard, HSDPA, HSDPA 2, 3i
	OCNS seed (only if OCNS mode is set to 3i)	0 to 65535

Uplink simulation		
Uplink higher order modulation (HOM): 4PAM (requires the K45 option)		
Enhancements	The K45 option supports E-DPDCH channels with BPSK modulation only. The K59 option now enables 4PAM modulation for E-DPDCH channels without channel coding and with channel coding (FRC 8).	
Ranges in the E-DPDCH settings	modulation (if the overall symbol rate is 2 × 960 ksps, 2 × 1920 ksps, 2 × 960 ksps + 2 × 1920 ksps, 2 × 960 ksps I only, 2 × 960 ksps Q only, 2 × 1920 ksps I only, 2 × 1920 ksps Q only, 2 × 960 ksps + 2 × 1920 ksps I only or 2 × 960 ksps + 2 × 1920 ksps Q only)	BPSK, 4PAM
Ranges in the FRC settings	fixed reference channel (FRC)	1 to 8, user 4PAM can be simulated by selecting FRC 8 or user
	modulation (if the overall symbol rate is 2 × 960 ksps, 2 × 1920 ksps or 2 × 960 ksps + 2 × 1920 ksps)	BPSK, 4PAM
	transport block size table	table 0 (2 ms), table 1 (2 ms), table 2 (2 ms), table 3 (2 ms), table 0 (10 ms), table 1 (10 ms)
Uplink HS-DPCCH extension for MIMO and DC-HSDPA (requires the K43 option)		
Enhancements	The K43 option allows the generation of HS-DPCCH channels to simulate UEs that are neither configured in MIMO mode nor for an active secondary cell. The K59 option now also enables the simulation of UEs that are configured in MIMO mode and/or for an active secondary cell.	
Ranges	MIMO mode	off/on
Ranges if “Release 8 and later” or “Release 8 and later RT” compatibility mode is selected	secondary cell active	off/on
Ranges if “up to Release 7” compatibility mode is selected and MIMO mode is on	power offset ACK/ACK	–10 dB to +10 dB
	power offset ACK/NACK	–10 dB to +10 dB
	power offset NACK/ACK	–10 dB to +10 dB
	power offset NACK/NACK	–10 dB to +10 dB
	power offset CQI type A	–10 dB to +10 dB
	number of TTIs	1 to 32
	ranges for parameters in each TTI configuration (used cyclically)	
	HARQ-ACK	DTX single TB: ACK single TB: NACK TB1: ACK, TB2: ACK TB1: ACK, TB2: NACK TB1: NACK, TB2: ACK TB1: NACK, TB2: NACK
	PCI	0 to 3
	CQI type	type A single TB type A dual TB type B
	$CQI/CQI_s/CQI_1$	0 to 30 (for CQI type A single TB or type B) 0 to 14 (for CQI type A dual TB)
	CQI_2 (only for CQI type A dual TB)	0 to 14
Ranges if “Release 8 and later” or “Release 8 and later RT” compatibility mode is selected and MIMO mode is on and secondary cell active is off	ranges for parameters in each table row	
	HARQ-ACK	DTX, A, N, AA, AN, NA, NN, PRE, POST
	CQI type	DTX type A single TB type A dual TB type B
	$CQI/CQI_s/CQI_1$	0 to 30 (for CQI type A single TB or type B) 0 to 14 (for CQI type A dual TB)
	CQI_2 (only for CQI type A dual TB)	0 to 14
	PCI	0 to 3

Ranges if “Release 8 and later” or “Release 8 and later RT” compatibility mode is selected and MIMO mode is off and secondary cell active is on	ranges for parameters in each table row	
	HARQ-ACK	DTX, A/D, N/D, D/A, D/N, A/A, A/N, N/A, N/N, PRE, POST
	CQI type	DTX, composite CQI
	$CQI/CQI_s/CQI_1$	0 to 30
	CQI_2	0 to 30
Ranges if “Release 8 and later” or “Release 8 and later RT” compatibility mode is selected and MIMO mode is on and secondary cell active is on	ranges for parameters in each table row	
	HARQ-ACK	DTX and all 50 HARQ-ACK combinations of table 15C.2 of 3GPP TS 25.212 v9.2.0
	CQI type	DTX type A single TB type A dual TB type B
	$CQI/CQI_s/CQI_1$	0 to 30 (for CQI type A single TB or type B) 0 to 14 (for CQI type A dual TB)
	CQI_2 (only for CQI type A dual TB)	0 to 14
	PCI	0 to 3
Uplink DPCCH with 4 TPC bits (requires the K43 or K45 option)		
Enhancements	The K42 option allows the simulation of DPCCH with 2 TPC bits per slot only (slot formats 0 to 3). The K59 option now enables simulation of DPCCH with 4 TPC bits per slot (slot formats 0 to 4).	
Ranges in the uplink DPCCH settings	slot format	0 to 4
	TPC mode	2 bit, 4 bit
UL-DTX CPC feature (requires the K45 option)		
Enhancements	The K59 option enables simulation of the UL-DTX CPC feature for mobile station 1.	
Ranges in the UL-DTX configuration dialog	state	off / on
	E-DCH TTI	2 ms, 10 ms
	offset	0 to 159 subframes for 2 ms TTI size, 0 to 155 subframes for 10 ms TTI size
	inactivity threshold for cycle 2	1, 4, 8, 16, 32, 64, 128, 256 TTIs
	long preamble length	2, 4, 15 slots
	DTX cycle 1	1, 4, 5, 8, 10, 16, 20 subframes
	DPCCH burst length 1	1, 2, 5 subframes
	preamble length 1	2 slots, fixed
	postamble length 1	1 slot, fixed
	DTX cycle 2	4, 5, 8, 10, 16, 20, 32, 40, 64, 80, 128, 160 subframes
	DPCCH burst length 2	1, 2, 5 subframes
	preamble length 2	2 slots, fixed
	postamble length 2	1 slot, fixed
Ranges in the dynamic power control configuration dialog	assignment mode for UL-DTX	normal, F-DPCH slot format 0 or 9
Uplink test models (in line with TS 34.121)		
3GPP Release 6 test models	K43 option required	TS 34.121, table C.10.1.4, subtests 1 to 6
3GPP Release 8 test models	K43 option required	TS 34.121, table C.10.1.4, subtests 1 to 4
	K43 and K45 options required	TS 34.121, table C.11.1.3, subtests 1 to 5
	K43, K45 and K59 options required	TS 34.121, table C.11.1.4, subtest 1

GSM/EDGE digital standard

For the R&S®SMU-K40, R&S®SMATE-K40, R&S®SMJ-K40, R&S®SMBV-K40 and R&S®AMU-K40 options.

GSM/EDGE digital standard		in line with GSM standard
Frequency range	frequency bands to GSM 05.05 in uplink and downlink	GSM450 GSM480 GSM850 GSM900 (P-GSM, E-GSM, R-GSM) DCS1800 PCS1900
	range	depending on the respective Rohde & Schwarz instrument
Sequence 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)	configuration of simple multiframe
	application: simulation of modulation change in a slot versus time	scenarios by combining two frames (see frame structure 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 × T = 0.3
	range	B × 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
	fall delay	–9 symbol to +9 symbol
Settable slot attenuation		0.0 dB to +60.0 dB, 8 different levels simultaneously possible (full level and 7 attenuated levels)
Burst on/off ratio		see data sheet of respective Rohde & Schwarz instrument, "Signal performance for digital standards" section

Data sources		for characteristics of data sources, see data sheet of respective Rohde & Schwarz instrument, "I/Q baseband generator" section
	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 data sheet of respective Rohde & Schwarz instrument, "I/Q baseband generator" section
Markers		convenient graphics editor for defining marker signals; in addition: • – frame, multiple frame • – slot, multiple slot • – pulse • – pattern • – on/off ratio
Phase error	see data sheet of respective Rohde & Schwarz instrument, "Signal performance for digital standards" section	
Error vector magnitude		
Power density spectrum		

EDGE Evolution digital standard

For the R&S®SMU-K41, R&S®SMATE-K41, R&S®SMJ-K41, R&S®SMBV-K41 and R&S®AMU-K41 options.

At least one K40 option must be installed on the respective instrument.

General parameters	This option enhances the K40 option (GSM/EDGE digital standard) to support EDGE Evolution (EDGE+) including VAMOS. Therefore, all general parameters of the K40 option such as frequency range are also valid for the K41 option.	
Symbol rate mode		normal symbol rate higher symbol rate
Sequence mode	unframed	normal symbol rate: MSK, AQPSK, 8PSK EDGE, 16QAM EDGE or 32QAM EDGE higher symbol rate: QPSK EDGE, 16QAM EDGE or 32QAM EDGE
	framed (single)	configuration of a signal via frame structure (see frame structure below)
	framed (double)	configuration of simple multiframe
Modulation		normal symbol rate: MSK, FSK, AQPSK, 8PSK EDGE, 16QAM EDGE or 32QAM EDGE higher symbol rate: QPSK EDGE, 16QAM EDGE or 32QAM EDGE
Training sequence		set 1 set 2: normal (GMSK), normal (AQPSK)
Symbol rate	standard	normal symbol rate: 270.833 kHz higher symbol rate: 325 kHz
	range	400 Hz to 325 kHz
Baseband filter	GSM, standard for normal symbol rate	Gaussian with B × T = 0.3
	range	B × T = 0.15 to 2.5
	EDGE, standard for normal symbol rate	Gaussian linearized (EDGE)
	EDGE+ for higher symbol rate	narrow pulse shape wide pulse shape
Frame structure	change possible from slot to slot and frame to frame	normal symbol rate: GSM, AQPSK, 8PSK EDGE, 16QAM EDGE, 32QAM EDGE higher symbol rate: QPSK EDGE, 16QAM EDGE, 32QAM EDGE
	additional burst types for normal symbol rate	normal (AQPSK, full rate – full rate) normal (AQPSK, full rate – half rate) normal (AQPSK, half rate – half rate) normal (16QAM) normal (32QAM) all data (16QAM) all data (32QAM)
	additional burst types for higher symbol rate	normal (QPSK) normal (16QAM) normal (32QAM) all data (QPSK) all data (16QAM) all data (32QAM)

CDMA2000® digital standard

For the R&S®SMU-K46, R&S®SMATE-K46, R&S®SMJ-K46, R&S®SMBV-K46 and R&S®AMU-K46 options.

CDMA2000® digital standard	Release C	in line with 3GPP2 C.S0002-C
Frequency	band class 0 to band class 12	410 MHz to 2170 MHz
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
Sequence length	sequence length entered in frames (80 ms each), max. length depending on baseband generator memory size	
	128 Msample: 1365 frames	
	64 Msample: 682 frames	
	16 Msample: 160 frames	
Baseband filter	standard for reverse link	cdmaOne
	standard for forward link	cdmaOne + equalizer
	for enhanced ACLR	
	reverse link	cdmaOne 705 kHz
	forward link	cdmaOne 705 kHz + equalizer
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 performed prior to baseband filtering and reduces the crest factor	value range 1 % to 100 %
Generate waveform file	filtering of data generated in ARB mode and saving it as waveform file	
Parameters of every BS		
State		on/off
Time delay	timing offset of signals of individual base stations	
	BS1	0 chip (fixed)
	BS2 to BS4	0 chip to 98304 chip
PN offset		0 to 511
Transmit diversity	If this function is activated, the output signal can be generated for either antenna 1 or antenna 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		on/off
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 link	reverse pilot (R-PICH)	
	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)	see data sheet of respective Rohde & Schwarz instrument, “Signal performance for digital standards” section	
Adjacent channel leakage ratio (ACLR)		

1xEV-DO digital standard

For the R&S®SMU-K47, R&S®SMATE-K47, R&S®SMJ-K47, R&S®SMBV-K47 and R&S®AMU-K47 options.

1xEV-DO digital standard	Release A	in line with 3GPP2 C.S0024-A 3.0
Frequency	band class 0 to band class 12	410 MHz to 2170 MHz
Chip rates	standard	1.2288 MHz (1X)
	range	1 MHz to 5 MHz
Link direction		forward link and reverse link
Signal generation modes	In forward link (downlink) mode, the signal is generated in realtime. Parameter changes during active signal output take effect immediately without signal interruption. In reverse link (uplink) mode, the signal is precalculated and played from the ARB memory. Parameter changes result in a recalculation of the signal.	
Sequence length (reverse link)	sequence length entered in slots (1.67 ms each), max. length depending on baseband generator memory size	
	128 Msample: 65536 slots	
	64 Msample: 32768 slots	
	16 Msample: 8192 slots	
Baseband filter	standard for reverse link	cdmaOne
	standard for forward link	cdmaOne + equalizer
	for enhanced ACLR	
	reverse link	cdmaOne 705 kHz
	forward link	cdmaOne 705 kHz + equalizer
Traffic channels	forward link	One base station generates up to four independent traffic channels for different users.
	reverse link	Up to four completely independent access terminals can be simulated.
Clipping level	setting of a limit value relative to the highest peak in percent; limitation is performed prior to baseband filtering and reduces the crest factor	value range 1 % to 100 %
Generate waveform file	filtering of data generated in ARB mode and saving it as waveform file	
PN offset		0 to 511
System time		0 to 2199023255551
Forward link parameters		
Physical layer subtype		0&1 or 2
Continuous pilot mode	transmits pilot only	on/off
Control channel	state	on/off
	data rate	38.4 kbps or 76.8 kbps
	packet start offset	0 to 3
Reverse activity bit (MAC)	state	on/off
	level	–25.0 dB to –7.0 dB
	length (subtype 0&1 only)	8, 16, 32, 64
	offset	0 to 7
Other users count	simulates additional MAC users	1 to 110
Settings for each forward link traffic channel		
State		on/off
Number of packets to send		0 to 65536 or infinite
Packet start offset		0 to 255
Rate index		1 to 12
Packet size	for subtype 0&1, the packet size depends only on the rate index	128 bit to 12288 bit
Data rate	depending on rate index and packet size	4.8 kbps to 3072.0 kbps
Slot count	depending on rate index and packet size	1 to 16
Data pattern		32 bit value
MAC index	subtype 0&1	5 to 63
	subtype 2	6 to 127
MAC level		–25.0 dB to –7.0 dB
Interleave factor		1 to 4
RPC modes		Hold, All Up, All Down, Range, Pattern

DRC lock (MAC)	state	on/off
	period, subtype 0&1	0, 8, 16
	period, subtype 2	0, 4
	length	1, 4, 8, 16, 32
	frame offset	0 to 15
HARQ mode	subtype 2 only	off, ACK, NAK
Settings for each reverse link access terminal in traffic mode		
Physical layer subtype		0&1 or 2
Disable quadrature spreading		on/off
Long code mask I		0 to 3FFF FFFF FFF
Long code mask Q		0 to 3FFF FFFF FFF
Pilot channel gain		–80.0 dB to +10.0 dB
Auxiliary pilot channel	subtype 2 only	
	state	on/off
	relative gain	–80.0 dB to +10.0 dB
	minimum payload	128 bit to 12288 bit
RRI channel	state	on/off
	relative gain (subtype 2 only)	–80.0 dB to +10.0 dB
DSC channel	subtype 2 only	
	state	on/off
	relative gain	–80.0 dB to +10.0 dB
	length	8 slots to 256 slots
	values	up to 16 octal values
DRC channel	state	on/off
	relative gain	–80.0 dB to +10.0 dB
	length	1 slot, 2 slots, 4 slots, 8 slots
	values	up to 16 hexadecimal values
	cover	0 to 7
	gating	on/off
ACK channel	state	on/off
	relative gain	–80.0 dB to +10.0 dB
	mode	BPSK/OOK (subtype 2 only)
	gating	can be set individually per slot, up to 16 values possible
	values	up to 16 binary values
Data channel	number of individual packets	1 (subtype 0&1)/1 to 3 (subtype 2)
	relative gain	–80.0 dB to +10.0 dB
	number of packets to send	0 to 65536 or infinite
	subpackets (subtype 2 only)	1 to 4
	payload size	128 bit to 12288 bit
	modulation, subtype 0&1	BPSK
	modulation, subtype 2	B4, Q4, Q2, Q4Q2, E4E2
	channel coding	on/off
	data source	All 0, All 1, pattern (up to 64 bit), PN 9 to PN 23, data lists
	append FCS	on/off
Settings for each reverse link access terminal in access mode		
Physical layer subtype		0&1 or 2
Disable quadrature spreading		on/off
Long code mask I		0 to 3FFF FFFF FFF
Long code mask Q		0 to 3FFF FFFF FFF
Preamble length		1 frame to 7 frames
Access cycle duration		1 slot to 255 slots
Access cycle offset		0 slot to 12 slots
Pilot channel gain		–80.0 dB to +10.0 dB
Data channel	state	on/off
	relative gain	–80.0 dB to +10.0 dB
	capsule length	1 frame to 15 frames
	data rate	9.6 kbps, 19.2 kbps, 38.4 kbps
	data source	All 0, All 1, pattern (up to 64 bit), PN 9 to PN 23, data lists
	append FCS	on/off

TD-SCDMA digital standard (3GPP TDD LCR)

For the R&S®SMU-K50, R&S®SMATE-K50, R&S®SMJ-K50, R&S®SMBV-K50 and R&S®AMU-K50 options.

WCDMA 3GPP TDD LCR (TD-SCDMA) digital standard		in line with 3GPP TDD standard for a chip rate of 1.28 Mcps (low chip rate mode)
Frequency range	frequency bands in line with 3GPP TS 25.102 in uplink and downlink	UTRA TDD frequency bands a) to d)
	range	depending on the respective Rohde & Schwarz instrument
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.	
	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 data sheet of respective Rohde & Schwarz instrument, “I/Q baseband generator” section
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	$\sqrt{\cos}$ α = 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	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		on/off
Slot mode	uplink dedicated: simulation of up to 16 DPCHs and 1 PUSCH PRACH: simulation of 1 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 chip: 8 chip step width controlled via current user and 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 and 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 from 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 tests including HSDPA

For the R&S®SMU-K51, R&S®SMATE-K51, R&S®SMJ-K51, R&S®SMBV-K51 and R&S®AMU-K51 options.

At least one K50 option must be installed on the respective instrument.

General parameters	This option enhances the K50 option (TD-SCDMA digital standard) to support full channel coding and HSDPA. Therefore, all general parameters of the K50 option such as frequency range or modulation are also valid for the K51 option.	
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	
	insertion of bit and block errors possible	
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 the K62 option) • 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)	

IEEE 802.16 WiMAX™ digital standard

For the R&S®SMU-K49, R&S®SMATE-K49, R&S®SMJ-K49, R&S®SMBV-K49 and R&S®AMU-K49 options.

IEEE 802.16 digital standard		in line with IEEE 802.16 Rev. 2
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, sampling 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 modulation modes 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 or B 4 antennas: matrix A, B or C collaborative spatial multiplexing CSTD
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 and interleaver can be switched on/off independently.
Repetition coding		0, 2, 4, 6
Subcarrier permutation		FUSC, PUSC, AMC2×3, sounding
Subchannel map		user-definable for PUSC
Subchannel rotation		on/off (for uplink PUSC)
Dedicated pilots		on/off (for downlink PUSC and AMC2×3)
Number of bursts with different modulation formats		64 per zone
Burst types		FCH, DL-MAP, UL-MAP, DCD, UCD, SUB-DL-UL-MAP, HARQ, ranging, fast feedback, data
Data		All 0, All 1 pattern (up to 64 bit) PN 9 to PN 23 data lists

IEEE 802.11a/b/g digital standard

For the R&S®SMU-K48, R&S®SMATE-K48, R&S®SMJ-K48, R&S®SMBV-K48 and R&S®AMU-K48 options.

IEEE 802.11a/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	depending on frame duration and available ARB memory	1 frame to 511 frames
Clipping		vector or scalar clipping, applied before filtering
Generate waveform file	filtering of data generated in ARB mode and saving it as waveform file	
Marker modes		restart, frame start, frame active part, pulse, pattern, on/off ratio
Triggering		see data sheet of respective Rohde & Schwarz instrument, “I/Q baseband generator” section
Parameters in framed mode		
Idle time	time between two successive packets (PPDUs)	
	range	0 s to 10000 µs
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) checksum for protecting MAC header and user data (frame body)
Settings for CCK (IEEE 802.11b/IEEE 802.11g)		
Chip rate	standard	11 Mcps
	range	depending on the respective Rohde & Schwarz instrument
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 or 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	depending on the respective Rohde & Schwarz instrument
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	depending on the respective Rohde & Schwarz instrument
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 802.11n digital standard

For the R&S®SMU-K54, R&S®SMATE-K54, R&S®SMJ-K54, R&S®SMBV-K54 and R&S®AMU-K54 options.

IEEE 802.11n digital standard		in line with IEEE 802.11n-2009, IEEE 802.11a-1999, IEEE 802.11b-1999, IEEE 802.11g-2003
General settings		
Bandwidth		20 MHz, 40 MHz
Clipping		vector or scalar clipping, applied before filtering
Generate waveform file	filtering of data generated in ARB mode and saving it as waveform file	
Marker modes		restart, frame block, frame, frame active part, pulse, pattern, on/off ratio
Triggering		see data sheet of respective Rohde & Schwarz instrument, "I/Q baseband generator" section
Chip/sample rate	standard	11 Mcps, 20 Msample/s, 40 Msample/s
	range	depends on the respective Rohde & Schwarz instrument
Baseband filter		spectral mask in line with IEEE 802.11a-1999 – wireless LAN MAC and PHY specifications – chapter 17.3.9.6.2 for LEGACY 20 MHz mode, IEEE 802.11n-2009, chapter 20.3.21, for high throughput (HT) modes
	CCK and PBCC	spectral mask in line with IEEE 802.11b-1999 – wireless LAN MAC and PHY specifications – chapter 18.4.7.3
Configure baseband B from baseband A (not available for the R&S®SMBV-K54 and R&S®SMJ-K54 options)		easy setup for MIMO by means of one configuration process for the coupled transmit antennas
Transmit antenna setup	number of antennas	1 to 4
	mapping coefficient range	(–1000 –1000 i) to (+1000 +1000 i) with resolution = 0.01/dimension
	output destination	current baseband, baseband B [7], file, off
Frame block configuration		
Frame blocks (table rows)		limited to 100; the wave-file size is checked at the beginning of the computation process to make sure that sufficient ARB memory is available
Type		DATA, SOUNDING
Physical mode	type = DATA	LEGACY, MIXED MODE, GREEN FIELD
	type = SOUNDING	GREEN FIELD, MIXED MODE
Transmit mode	physical mode = LEGACY	L-20 MHz, L-Duplicate, L-Upper, L-Lower, CCK, PBCC
	physical mode = MIXED MODE or GREEN FIELD	HT-20 MHz, HT-40 MHz, HT-Duplicate, HT-Upper, HT-Lower
Frames		1 frame to 20000 frames (depends on frame duration)
Idle time	time between two successive frames (PPDUs)	
	range	0 s to 1000 ms with 1 µs resolution

[7] Only if "Configure baseband B from baseband A" coupling is selected.

Settings for CCK		
PSDU parameters	MAC header	activating and configuring the MAC header with the following parameters: frame control, duration/ID, addresses 1 to 4, sequence control
	frame check sequence	activating or deactivating a 32 bit (4 byte) checksum for protecting MAC header and user data (frame body)
	PLCP preamble and header format	long PLCP and short PLCP
	preamble/header active	The preamble/header can be turned on or off. By turning it off and setting Idle Time to 0, the "unframed" mode is available.
	PSDU bit rate	1 Mbps, 2 Mbps, 5.5 Mbps, 11 Mbps
	PSDU modulation (depends 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
Settings for PBCC		
PSDU parameters	MAC header	activating and configuring the MAC header with the following parameters: frame control, duration/ID, addresses 1 to 4, sequence control
	frame check sequence	activating or deactivating a 32 bit (4 byte) checksum for protecting MAC header and user data (frame body)
	PLCP preamble and header format	long PLCP and short PLCP
	preamble/header active	The preamble/header can be turned on or off. By turning it off and setting Idle Time to 0, the "unframed" mode is available.
	PSDU bit rate	1 Mbps, 2 Mbps, 5.5 Mbps, 11 Mbps, 22 Mbps
	PSDU modulation (depends 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

Settings for OFDM		
PSDU parameters	MAC header	activating and configuring the MAC header with the following parameters: frame control, duration/ID, addresses 1 to 4, sequence control; for high throughput (HT), i.e. 'Not Legacy', QoS Control and HT Control are also configurable.
	frame check sequence	activating or deactivating a 32 bit (4 byte) checksum for protecting MAC header and user data (frame body)
	number of spatial streams	1 to 4
	number of space-time streams	1 to 4
	number of extended spatial streams	0 to 3
	space-time block coding	activated by simply choosing different values for the number of spatial and space-time streams
	PSDU modulation/space stream	BPSK, QPSK, 16QAM, 64QAM
	data length	1 byte to 4061 byte [8] for LEGACY frames, 1 byte to 65495 byte for HT frames; 0 is permissible only with sounding frames.
	number of data symbols (number of OFDM symbols in data portion of packet)	directly proportional to PSDU data length
	raw data rate	up to 600 Mbps
	preamble/header active	The preamble/header can be turned on or off. By turning it off and setting Idle Time to 0, the "unframed" mode is available.
	guard interval	short, long
	scrambling	data scrambling can be activated or deactivated; initial scrambler state can be set randomly or to a user-defined value
	coding	convolutional coding (BCC) or off, 1 or 2 encoders based on setup and coding rates of 1/2, 2/3, 3/4 and 5/6
	interleaver	can be activated or deactivated
	time domain windowing (transition times)	0 s to 1000 ns
	service field	user-defined service field value supported
	spatial mapping	off, direct, indirect and spatial expansion

[8] The maximum PPDU length for legacy is 4095 byte. It can be obtained by activating all the MAC fields. The same applies to HT; 65535 byte can be implemented.

IEEE 802.11ac digital standard

For the R&S®SMU-K86, R&S®SMATE-K86, R&S®SMJ-K86, R&S®SMBV-K86 and R&S®AMU-K86 options.

For each K86 option, a K54 option must also be installed on the respective instrument.

General parameters	This option enhances the K54 option (IEEE 802.11n) to support IEEE 802.11ac modes. The K86 option requires the K54 option (IEEE 802.11n). Therefore, all general parameters of the K54 option such as frame block configuration or PSDU parameters are also valid for the K86 option, unless stated otherwise below.	
IEEE 802.11ac digital standard		in line with IEEE P802.11ac/D1.0
General settings		
Bandwidth		20 MHz, 40 MHz, 80 MHz
Sample rate	standard	20/40/80 Msample/s
	range	depends on the respective Rohde & Schwarz instrument
Baseband filter		spectral mask in line with IEEE P802.11ac/D1.0, chapter 22.3.18, for very high throughput (VHT) modes
Frame block configuration		
Transmit mode	physical mode = MIXED MODE	VHT-20 MHz, VHT-40 MHz, VHT-80 MHz
Settings for OFDM		
PSDU parameters	MAC header	activating and configuring the MAC header with the following parameters: frame control, duration/ID, addresses 1 to 4, sequence control; for very high throughput (VHT), QoS Control and VHT Control are also configurable
	PSDU modulation/space stream	BPSK, QPSK, 16QAM, 64QAM, 256QAM
	data length	1 byte to 65495 byte for VHT frames
	raw data rate	up to 1733.33 Mbps

Bluetooth® EDR/low energy digital standard

For the R&S®SMU-K60, R&S®SMATE-K60, R&S®SMJ-K60, R&S®SMBV-K60 and R&S®AMU-K60 options.

Basic rate + EDR		
Bluetooth® version		version 2.1 + EDR
Transport modes		ACL + EDR, SCO, eSCO + EDR
Supported packet types	in all data mode or with packet editor	ID, NULL, POLL, FHS, DM1, DM3, DM5, DH1, DH3, DH5, AUX1, 2-DH1, 2-DH3, 2-DH5, 3-DH1, 3-DH3, 3-DH5, HV1, HV2, HV3, DV, EV3, EV4, EV5, 2-EV3, 2-EV5, 3-EV3, 3-EV5
Sequence length		depending on available ARB memory
Data sources (in all data mode)		All 0, All 1, PRBS 7 to PRBS 23, pattern, data list
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 9 to PRBS 23, pattern, data list
	payload CRC	calculated automatically
Power ramping	ramp function	$\cos^2$, linear
	ramp time	1 symbol to 32 symbol
	rise offset, fall offset	–32 symbol to 32 symbol
Modulation	default settings	preset in line with Bluetooth® standard 2FSK, 160 kHz deviation, 1 MHz symbol rate π/4-DQPSK/8DPSK, 1 MHz symbol rate for EDR packets
	2FSK frequency deviation	100 kHz to 200 kHz
	2FSK symbol rate	400 Hz to 15 MHz
Filter	filter function	Gaussian, root cosine (others available)
	B × T (for Gaussian filter)	0.15 to 2.5
Dirty transmitter test	frequency drift rate	1.6 kHz
	start phase	0° to 359°
	frequency drift deviation	–100 kHz to +100 kHz
	carrier frequency offset	–150 kHz to +150 kHz
	symbol timing error	–150 ppm to +150 ppm
	modulation index	0.28 to 0.35
Bluetooth® low energy		
Bluetooth® low energy version		LE D09R02
Channel types		advertising, data
Supported packet types		ADV_IND, ADV_DIRECT_IND, ADV_NONCONN_IND, ADV_DISCOVER_IND, SCAN_REQ, SCAN_RSP, CONNECT_REQ, DATA, CONTROL_DATA, TEST PACKET
Sequence length		depending on available ARB memory
Power ramping	ramp function	$\cos^2$, linear
	ramp time	1 symbol to 32 symbol
	rise offset, fall offset	–32 symbol to 32 symbol
Modulation	default settings	preset in line with Bluetooth® LE standard 2FSK, 250 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 (others available)
	B × T (for Gaussian filter)	0.15 to 2.5

Dirty transmitter test	frequency drift rate	0 Hz or 625 Hz
	start phase	0° to 359°
	frequency drift deviation	–100 kHz to +100 kHz
	carrier frequency offset	–150 kHz to +150 kHz
	symbol timing error	–150 ppm to +150 ppm
	modulation index	0.45 to 0.55
Settings for advertising channel		
Advertising event interval		0.9 ms to 6.4 s
Advertising event delay		0 to 10 ms
Scan window		2.5 ms to 10.24 s
Scan interval		2.5 ms to 6.4 s
Data whitening		supported
Packet editor features	advertiser’s address type	public, private
	initiator’s address type	public, private
	scanner’s address type	public, private
	advertiser's device address	user-definable
	initiator’s device address	user-definable
	scanner's device address	user-definable
	access address	predefined in line with specification, user-definable for CONNECT_REQ packets
	payload data sources	All 0, All 1, PRBS 9 to PRBS 23, pattern, data list
	payload CRC	calculated automatically
	CONNECT_REQ parameters	
	transmit window size	1.25 ms to 6.25 ms
	transmit window offset	0 to 7.5 ms
	connection event interval	7.5 ms to 6.4 s
	slave latency	0 to 1000 events
	LL connection timeout	100 ms to 32 s
	hop length	5 to 16
	sleep clock accuracy	20 ppm to 500 ppm
Settings for data channel		
Bluetooth® controller role		master, slave
Number of TX packets per event		1 to 3
Connection event interval		7.5 ms to 6.4 s
LL connection mode		unencrypted, encrypted
Data whitening		supported
Packet editor features	access address	user-definable
	NESN start value	0 or 1
	SN start value	0 or 1
	payload data sources	All 0, All 1, PRBS 9 to PRBS 23, pattern, data list
	payload CRC	calculated automatically
	CONNECTION_UPDATE_REQ parameters	
	transmit window size	1.25 ms to 6.25 ms
	transmit window offset	0 to 7.5 ms
	connection event interval	7.5 ms to 4 s
	slave latency	0 to 1000 events
	LL connection timeout	100 ms to 32 s
	connection event count	0 or 1 events
Settings for test packets		
Packet interval		625 µs to 12.5 ms in steps of 625 µs
Payload type		PRBS 9, PRBS 15, pattern 11110000, 10101010, 11111111, 00000000, 00001111, 01010101
Payload length		37 byte
Payload CRC		calculated automatically

TETRA Release 2 digital standard

For the R&S®SMU-K68, R&S®SMATE-K68, R&S®SMJ-K68, R&S®SMBV-K68 and R&S®AMU-K68 options.

TETRA Release 2 digital standard		in line with ETSI EN 300 392-2 digital standard (V3.2.1) and TETRA conformance testing specification ETSI EN 300 394-1 (V3.1.1)
General settings		
Link direction	not available in T3 mode	downlink, uplink
Channel type	test channel (NOT logical channel) only in T1 and T4 mode	see test modes
Sequence length	The sequence length can be entered in multiframes and is highly dependent on the settings made. With default values (T1), 14.28 multiframes/Msample are available. Example: An R&S®SMU200A with 64 Msample can generate 913 multiframes.	
Baseband filter	default	root raised cosine (roll-off factor 0.2)
	others	available
Impulse length		1 to 40
Sample rate		calculated internally as a function of filter and oversampling requirements
Clipping	setting of clipping value relative to highest peak in percent; clipping reduces the crest factor	
	modes	vector |i + j q| scalar |i|, |q|
	clipping level	1 % to 100 %
Marker		restart slot start frame start multiframe start hyperframe start pulse pattern on/off ratio
Power ramping	ramp function	$\cos^2$, linear
	ramp time	1 symbol to 16 symbol
	rise offset	–4 symbol to 0 symbol
	fall offset	0 symbol to 4 symbol
Settable slot attenuation		0.0 dB to +50.0 dB, 5 different levels simultaneously possible (full level and 4 attenuated levels)
Test modes		
T1	downlink channels	0, 1, 2, 3, 4, 21, 22, 24
	uplink channels	7, 8, 9, 10, 11, 21, 23, 24
T2	TETRA interferer	phase modulation, QAM
T3	CW interferer	
T4	downlink channels	27
	uplink channels	25, 26
User-defined		see "User-defined mode"
Frame configuration		
Frames 1 to 17	slots	configurable as specified by test mode (logical channel, etc.), see "User-defined mode" different slot levels (off, attenuated, full)
Frame 18	slots	configurable as specified by test mode (logical channel, etc.), see "User-defined mode" different slot levels (off, attenuated, full)
User-defined mode		
In user-defined mode, the slots can be configured without restrictions. In all other test modes, the settings are limited by the test mode specification.		
Modulation type		phase modulation, QAM
Downlink burst type	only with phase modulation	continuous, discontinuous

Slot settings		
Slot level	full	not attenuated
	attenuated	1 of 4 attenuation levels
	off	inactive
Slot attenuation	A1 to A4	1 of 4 attenuation levels
Logical channel type (burst types are controlled by the logical channels)	downlink, phase modulation available burst types: • normal continuous downlink • synchronization continuous downlink • normal discontinuous downlink • synchronization discontinuous downlink	TCH/7,2 (π/4-DQPSK) TCH/4,8 (π/4-DQPSK) TCH/2,4 (π/4-DQPSK) TCH/F (π/4-DQPSK) TCH/H (π/4-DQPSK) STCH+TCH (π/4-DQPSK) STCH+STCH (π/4-DQPSK) SCH/F(π/4-DQPSK) TCH-P8/10,8/F(π/8-DQPSK) SCH-P8/F(π/8-DQPSK) SCH/HD | SCH/HD (π/4-DQPSK) BSCH | SCH/HD (π/4-DQPSK) SCH/HD | BNCH (π/4-DQPSK) BSCH | BNCH (π/4-DQPSK) SCH-P8/HD | SCH-P8/HD (π/8-DQPSK)
	uplink, phase modulation available burst types: • normal uplink • control uplink	TCH/7,2 (π/4-DQPSK) TCH/4,8 (π/4-DQPSK) TCH/2,4 (π/4-DQPSK) TCH/F (π/4-DQPSK) TCH/H (π/4-DQPSK) STCH+TCH (π/4-DQPSK) STCH+STCH (π/4-DQPSK) SCH/F(π/4-DQPSK) TCH-P8/10,8/F(π/8-DQPSK) SCH-P8/F(π/8-DQPSK) SCH/HU | SCH/HU (π/4-DQPSK) SCH-P8/HU | SCH-P8/HU (π/8-DQPSK) SCH/HU (π/4-DQPSK) | SCH-P8/HU (π/8-DQPSK) SCH-P8/HU (π/8-DQPSK) | SCH/HU (π/4-DQPSK)
	downlink, QAM available burst types: • normal downlink	SCH-Q/D-4H (4QAM, high protection) SCH-Q/D-16H SCH-Q/D-64H SCH-Q/D-64M (64QAM, mid-protection) SCH-Q/D-16U (16QAM, unprotected) SCH-Q/D-64U BNCH-Q/4H BNCH-Q/16H BNCH-Q/64H BNCH-Q/64M BNCH-Q/16U BNCH-Q/64U
	uplink, QAM available burst types: • normal uplink • control uplink • random access	SCH-Q/U-4H SCH-Q/U-16H SCH-Q/U-64H SCH-Q/U-64M SCH-Q/U-16U SCH-Q/U-64U SCH-Q/HU-4H | SCH-Q/HU-4H SCH-Q/HU-16H | SCH-Q/HU-16H SCH-Q/HU-64H | SCH-Q/HU-64H SCH-Q/HU-64M | SCH-Q/HU-64M SCH-Q/HU-16U | SCH-Q/HU-16U SCH-Q/HU-64U | SCH-Q/HU-64U SCH-Q/RA | SCH-Q/RA
Data sources (in all data modes)		All 0, All 1, PRBS 7 to PRBS 23, pattern, data list
Scrambling		on, off

Training sequence TSC	only in phase modulation	default user-defined
AACH-Q configuration – AACH-Q mode	only in QAM	ACCESS-ASSIGN PDU reserved element
ACCESS-ASSIGN PDU	only in downlink	header: 2 bit
		field 1: 6 bit
		field 2: 6 bit
BSCH/BNCH/T settings		
Main carrier frequency calculation	carrier bandwidth	25 kHz, 50 kHz, 100 kHz, 150 kHz, depending on modulation type
	main carrier number	0 to 4096
	frequency band	100 MHz to 900 MHz in 100 MHz steps
	offset	0 Hz, –6.25 kHz, 6.25 kHz, 12.5 kHz
	duplex spacing	0 Hz, 1.6 MHz, 4.5 MHz
	downlink/uplink reversal	on, off
Content settings	system code	0 to 7
	sharing mode	continuous transmission carrier sharing MCCH sharing traffic carrier sharing
	TS reserved frames	1, 2, 3, 4, 6, 9, 12, 18
	U-plane DTX	allowed, not allowed
	frame 18 extension	allowed, not allowed
	cell service level	cell load unknown low cell load medium cell load high cell load
	late entry	supported, not supported
	MS_TXPWR_MAX_CELL	15 dBm to 45 dBm in 5 dBm steps
	ACCESS_PARAMETER	–23 dBm to –53 dBm in 2 dBm steps
	TX_On	reception on, transmission on
	TX_Burst_Type	normal uplink burst, control uplink burst
	T1_T4_Burst_Type	most of the channels mentioned under "Logical channel type"
	loopback	on, off
	error correction	on, off
Neighbor cell broadcast	D-NWRK-BROADCAST broadcast	supported, not supported
	D-NWRK-BROADCAST enquiry	supported, not supported
Scrambling	base color code	1 to 63
	mobile country code	0 to 1023
	mobile network code	0 to 16383

DVB-H/DVB-T digital standard

For the R&S®SMU-K52, R&S®SMATE-K52, R&S®SMJ-K52, R&S®SMBV-K52 and R&S®AMU-K52 options.

DVB-H/DVB-T digital standard		in line with ETSI EN 300 744 v.1.5.1
General settings		
Frequency		default: VHF 212.5 MHz user-selectable in entire frequency range of respective Rohde & Schwarz instrument
Output level		default: –30 dBm user-selectable in entire output level range of respective Rohde & Schwarz instrument
Hierarchy mode		non-hierarchical
Sequence length	number of superframes	min.: 1 max.: depending on baseband generator memory
Baseband filter	standard	cosine, α = 0.1
	other	see data sheet of respective Rohde & Schwarz instrument, “I/Q baseband generator” section
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 %
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 data sheet of respective Rohde & Schwarz instrument, “I/Q baseband generator” section
Signal path parameters		
Input data	Zero packets are generated and filled with the wanted data.	All 0 All 1 PN 15, 23
	transport stream	transport stream file (.GTS, .TS, .TRP)
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 interleaving symbol interleaving
	state	on/off
	symbol interleaving block size	1512 bit in 2k mode 3024 bit in 4k mode 6048 bit 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		
Superframe 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

DAB/T-DMB digital standard

For the R&S®SMU-K53, R&S®SMATE-K53, R&S®SMJ-K53, R&S®SMBV-K53 and R&S®AMU-K53 options.

DAB/T-DMB digital standard		in line with ETSI EN 300 401 v.1.3.3 (with restrictions, see below)
Ensemble transport interface		in line with ETSI ETS 300 799 (with restrictions, see below)
General settings		
Source data	FIC and CIFs, each filled with	All 0 All 1 PN 15, 23
	ETI frames number of ETI frames to process	ETI file (.ETI) This number depends on the number and size of streams contained in the ETI file and on the memory size of the I/Q baseband generator. With a baseband generator with 64 Msample memory (e.g. R&S®SMU-B10) and ETI files with nearly full content, the loop duration is approx. 10 min.
Transport mode	for sources other than ETI file	I, II, III, IV
	ETI file	specified by ETI frames
Baseband filter	standard	cosine, α = 0.1
	other	see data sheet of respective Rohde & Schwarz instrument, “I/Q baseband generator” section
Marker		restart frame start pulse pattern on/off ratio
Signal path parameters		
PN scrambler state	affects all channels	on/off
Convolutional coder state	affects all channels if off, missing bits are taken from source	on/off
Time interleaver state	affects all channels	on/off
DAB-related constraints		
Max. number of streams/channels		FIC + 15 streams
ETI-related constraints		
ETI type		ETI (NI, G.703)
Stream configuration	multiplex configuration number of streams size of streams protection of streams	must not change within the frames
Frame length		24 ms
Sampling rate		48 kHz

XM Radio digital standard

For the R&S®SMU-K56, R&S®SMATE-K56, R&S®SMJ-K56, R&S®SMBV-K56 and R&S®AMU-K56 options.

XM Radio digital standard		in line with DARS-FHG-FDSC-608-110000 edition 03/revision 01 for satellite physical layer and XM-SYS-0-0004-RD revision 1.2 for terrestrial physical layer
General settings		
Frequency		default: carrier frequency for selected receiver segment user-selectable in entire frequency range of respective Rohde & Schwarz instrument
Output level		default: –30 dBm user-selectable in entire output level range of respective Rohde & Schwarz instrument
Frequency offset		see data sheet of respective Rohde & Schwarz instrument, “I/Q baseband generator” section
Triggering		see data sheet of respective Rohde & Schwarz instrument, “I/Q baseband generator” section
Signal path parameters for satellite physical layer		
Data sources		All 0 All 1 PRBS 9, 11, 15, 16, 20, 21, 23 pattern (length: 1 bit to 64 bit) data list
Modulation		QPSK
Data rate		1.64 Msps
Data generator (memory size)		max. 4.29 Gbit (21 minutes before repletion) with B9 option
	R&S®SMBV-K56	max. 8.58 Gbit (42 minutes before repletion) with B55 option
Baseband filter	standard	root cosine, α = 0.15
	other	see data sheet of respective Rohde & Schwarz instrument, “I/Q baseband generator” section
Marker		pulse, pattern, user period, on/off ratio
Signal path parameters for terrestrial physical layer		
Data sources		All 0, All 1 PRBS 9, 11, 15, 16, 20, 21, 23 pattern (length: 1 bit to 64 bit) data list
Modulation		COFDM with 647 active carriers, each DQPSK-modulated
Date rate		4.06333 Mbps
Data generator (memory size)		max. 4.29 Gbit (17 minutes before repletion) with B9 option
	R&S®SMBV-K56	max. 8.58 Gbit (34 minutes before repletion) with B55 option
Baseband filter	standard	in line with spectral mask
	other	see data sheet of respective Rohde & Schwarz instrument, “I/Q baseband generator” section
Frequency response	–1.24 MHz < f < +1.24 MHz	±0.5 dB
	attenuation at 1.25 MHz carrier offset	–1 dB
	attenuation at 1.35 MHz carrier offset	–28 dB
	attenuation at 1.75 MHz carrier offset	–35 dB
	attenuation at 2.25 MHz carrier offset	–51 dB
	attenuation at 2.75 MHz carrier offset	–66 dB
	attenuation at > 2.75 MHz carrier offset	–70 dB
Marker		TPL frame MCM symbol user period on/off ratio

FM stereo modulation

For the R&S®SMU-K57, R&S®SMATE-K57, R&S®SMJ-K57, R&S®SMBV-K57 and R&S®AMU-K57 options.

Stereo modes	internal with modulation generator	L, R, R = L, R = –L
	internal from WAV audio file	L, R, R = L, R = –L, R ≠ L
	external digital (via S/P DIF input)	L, R, R = L, R = –L, R ≠ L
MPX frequency deviation		0 Hz to +80 kHz
	resolution	10 Hz
L, R signal	AF frequency range	20 Hz to 15 kHz
	AF frequency response (referenced to 500 Hz)	< 0.2 dB
Stereo crosstalk attenuation	AF = 1 kHz	> 50 dB
Distortion	67.5 kHz MPX frequency deviation, AF = 1 kHz	< 0.1 %, typ. 0.05 %
S/N ratio (stereo/RDS signal)	ITU-R weighted (quasi-peak)	> 60 dB, typ. 62 dB
	ITU-R unweighted (RMS)	> 70 dB, typ. 72 dB
	A-weighted (RMS)	> 70 dB, typ. 72 dB
Preemphasis		off, 50 µs, 75 µs
Pilot tone	frequency	19 kHz (fixed)
	uncertainty	typ. 2 Hz
	deviation	0 Hz to +10 kHz
	resolution	10 Hz
	phase (relative to 38 kHz phase)	–5° to +5°
	resolution	0.1°
RDS/RBDS subcarrier frequency		57 kHz (fixed)
	uncertainty	typ. 6 Hz
RDS/RBDS subcarrier deviation		0 Hz to +10 kHz
	resolution	10 Hz
RDS/RBDS functions		support of PI, PS, TP, TA, PTY, PTYN, DI, MS, CT, RT, AF, EON, user-definable message type and group type

Sirius digital standard

For the R&S®SMU-K58, R&S®SMJ-K58 and R&S®SMBV-K58 options.

Sirius digital standard		in line with Sirius Satellite Radio, number revision: RX000114-A
General settings		
Frequency		default: carrier frequency for selected receiver segment user-selectable in entire frequency range of respective Rohde & Schwarz instrument
Output level		default: –30 dBm user-selectable in entire output level range of respective Rohde & Schwarz instrument
Frequency offset		see data sheet of respective Rohde & Schwarz instrument, “I/Q baseband generator” section
Triggering		see data sheet of respective Rohde & Schwarz instrument, “I/Q baseband generator” section
Signal path parameters for satellite physical layer		
Data sources		All 0, All 1 PRBS 9, 11, 15, 16, 20, 21, 23 pattern (length: 1 bit to 64 bit) data list
Modulation		QPSK
Symbol rate		3.7584 Msps
Data generator (memory size)		only limited by internal hard disk when streaming of data list is activated [9]
Baseband filter	standard	root cosine, α = 0.20
	other	see data sheet of respective Rohde & Schwarz instrument, “I/Q baseband generator” section
Marker		frame pulse pattern user period on/off ratio
Signal path parameters for terrestrial physical layer		
Data sources		All 0, All 1 PRBS 9, 11, 15, 16, 20, 21, 23 pattern (length: 1 bit to 64 bit) data list
Modulation		COFDM with 1000 active carriers, each DQPSK-modulated, 2 carriers as unmodulated pilots, 1 central nulled carrier in normal mode
Symbol rate		7.340625 Msps
Data generator (memory size)		only limited by internal hard disk when streaming of data list is activated [9]
Baseband filter	standard	in line with spectral mask
	other	see data sheet of respective Rohde & Schwarz instrument, “I/Q baseband generator” section
Frequency response	–2.006 MHz < f < +2.006 MHz	±0.25 dB
Marker		frame symbol symbol within frame user period on/off ratio

[9] Required baseband option for special operating mode: R&S®SMU-K58 requires R&S®SMU-B10/R&S®SMU-B9; R&S®SMJ-K58 requires R&S®SMJ-B10/R&S®SMJ-B9; R&S®SMBV-K58 requires R&S®SMBV-B10/R&S®SMBV-B55/R&S®SMBV-B90.

GPS digital standard

For the R&S®SMU-K44, R&S®SMATE-K44, R&S®SMJ-K44 and R&S®AMU-K44 options.

GPS digital standard		in line with ICD-GPS-200 revision C
General settings		
Frequency	for R&S®SMU-K44, R&S®SMATE-K44, R&S®SMJ-K44	default: L1 = 1575.42 MHz user-selectable in entire frequency range of respective Rohde & Schwarz instrument
	for R&S®AMU-K44: virtual RF frequency	default: L1 = 1575.42 MHz
Output level	for R&S®SMU-K44, R&S®SMATE-K44, R&S®SMJ-K44	default: –115 dBm user-selectable in entire output level range of respective Rohde & Schwarz instrument
Modulation		BPSK (CDMA)
Symbol rate (chip rate)		1.023 MHz
Baseband filter		Gaussian, filter parameter B × T = 1, rectangular
Simulation modes	generic mode	generation of up to 4 satellites in realtime with user-definable time shift, power and Doppler, e.g. for sensitivity measurements
	localization mode (auto SV selection)	generation of realtime scenarios with user-definable almanac, location and start time; simulation is only time-limited by the visibility of the simulated satellites
	localization mode (auto SV selection and update)	generation of realtime scenarios with user-definable almanac, location and start time; simulation is not time-limited due to dynamic exchange of simulated satellites, i.e. 4 satellites are always visible
Marker		navigation data bit (20460 chip)
		navigation data word (30 data bit)
		navigation data subframe (10 data words)
		1 PPS
		pulse
		pattern
		on/off radio
Triggering		see data sheet of respective Rohde & Schwarz instrument, “I/Q baseband generator” section
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 and YUMA almanacs, any valid date and time (GMT) during almanac week
Navigation data rate		50 bps

Satellite configurations		
Number of satellites	If the Rohde & Schwarz instrument is equipped with two baseband generators and two K44 options, these can be combined to double the number of satellites.	1 to 4 satellites with C/A code or 1 satellite with C/A and P code or 1 satellite with P code in realtime
Use of 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 chip each
		P code: 37 Gold codes
Time shift	separately settable for each satellite	0 to 10000000 (C/A code chip)/40
Power	separately settable for each satellite	–50 dB to +10 dB
Doppler shift	separately settable for each satellite	±100 kHz (selectable in steps of 0.01 Hz)
Additional time shift	separately settable for each satellite to simulate multipath	0 to 10000000 (C/A code chip)/40
Additional power	separately settable for each satellite to simulate multipath	±10 dB
Additional Doppler shift	separately settable for each satellite to simulate multipath	±100 kHz (selectable in steps of 0.01 Hz)
Initial carrier phase	separately settable for each satellite	0 to 2π (selectable in steps of 0.01 rad)
Localization mode		
Latitude	latitude of simulated location	±90° (selectable in steps of 0.000001°), format selectable between “DEG:MIN:SEC” and “Decimal Degrees”
Longitude	longitude of simulated location	±180° (selectable in steps of 0.000001°), format selectable between “DEG:MIN:SEC” and “Decimal Degrees”
Altitude	altitude of simulated location	±10000 m (selectable in steps of 0.1 m)

Assisted GPS digital standard

For the R&S®SMU-K65, R&S®SMATE-K65 and R&S®AMU-K65 options.

Two baseband generators and two K44 options must be installed on the respective instrument.

GPS/A-GPS digital standard		in line with ICD-GPS-200 revision C, 3GPP TS 34.108 v.8.0.0, 3GPP TS 34.123-3 v.6.4.0, 3GPP TS 34.171 v.7.0.1, 3GPP TS 51.010-1 v.7.7.0
General settings		
A-GPS test scenarios	The K65 option provides the GPS signals for the test scenarios.	GSM signaling test scenario (3GPP TS 51.010-1 v.7.7.0)
		GSM performance test scenario 1 (3GPP TS 51.010-1 v.7.7.0)
		GSM performance test scenario 2 (3GPP TS 51.010-1 v.7.7.0)
		GSM performance test scenario 3 (3GPP TS 51.010-1 v.7.7.0)
		3GPP FDD signaling test scenario (3GPP TS 34.108 v.8.0.0, 3GPP TS 34.123-3 v.6.4.0)
		3GPP FDD performance test scenario 1 (3GPP TS 34.108 v.8.0.0, 3GPP TS 34.171 v.7.0.1)
		3GPP FDD performance test scenario 2 (3GPP TS 34.108 v.8.0.0, 3GPP TS 34.171 v.7.0.1)
		3GPP FDD performance test scenario 3 (3GPP TS 34.108 v.8.0.0, 3GPP TS 34.171 v.7.0.1) user-defined A-GPS test scenarios
Simulation modes	localization mode (full configuration)	generation of realtime scenarios with user-definable almanac, location, start time and satellite orbits; all parameters of the navigation parameters can be adjusted; simulation is only time-limited by the visibility of the simulated satellites
Generation of assistance data		generation of assistance data such as almanac file, ionospheric file, navigation file, UTC file and acquisition file for user-defined A-GPS test cases in comma-separated-values (CSV) format
Configure navigation data		
Ephemeris and clock correction parameters	separately settable for each satellite	range as defined in ICD-GPS-200
UTC parameters	separately settable for each satellite	range as defined in ICD-GPS-200
Ionospheric parameters	separately settable for each satellite	range as defined in ICD-GPS-200
AODO	separately settable for each satellite	range as defined in ICD-GPS-200
(A-S) flags and SV configurations	separately settable for each satellite	range as defined in ICD-GPS-200
Localization mode		
Location		uploadable waypoint file to simulate moving scenarios; maximum number of waypoints depending on baseband generator memory; minimum duration before repetition > 1 day

Multicarrier CW signal generation

For the R&S®SMU-K61, R&S®SMATE-K61, R&S®SMJ-K61, R&S®SMBV-K61 and R&S®AMU-K61 options.

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 and bandwidth of baseband generator	
	R&S®SMU-K61, R&S®SMATE-K61, R&S®SMJ-K61, R&S®AMU-K61	1 Hz to 80 MHz
	R&S®SMBV-K61	1 Hz to 120 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 presettable 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 particular 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	LVTTL
	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
RF frequency response	see data sheet of respective Rohde & Schwarz instrument, "Signal performance for digital standards" section	
Suppression of unwanted carriers		

Digital standards with external PC software or waveforms

Prerequisite for installation – R&S®SMU200A, R&S®SMATE200A, R&S®AMU200A

At least one I/Q baseband generator of the following types must be installed:

- For the R&S®SMU200A: R&S®SMU-B9, R&S®SMU-B10 or R&S®SMU-B11
- For the R&S®SMATE200A: R&S®SMATE-B9, R&S®SMATE-B10 or R&S®SMATE-B11
- For the R&S®AMU200A: R&S®AMU-B9, R&S®AMU-B10 or R&S®AMU-B11

If two I/Q baseband generators are installed and two signals of the same standard are to be output simultaneously, two corresponding software options must also be installed. If only one option is installed and the standard is selected in one I/Q baseband generator, the other I/Q baseband generator is disabled for that standard. However, a software option is not tied to a specific I/Q baseband generator.

Prerequisite for installation – R&S®SMJ100A

The R&S®SMJ-K6, R&S®SMJ-K256, R&S®SMJ-K352 options work with all R&S®SMJ-B9, R&S®SMJ-B10, R&S®SMJ-B11, R&S®SMJ-B50 and R&S®SMJ-B51 I/Q baseband generators.

Prerequisite for installation – R&S®SMBV100A

The R&S®SMBV-K6, R&S®SMBV-K256, R&S®SMBV-K352 options work with all R&S®SMBV-B10, R&S®SMBV-B50 and R&S®SMBV-B51 I/Q baseband generators.

Prerequisite for installation – R&S®AFQ100A, R&S®AFQ100B

The R&S®AFQ-K6, R&S®AFQ-K256, R&S®AFQ-K352 options work with all R&S®AFQ-B10, R&S®AFQ-B11 and R&S®AFQ-B12 baseband hardware.

Pulse sequencer (external PC software)

For the R&S®SMU-K6, R&S®SMATE-K6, R&S®SMJ-K6, R&S®SMBV-K6, R&S®AMU-K6 and R&S®AFQ-K6 options.

The pulse sequencer software generates complex pulses and bursts. This software is a standalone, PC-based application that creates waveform files.

Typical applications	DFS signal generation	FCC CFR 47 part 15.407 (06-96A) ETSI EN 301 893 v.1.3.1, v.1.4.1, v.1.5.1 ETSI EN 302502 v.1.2.1, Japan TELEC-T403, Korea
	radar waveform generation	
	component test with pulsed signals	
Data structure of project files	pulse library	up to 256 pulse definitions
	sequence library	up to 64 sequences
	multisegment waveforms	up to 64 definitions
	RF lists	up to 100 lists
	settings	delay, rise, pulse on, fall, pulse off, PRI, PRF
Pulse timing parameters	resolution	1 ns or 1/ARB clock rate, whichever is larger
	minimum pulse width for baseband generator with 40 MHz I/Q bandwidth	38 ns (nom.)
	minimum pulse width for baseband generator with 300 MHz I/Q bandwidth	5 ns (nom.)
	settings	attenuation, droop
Pulse level parameters	on/off ratio	> 55 dB without pulse modulator, > 70 dB with use of pulse modulator
	ramp type	linear, raised cosine, $\cos^2$, square root, custom
Other pulse parameters	frequency/phase	frequency offset, start phase
	AM types	AM, ASK
	AWGN	level, bandwidth
Intrapulse modulation	FM types	FM, FM stereo, FSK, multitone, FM chirp, polynomial FM
	PSK types	BPSK, QPSK, 8PSK, MSK, polyphase
	other modulation types	VSB8, VSB16, multicarrier CW, user plug-in
	data sources	PRBS: 7, 9, 11, 15, 16, 20, 21, 23, user data, patterns
	markers 1 to 4	delay, rise, pulse on, fall, off, restart
Marker settings	distribution	uniform, normal, ramp, sine, staircase, value list, shape, rules
Jitter	number of jitters	up to 4, independent
	affected parameters	timing settings, frequency offset, phase, level settings, FM deviation, blanking
	filter function	rectangular, Gaussian, cosine, root raised cosine
Baseband filter	window functions	Rife Vincent 2, von Hann, Hamming, Blackman, Blackman-Harris, Flat Top
	pulse entries in sequence	up to 128
Sequences	pulse data mode	append, overlay add, overlay multiply
	jitter mode versus repetitions	all individual, all same, next in list, reuse previous, multisegment waveform, off
	marker mask versus repetitions	all, first only, last only, none
	sequence entries in MSW	up to 64
Multisegment waveforms	number of list entries	up to 10000
RF List mode	data sources	import, all same, uniform, unique
	I/Q versus time	I/Q, polar, log. mag., level and frequency
Graphical display	I/Q plane	vector, density plot
	FFT	entire data, view port only
	cursors	t1, t2, Δt, Δf

HD Radio™ waveforms

For the R&S®SMU-K352, R&S®SMJ-K352, R&S®SMBV-K352 and R&S®AFQ-K352 options.

The provision and use of the HD Radio™ [10] waveforms require a license agreement with iBiquity Digital Corporation.

HD Radio™ waveforms	I/Q sequences in line with iBiquity	R&S®SMU/R&S®SMJ/R&S®SMBV/ R&S®AFQ certified by iBiquity
		see description of option for details
ARB memory	requires waveform memory	
	for the R&S®SMU200A/R&S®SMJ100A/ R&S®AFQ100A/B	256 Mbyte (64 Msample) [11], 512 Mbyte (128 Msample)
	for the R&S®SMBV100A	1 Gbyte (256 Msample) [12]
Transmission	operating modes	FM
		FM and digital radio
		AM
		AM mono and digital radio
Signal set	sequences	iBiquity test vectors
	content	analog audio, digital audio, data
	length	depending on loaded test vector
	bandwidth	depending on operating mode
Test vector support	full support	all test vectors

[10] HD Radio™ is a proprietary trademark of iBiquity Digital Corporation.

[11] Required waveform memory for special operating mode: R&S®SMU-K352 requires R&S®SMU-B10/R&S®SMU-B9, R&S®SMJ-K352 requires R&S®SMJ-B10/R&S®SMJ-B9, and R&S®AFQ-K352 requires R&S®AFQ-B10/R&S®AFQ-B11/R&S®AFQ-B12.

[12] Required waveform memory for special operating mode: R&S®SMBV-K352 requires R&S®SMBV-B55.

Ordering information

Digital standards for the R&S®SMU200A vector signal generator

Designation	Type	Order No.
Digital standards		
GSM/EDGE	R&S®SMU-K40	1160.7609.02
EDGE Evolution	R&S®SMU-K41	1408.7810.02
3GPP FDD	R&S®SMU-K42	1160.7909.02
3GPP Enhanced MS/BS Tests incl. HSDPA	R&S®SMU-K43	1160.9660.02
GPS	R&S®SMU-K44	1161.0566.02
3GPP FDD HSUPA	R&S®SMU-K45	1161.0666.02
CDMA2000®	R&S®SMU-K46	1160.9876.02
1xEV-DO	R&S®SMU-K47	1408.7410.02
IEEE 802.11 (a/b/g)	R&S®SMU-K48	1161.0266.02
IEEE 802.16	R&S®SMU-K49	1161.0366.02
TD-SCDMA	R&S®SMU-K50	1161.0966.02
TD-SCDMA Enhanced BS/MS Tests	R&S®SMU-K51	1161.1062.02
DVB-H/DVB-T	R&S®SMU-K52	1408.7010.02
DAB/T-DMB	R&S®SMU-K53	1400.6209.02
IEEE 802.11n	R&S®SMU-K54	1408.7562.02
EUTRA/LTE	R&S®SMU-K55	1408.7310.02
XM Radio	R&S®SMU-K56	1161.1162.02
FM Stereo Modulation	R&S®SMU-K57	1400.6250.02
Sirius Radio	R&S®SMU-K58	1408.7910.02
3GPP FDD HSPA+	R&S®SMU-K59	1415.0001.02
Bluetooth® EDR/Low Energy	R&S®SMU-K60	1408.7962.02
Multicarrier CW Signal Generation	R&S®SMU-K61	1160.8505.02
Assisted GPS	R&S®SMU-K65	1415.0053.02
TETRA Release 2	R&S®SMU-K68	1408.8217.02
EUTRA/LTE Closed-Loop BS Test	R&S®SMU-K69	1408.8117.02
EUTRA/LTE Log File Generation	R&S®SMU-K81	1408.8169.02
EUTRA/LTE Release 9 and Enhanced Features	R&S®SMU-K84	1408.8475.02
EUTRA/LTE Release 10 (LTE-Advanced)	R&S®SMU-K85	1408.8498.02
IEEE 802.11ac	R&S®SMU-K86	1408.8552.02
Digital standards using an external PC software or waveforms		
Pulse Sequencer	R&S®SMU-K6	1408.7662.02
Playback of XM Radio Waveforms [13]	R&S®SMU-K256	1161.1240.02
Playback of HD Radio™ Waveforms	R&S®SMU-K352	1408.8069.02

[13] Signal generation requires waveforms from XM Radio.

Digital standards for the R&S®SMATE200A vector signal generator

Designation	Type	Order No.
Digital standards		
GSM/EDGE	R&S®SMATE-K40	1404.5107.02
EDGE Evolution	R&S®SMATE-K41	1404.8306.02
3GPP FDD	R&S®SMATE-K42	1404.5207.02
3GPP Enhanced MS/BS Tests incl. HSDPA	R&S®SMATE-K43	1404.5307.02
GPS	R&S®SMATE-K44	1404.5407.02
3GPP FDD HSUPA	R&S®SMATE-K45	1404.7300.02
CDMA2000®	R&S®SMATE-K46	1404.5507.02
1xEV-DO	R&S®SMATE-K47	1404.7900.02
IEEE 802.11 (a/b/g)	R&S®SMATE-K48	1404.6703.02
IEEE 802.16	R&S®SMATE-K49	1404.6803.02
TD-SCDMA	R&S®SMATE-K50	1404.7100.02
TD-SCDMA Enhanced BS/MS Tests	R&S®SMATE-K51	1404.7200.02
DVB-H/DVB-T	R&S®SMATE-K52	1404.7800.02
DAB/T-DMB	R&S®SMATE-K53	1400.6409.02
IEEE 802.11n	R&S®SMATE-K54	1404.7951.02
EUTRA/LTE	R&S®SMATE-K55	1404.7805.02
XM Radio	R&S®SMATE-K56	1404.7751.02
FM Stereo Modulation	R&S®SMATE-K57	1400.6450.02
3GPP FDD HSPA+	R&S®SMATE-K59	1415.1320.02
Bluetooth® EDR/Low Energy	R&S®SMATE-K60	1404.8412.02
Multicarrier CW Signal Generation	R&S®SMATE-K61	1404.5707.02
Assisted GPS	R&S®SMATE-K65	1415.1372.02
TETRA Release 2	R&S®SMATE-K68	1404.8664.02
EUTRA/LTE Closed-Loop BS Test	R&S®SMATE-K69	1404.8564.02
EUTRA/LTE Log File Generation	R&S®SMATE-K81	1404.8612.02
EUTRA/LTE Release 9 and Enhanced Features	R&S®SMATE-K84	1404.8829.02
EUTRA/LTE Release 10 (LTE-Advanced)	R&S®SMATE-K85	1404.8841.02
IEEE 802.11ac	R&S®SMATE-K86	1404.8864.02
Digital standards using external PC software		
Pulse Sequencer	R&S®SMATE-K6	1404.8006.02

Digital standards for the R&S®SMJ100A vector signal generator

Designation	Type	Order No.
Digital standards		
GSM/EDGE	R&S®SMJ-K40	1404.0305.02
EDGE Evolution	R&S®SMJ-K41	1409.2706.02
3GPP FDD	R&S®SMJ-K42	1404.0405.02
3GPP Enhanced MS/BS Tests incl. HSDPA	R&S®SMJ-K43	1404.0505.02
GPS	R&S®SMJ-K44	1404.1401.02
3GPP FDD HSUPA	R&S®SMJ-K45	1409.1816.02
CDMA2000®	R&S®SMJ-K46	1404.0605.02
1xEV-DO	R&S®SMJ-K47	1409.2306.02
IEEE 802.11 (a/b/g)	R&S®SMJ-K48	1404.1001.02
IEEE 802.16	R&S®SMJ-K49	1404.1101.02
TD-SCDMA	R&S®SMJ-K50	1404.1660.02
TD-SCDMA Enhanced BS/MS Tests	R&S®SMJ-K51	1404.1760.02
DVB-H/DVB-T	R&S®SMJ-K52	1409.2106.02
DAB/T-DMB	R&S®SMJ-K53	1400.6309.02
IEEE 802.11n	R&S®SMJ-K54	1409.2506.02
EUTRA/LTE	R&S®SMJ-K55	1409.2206.02
XM Radio	R&S®SMJ-K56	1404.1806.02
FM Stereo Modulation	R&S®SMJ-K57	1400.6350.02
Sirius Radio	R&S®SMJ-K58	1409.2806.02
3GPP FDD HSPA+	R&S®SMJ-K59	1415.1508.02
Bluetooth® EDR/Low Energy	R&S®SMJ-K60	1409.2858.02
Multicarrier CW Signal Generation	R&S®SMJ-K61	1404.0705.02
TETRA Release 2	R&S®SMJ-K68	1409.3102.02
EUTRA/LTE Closed-Loop BS Test	R&S®SMJ-K69	1409.3002.02
EUTRA/LTE Log File Generation	R&S®SMJ-K81	1409.3054.02
EUTRA/LTE Release 9 and Enhanced Features	R&S®SMJ-K84	1409.3360.02
EUTRA/LTE Release 10 (LTE-Advanced)	R&S®SMJ-K85	1409.3383.02
IEEE 802.11ac	R&S®SMJ-K86	1409.3448.02
Digital standards using an external PC software or waveforms		
Pulse Sequencer	R&S®SMJ-K6	1409.2558.02
Playback of XM Radio Waveforms [14]	R&S®SMJ-K256	1409.2606.02
Playback of HD Radio™ Waveforms	R&S®SMJ-K352	1409.2958.02

[14] Signal generation requires waveforms from XM Radio.

Digital standards for the R&S®SMBV100A vector signal generator

Designation	Type	Order No.
Digital standards		
GSM/EDGE	R&S®SMBV-K40	1415.8031.02
EDGE Evolution	R&S®SMBV-K41	1415.8460.02
3GPP FDD	R&S®SMBV-K42	1415.8048.02
3GPP Enhanced MS/BS Tests incl. HSDPA	R&S®SMBV-K43	1415.8054.02
3GPP FDD HSUPA	R&S®SMBV-K45	1415.8077.02
CDMA2000®	R&S®SMBV-K46	1415.8083.02
1xEV-DO	R&S®SMBV-K47	1415.8090.02
IEEE 802.11 (a/b/g)	R&S®SMBV-K48	1415.8102.02
IEEE 802.16	R&S®SMBV-K49	1415.8119.02
TD-SCDMA	R&S®SMBV-K50	1415.8125.02
TD-SCDMA Enhanced BS/MS Tests	R&S®SMBV-K51	1415.8131.02
DVB-H/DVB-T	R&S®SMBV-K52	1415.8148.02
IEEE 802.11n	R&S®SMBV-K54	1415.8160.02
EUTRA/LTE	R&S®SMBV-K55	1415.8177.02
3GPP FDD HSPA+	R&S®SMBV-K59	1415.8219.02
Bluetooth® EDR/Low Energy	R&S®SMBV-K60	1415.8477.02
Multicarrier CW Signal Generation	R&S®SMBV-K61	1415.8225.02
TETRA Release 2	R&S®SMBV-K68	1415.8490.02
EUTRA/LTE Release 9 and Enhanced Features	R&S®SMBV-K84	1415.8602.02
EUTRA/LTE Release 10 (LTE-Advanced)	R&S®SMBV-K85	1415.8619.02
IEEE 802.11ac	R&S®SMBV-K86	1415.8648.02
Digital standards using an external PC software or waveforms		
Pulse Sequencer	R&S®SMBV-K6	1415.8390.02
Playback of XM Radio Waveforms [14]	R&S®SMBV-K256	1415.8402.02
Playback of HD Radio™ Waveforms	R&S®SMBV-K352	1415.8431.02

Digital standards for the R&S®AMU200A baseband signal generator and fading simulator

Designation	Type	Order No.
Digital standards		
GSM/EDGE	R&S®AMU-K40	1402.6106.02
EDGE Evolution	R&S®AMU-K41	1403.0253.02
3GPP FDD	R&S®AMU-K42	1402.6206.02
3GPP Enhanced MS/BS Tests incl. HSDPA	R&S®AMU-K43	1402.6306.02
GPS	R&S®AMU-K44	1402.6406.02
3GPP FDD HSUPA	R&S®AMU-K45	1402.8909.02
CDMA2000®	R&S®AMU-K46	1402.6506.02
1xEV-DO	R&S®AMU-K47	1402.6606.02
IEEE 802.11 (a/b/g)	R&S®AMU-K48	1402.6706.02
IEEE 802.16	R&S®AMU-K49	1402.7002.02
TD-SCDMA	R&S®AMU-K50	1402.8950.02
TD-SCDMA Enhanced BS/MS Tests	R&S®AMU-K51	1402.9005.02
DVB-H/DVB-T	R&S®AMU-K52	1402.9557.02
DAB/T-DMB	R&S®AMU-K53	1402.9957.02
IEEE 802.11n	R&S®AMU-K54	1402.9705.02
EUTRA/LTE	R&S®AMU-K55	1402.9405.02
XM Radio	R&S®AMU-K56	1402.9905.02
FM Stereo Modulation	R&S®AMU-K57	1403.0001.02
3GPP FDD HSPA+	R&S®AMU-K59	1403.0053.02
Bluetooth® EDR/Low Energy	R&S®AMU-K60	1403.0353.02
Multicarrier CW Signal Generation	R&S®AMU-K61	1402.7102.02
Assisted GPS	R&S®AMU-K65	1403.0101.02
TETRA Release 2	R&S®AMU-K68	1403.0601.02
EUTRA/LTE Closed-Loop BS Test	R&S®AMU-K69	1403.0501.02
EUTRA/LTE Log File Generation	R&S®AMU-K81	1403.0553.02
EUTRA/LTE Release 9 and Enhanced Features	R&S®AMU-K84	1403.0818.02
EUTRA/LTE Release 10 (LTE-Advanced)	R&S®AMU-K85	1403.0830.02
IEEE 802.11ac	R&S®AMU-K86	1403.0899.02
Digital standards using external PC software		
Pulse Sequencer	R&S®AMU-K6	1402.9805.02

Digital standards for the R&S®AFQ100A and R&S®AFQ100B I/Q modulation generators

Designation	Type	Order No.
Digital standards using an external PC software or waveforms		
Pulse Sequencer	R&S®AFQ-K6	1401.5606.02
Playback of XM Radio Waveforms [15]	R&S®AFQ-K256	1401.6002.02
Playback of HD Radio™ Waveforms	R&S®AFQ-K352	1401.6154.02

[15] Signal generation requires waveforms from XM Radio.

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